COMPETITIVE MATHEMATICS

By

GROUP OF NATION MAKING

NATION MAKING

GOD HELPS THOSE WHO HELP OTHERS

FOR

SSC, UPSC, RRB, IBPS,NET, GATE, CAT

OUR MOTIVE AND INTENTION

The sole meaning of our WORK is to serve the humanity. It's our initiation towards nation making by providing this book to all candidates who want to contribute something in nation making and can continue the chain of knowledge distribution to at least one needy candidates of society with same conditions of chain formation and thus can educate more and more people of country to make it educated. Our nature of work is totally based on honesty and faith, with a dream of betterment of our society and nation.

All the work on this book were done by our team/volunteers of class and some friends on social media after searching various online sources. We have tried to make it different from other books but and if some question matches with someone's book please inform us so that we can replace it.

I thank all the students for their support, help, dedication, attention and open-minded thinking and for their readiness to help with very prompt response on various matters. Whenever I asked, I had no time and proper facilities to develop this book, but they helped me a lot like, copying sums in class, typing on computers, rectifying, searching net for new types of sums and matching it with various books so as to make different questions from their sums, though it was not their responsibility to do so, But they volunteered to help me with this.

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This Book took approx six month of hard work , research and development with a cost of around Rs. 65,000 that include the cost of one laptop, one printer, One android mobile and around 10 rim papers. We have tried to make it most developed and advanced version of book with latest questions of various exams. This book contains the topics and questions we discussed and created in our classes or obtained from cross questions of students as their doubts or suggested by some of my friends and some coaching centres. All the questions noted, typed, redesigned and rectified by group of volunteers consisting of:

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We would like to thank all the members and volunteers who worked hard for it and if everything goes well, we will do more curriculums for betterment of our country. We need well wishes and blessings from seniors, juniors and everyone for our future endeavours. We need your supports to make a better tomorrow with a chain formation of knowledge distributors. We also invite all intelligentsia to contribute their positive thoughts and energy towards society. Remember our society and nation can not develop without our initiative. No government can eradicate all the problems of nation unless its citizen come forward.

We welcome suggestions on our email Id: nationmaking2015@gmail.com

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NUMBER SYSTEM

Decimal number system:

There are ten symbols namely 0, 1, 2,3,4,5,6,7,8 and 9 called digits. A number is denoted by group of these digits called as numerals.

Face Value:

Face value of a digit in a numeral is value of the digit itself. For example in 321, face value of 1 is 1, face value of 2 is 2 and face value of 3 is 3.

Place Value:

Place value of a digit in a numeral is value of the digit multiplied by 10n where n starts from 0. For example in 321:

Place value of $1 = 1 \times 10^0 = 1 \times 1 = 1$

Place value of $2 = 2 \times 10^1 = 2 \times 10 = 20$

Place value of $3 = 3 \times 10^2 = 3 \times 100 = 300$

0th position digit is called unit digit and is the most commonly used topic in aptitude tests.

Types of Numbers:

1. **Natural Numbers:** A number n > 0 where n is counting number; [1,2,3...]
2. **Whole Numbers:** A number n ≥ 0 where n is counting number; [0,1,2,3...].
   0 is the only whole number which is not a natural number.
   Every natural number is a whole number.
3. **Integers:** A number n ≥ 0 or n ≤ 0 where n is counting number;...,-3,-2,-1,0,1,2,3... are integers.
4. **Positive Integers:** A number n > 0; [1,2,3...]
5. **Negative Integers**: A number n < 0; [-1,-2,-3...]
6. **Non-Positive Integers**: n ≤ 0; [0,-1,-2,-3...]
7. **Non-Negative Integers:** A number n ≥ 0; [0,1,2,3...]
   0 is neither positive nor negative integer.
8. **Even Numbers:** A number divisible by 2; [for example 0,2,4,...]
9. **Odd Numbers:** A number not divisible by 2; [for example 1,3,5,...]
10. **Prime Numbers:** A number numbers which is divisible by themselves only apart from 1.
    1 is not a prime number.

Testing of prime numbers:

To test a number p to be prime, find a whole number k such that k > √p. Get all prime numbers less than or equal to k and divide p with each of these prime numbers. If no number divides p exactly then p is a prime number otherwise it is not a prime number.

Example: 191 is prime number or not?
Step 1 - 14 > √191
Step 2 - Prime numbers less than 14 are 2,3,5,7,11 and 13.
Step 3 - 191 is not divisible by any above prime number.
Result - 191 is a prime number.

Example: 187 is prime number or not?
Step 1 - 14 > √187
Step 2 - Prime numbers less than 14 are 2,3,5,7,11 and 13.
Step 3 - 187 is divisible by 11.
Result - 187 is not a prime number.

7. **Composite Numbers:** A number non-prime numbers > 1. For example, 4,6,8,9 etc.
   1 is neither a prime number nor a composite number. 2 is the only even prime number.

8. **Co-Primes Numbers**: - Two natural numbers are co-primes if their H.C.F. is 1. For example, (2,3), (4,5) are co-primes.

9. **Twin prime numbers:-**
Two prime numbers A, B (A<B) are called twin primes if they differ by 2 (e.g. 11, 13, or 41,43....).

Following are formulaes for basic number series:

1. $(1+2+3+...+n) = \frac{n}{2}(n+1)$

2. $(1^2+2^2+3^2+...+n^2) = \frac{n}{6}(n+1)(2n+1)$

3. $(1^3+2^3+3^3+...+n^3) = \left[\frac{n(n+1)}{2}\right]^2$

Basic Formulaes:

1. $(a+b)^2 = a^2+b^2+2ab$
2. $(a-b)^2 = a^2+b^2-2ab$
3. $(a+b)^2-(a-b)^2 = 4ab$
4. $(a+b)^2+(a-b)^2 = 2(a^2+b^2)$
5. $(a^2-b^2) = (a+b)(a-b)$
6. $(a+b+c)^2 = a^2+b^2+c^2+2(ab+bc+ca)$
7. $(a^3+b^3) = (a+b)(a^2-ab+b^2)$
8. $(a^3-b^3) = (a-b)(a^2+ab+b^2)$
9. $(a^3+b^3+c^3-3abc) = (a+b+c)(a^2+b^2+c^2-ab-bc-ca)$

Unit digit of sum/difference/products of numbers:

To get last digit of numbers in sum/difference/product form just multiply the last digits of each numbers. For example last digit of 123+345+5678 is same as last digit of 3+5+8=16 i.e. 6

And last digit of 123x34567x8739 is same as last digit of 3x7x9=189 i.e. 9

Last digit of products of numbers having powers:

Finding the Unit Digit of Powers of numbers having last digit as 2:

1. First of all, Divide the power of last digit of given number i.e.2 by 4.
2. If you get any remainder, put it as the power of 2 and get the result using the below given table.
3. If you don't get any remainder after dividing the power of 2 by 4, your answer will be $(2)^4$ which always give 6 as the remainder

Power	Unit Digit
$(2)^1$	2
$(2)^2$	4
$(2)^3$	8
$(2)^4$	6

(1) Find the Units Digit in $(5122)^{24433}$:
Solution: -

Step-1: Divide the power of last digit of given number i.e.2 by 4. It means, divide 33 by 4.

Step-2: You get remainder 1.
Step-3: Since you have got 1 as a remainder , put it as a power of 2 i.e. $(2)^1$.
Step-4: Have a look on table, $(2)^1$=2. So, Answer will be 2

(2) Find the Unit Digit in $(13452)^{1240}$:
Solution: -

Step-1: Divide the power of last digit of given number i.e.2 by 4. It means, divide 40 by 4.
Step-2: It's completely divisible by 4. It means, the remainder is 0.
Step-3: Since you have got nothing as a remainder , put 4 as a power of 2 i.e. $(2)^4$.
Step-4: Have a look on table, $(2)^4$=6. So, Answer will be 6

Finding the Unit Digit of Powers of numbers having last digit as 3:

1. First of all, Divide the power of last digit of given number i.e.3 by 4.
2. If you get any remainder, put it as the power of 3 and get the result using the below given table.
3. If you don't get any remainder after dividing the power of 3 by 4, your answer will be $(3)^4$ which always give 1 as the remainder

Power	Unit Digit
$(3)^1$	3
$(3)^2$	9
$(3)^3$	7
$(3)^4$	1

(1) Find the Units Digit in $(123)^{346433}$:
Solution: -

Step-1: Divide the power of last digit of given number i.e.3 by 4. It means, divide 33 by 4.
Step-2: You get remainder 1.
Step-3: Since you have got 1 as a remainder , put it as a power of 3 i.e. $(3)^1$.
Step-4: Have a look on table, $(3)^1$=3. So, Answer will be 3

(2) Find the Unit Digit in $(1453)^{25632}$:
Solution: -

Step-1: Divide the power of last digit of given number i.e.3 by 4. It means, divide 32 by 4.
Step-2: It's completely divisible by 4. It means, the remainder is 0.
Step-3: Since you have got nothing as a remainder , put 4 as a power of 3 i.e. $(3)^4$.
Step-4: Have a look on table, $(3)^4$=1. So, Answer will be 1

Finding the Unit Digit of Powers of numbers having last digit 0,1,5,6:

The unit digit of 0,1,5,6 always remains same i.e. 0,1,5,6 respectively for every power.
Finding the Unit Digit of Powers of 4 & 9
In case of 4 & 9, if powers are Even, the result will be 6 & 4. However, when their powers are Odd, the result will be 1 & 9. The same is depicted below:

- If the Power of 4 is Even, the result will be 6
- If the Power of 4 is Odd, the result will be 4
- If the Power of 9 is Even, the result will be 1
- If the Power of 9 is Odd, the result will be 9.

For Example -

- $(119)^{1684} = 1$
- $(239)^{2421} = 9$
- $(564)^{3264} = 6$
- $(874)^{4463} = 4$

Finding the Unit Digit of Powers of numbers having last digit as 7:

1. First of all, Divide the power of last digit of given number i.e.7 by 4.
2. If you get any remainder, put it as the power of 7 and get the result using the below given table.
3. If you don't get any remainder after dividing the power of 7 by 4, your answer will be $(7)^4$ which always give 1 as the remainder

Power	Unit Digit
$(7)^1$	7
$(7)^2$	9
$(7)^3$	3
$(7)^4$	1

(1) Find the Units Digit in $(987)^{5234}$
Solution: -

Step-1: Divide the power of last digit of given number i.e.7 by 4. It means, divide 5234 by 4.
Step-2: You get remainder 2.
Step-3: Since you have got 2 as a remainder , put it as a power of 7 i.e. $(7)^2$.
Step-4: Have a look on table, $(7)^2=9$. So, Answer will be 9

(2) Find the Unit Digit in $(5647)^{81284}$
Solution: -

Step-1:: Divide the power of last digit of given number i.e.7 by 4. It means, divide 84 by 4.
Step-2: It's completely divisible by 4. It means, the remainder is 0.
Step-3: Since you have got nothing as a remainder , put 4 as a power of 7 i.e. $(7)^4$.
Step-4: Have a look on table, $(7)^4=1$. So, Answer will be 1

Finding the Unit Digit of Powers of numbers having last digit as 8:

1. First of all, Divide the power of last digit of given number i.e.8 by 4.
2. If you get any remainder, put it as the power of 8 and get the result using the below given table.
3. If you don't get any remainder after dividing the power of 8 by 4, your answer will be $(8)^4$ which always give 6 as the remainder

Power	Unit Digit
$(8)^1$	8
$(8)^2$	4
$(8)^3$	2
$(8)^4$	6

(1) Find the Units Digit in $(1238)^{31234}$:
Solution: -

Step-1:: Divide the power of last digit of given number i.e.1238 by 4. It means, divide 31234 by 4.
Step-2: You get remainder 2.

Step-3: Since you have got 2 as a remainder , put it as a power of 8 i.e. $(8)^2$.
Step-4: Have a look on table, $(8)^2=4$. So, Answer will be 4

(2) Find the Unit Digit in $(78658)^{36032}$:
Solution: -

Step-1:: Divide the power of last digit of given number i.e.8 by 4. It means, divide 36032 by 4.
Step-2: It's completely divisible by 4. It means, the remainder is 0.
Step-3: Since you have got nothing as a remainder , put 4 as a power of 8 i.e. $(8)^4$.
Step-4: Have a look on table, $(8)^4=1$. So, Answer will be 6

----------EXERCISE----------

Q1. Which of the following is a prime number?

A 187 B 341 C 437 D 811

Q2. Which of the following is the output of 6894 x 99?

A 685506 B 682506 C 696506 D 715506

Q3. Which of the following is the output of 685798 x 125?

A 85724750 B 83275750 C 84275950 D 85247760

Q4. Which of the following is the output of 43986 x 625?

A 27491450 B 27491350 C 27491250 D 27491150

Q5. Which of the following is the output of 869 x 738 + 869 x 262?

A 562000 B 638000 C 769000 D 869000

Q6. Which of the following is the output of 936 x 587 - 936 x 487?

A 93600 B 88700 C 78700 D 65800

Q7. Which of the following is the output of 1496 x 1496?

A 2138016 B 2238016 C 2348016 D 2458016

Q8. Which of the following is the output of 1607 x 1607?

A 2381449 B 2493449 C 2582449 D 2674449

Q9. Which of the following is the output of 596 x 596 - 104 x 104?

A 377700 B 366600 C 355500 D 344400

Q10. Which of the following is the output of 57 x 57 + 43 x 43 + 2 x 57 x 43?

A 10000 B 8700 C 7300 D 6514

Q11. Which of the following is the output of 93 x 93 + 73 x 73 - 2 x 93 x 73?

A 378 B 400 C 515 D 620

Q12. Value of $\frac{578 \times 578 \times 578 + 422 \times 422 \times 422}{578 \times 578 - 578 \times 422 + 422 \times 422}$:-

A 100 B 400 C 800 D 1000

Q13. Value of $\frac{141 \times 141 \times 141 - 58 \times 58 \times 58}{141 \times 141 + 141 \times 58 + 58 \times 58}$:-

A 83 B 91 C 99 D 107

Q14. Which of the following is the output of 213 x 213 + 187 x 187?

A 51338 B 60338 C 70169 D 80338

Q15. Which of the following is the output of $[(637 + 478)^2 - (637 - 478)^2]/(637 \times 478)$?

A 1 B 2 C 3 D 4

Q16. Which of the following is the output of $((964 + 578)^2 + (964 - 578)^2)/(964 \times 964 + 578 \times 578)$?

A 1 B 2 C 3 D 4

Q17. On dividing a number by 342, 47 is the remainder. What will be remainder if same number is divided by 18?

A 11 B 9 C 7 D 5

Q18. What will be unit digit in $(3157)^{754}$?

A 1 B 3 C 7 D 9

Q19. What will be unit digit in 658 x 539 x 436 x 312?

A 1 B 2 C 3 D 4

Q20. What will be unit digit in 357 x 641 x 763?

A 1 B 3 C 5 D 7

Q21. What is the unit digit in $7^{35} - 3^{48}$?

A 4 B 3 C 2 D 1

Q22. A shopkeeper gives one pen in return of four used pen. I gifted a student a pack of 10 use and through pens, then how many pens can he use at all?

A. 10 B. 11 C. 12 D. 13

Q23. If p and q are ODD Numbers, then which of these is even?

A pq B p + q C pq – 2 D None of these

Q24. What will be the remainder when 17^{200} is divided by 18?

A 1 B 3 C 5 D 7

Q25. Find the total number of prime factors in the product $14^{13} \times 7^3 \times 9^2$?

A 235 B 963 C 1190 D 2330

Q26. Find the sum of $1^2 - 2^2 + 3^2 - 4^2 + .. + 9^2 - 10^2$?

A 45 B -45 C 54 D -55

Q27. Find the sum of $(11^2 + 12^2 + 13^2 + ... + 20^2) = ?$

A 2085 B 2485 C 2870 D 3235

Q28. $(y)^2 = 351649$. What is y?

A 433 B 593 C 623 D 657

Q29. Which of the following will always divide difference between squares of two consecutive even numbers completely?

A 3 B 4 C 5 D 6

Q30. What is the common factor in $(47^{97} + 43^{97})$ and $(47^{101} + 43^{101})$

A 47-43 B 47+43 C $47^6 + 43^6$ D $47^4 + 43^4$

Q31. Which of the following has most number of divisors?

A. 99 B. 101 C. 176 D. 182

Q32. A girl wrote all the numbers from 100 to 200. Then she started counting the number of one's that has been used while writing all these numbers. What is the number that she got?

A. 111 B. 119 C. 120 D. 121

Q33. How many three digit numbers can be formed using the digits 1,2,3,4,5,6,7 and 8 without repeating the digits and such that the tens digit is greater than the hundreds digit and less than the units digit?

A. 48 B. 56 C. 64 D. 72

Q34. N is the smallest number that has 5 factors. Then maximum how many factors may (N−1) have?

A. 2 B. 3 C. 4 D. 5

Q35. If A and B are twin primes with B>23, then which of the following numbers would always divide A+B?

A. 2 B. 6 C. 12 D. None of these

Q36. If a and b are integers, and x=2×3×7×a , and y=2×2×8×b ,and x,y lies between 120 and 130, then a–b=?

A. 1 B. -1 C. 2 D. -2

Q37. Each of n alarm tolls at regular intervals. All of them tolls together twelve times a day. No two alarm tolls at equal intervals of time. If each alarm tolls after a whole number of minutes, what is the maximum possible value of n?

A. 14 B. 16 C. 18 D. 20

Q38. What is the maximum value of m such that 7^m divides 20! Completely without leaving any remainder?

A. 1 B. 2 C. 3 D. 4

Q39. A number when divided by 342 gives a remainder 47. When the same number is divided by 19, what would be the remainder?

A. 5 B. 9 C. 4 D. 0

Q40. If n is a positive integer, which one of the following numbers must have a remainder of 3 when divided by any of the numbers 4, 5 and 6?

A. 12n+3 B. 24n+3 C. 90n+2 D. 120n+3

Q41. The positive integers m and n leave remainders of 2 and 3, respectively, when divided by 6. m>n. What will be the remainder when m–n is divided by 6?

A. 2 B. 3 C. 5 D. 6

Q42. The largest number amongst the following that will perfectly divide 101^{100}–1 is:

A. 100 B. 10,000 C. 1,00,000 D. 1,01,000

Q43. Find the unit's digit in $264^{102}+264^{103}$

A. 0 B. 2 C. 4 D. 6

Q44. Find the remainder when 2^{89} is divided by 89?

A. 0 B. 1 C. 2 D. 88

Q45. A boy writes all the numbers from 100 to 999. The number of zeroes that he uses is 'x', the number of 5's that he uses is 'y' and the number of 8's he uses is 'z'. What is the value of y+z-x?

A. 280 B. 380 C. 180 D. 80

Q46. What is the unit's digit of the number $75866^{256}–12344^{256}$.

A. 0 B. 1 C. 4 D. 7

Q47. What is the last digit of the number $35^{79}+ 1$?

A. 1 B. 3 C. 6 D. 9

Q48. If X and Y are any natural numbers, then which of the following is an ODD Number?

A. xy+yx+(x−y)(xy+x) B. xy(x+y)(xy+x)
C. yx(xy−y)(xy−x) D. None of these

Q49. Jeet is solving puzzles "which whole numbers, greater than one, can divide all the nine three digit numbers i.e. 111,222,333,444,555,666,777,888 and 999?"what should he answer

A. 3, 37 and 121 B. 3, 37 and 111 C. 11, 37 and 101 D. 3, 11 and 113

This chapter contains the topics and questions we discussed and created in our classes or obtained from students as their cross questions and doubts. All the questions noted, typed, redesigned and rectified by group of volunteers consisting of:

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----------ANSWERS ----------

Q1.D	**Q2.B**	**Q3.A**	**Q4.C**	**Q5.D**
Q6.A	**Q7.B**	**Q8.C**	**Q9.D**	**Q10.A**
Q11.B	**Q12.D**	**Q13.A**	**Q14.D**	**Q15.D**
Q16.B	**Q17.A**	**Q18.D**	**Q19.D**	**Q20.A**
Q21.C	**Q22.D**	**Q23.B**	**Q24.A**	**Q25.C**
Q26.D	**Q27.B**	**Q28.B**	**Q29.B**	**Q30.B**
Q31.C	**Q32.C**	**Q33.B**	**Q34.C**	**Q35.C**
Q36.B	**Q37.B**	**Q38.B**	**Q39.B**	**Q40.D**
Q41.C	**Q42.B**	**Q43.A**	**Q44.C**	**Q45.B**
Q46.A	**Q47.C**	**Q48.D**	**Q49.B**	

----------ANSWERS WITH SOLUTION----------

Q1.D

Q1 Solution:-

Step 1. We take an integer n such that n^2 > number.

142 > 187.

302 > 811.

192 > 341.

212 > 437.

Step 2. Get all prime numbers which are < n

14 - 2 , 3, 5, 7, 11, 13

30 - 2 , 3, 5, 7, 11, 13, 17, 19, 23, 29

19 - 2 , 3, 5, 7, 11, 13, 17

21 - 2 , 3, 5, 7, 11, 13, 17, 19

Step 3. Check divisiblity of each number with prime numbers which are < n.

187 is divisible by 11.

811 is not divisible by any prime number.

341 is divisible by 11.

437 is divisible by 19.

Result: 811 is the prime number.

Q2.B

Q2 Solution:-

6894 x 99= 6894 x (100 - 1)= 6894 x 100 - 6894 x 1= 689400 - 6894= 682506

Q3.A

Q3 Solution:-

685798 x 125 = 685798000/8 [shortcut method of multiplication by 125:-putting three zeroes at the end of number and dividing it by 8]

= 85724750

Q4.C

Q4 Solution:-

43986 x 625

$= \frac{43986000}{16}$ [shortcut method of multiplication by 625:-putting three zeroes at the end of number and dividing it by 16]

= 27491250

Q5.D
Q5 Solution:-
869 x 738 + 869 x 262 = 869 x (738 + 262) = 869 x 1000 = 869000

Q6.A
Q6 Solution:-
936 x 587 - 936 x 487 = 936 x (587 - 487) = 936 x 100 = 93600

Q7B
Q7 Solution:-
1496 x 1496= 14962= $(1500-4)^2$= $1500^2 + 4^2 - 2 \times 1500 \times 4$= 2250000 + 16 - 12000= 2238016

Q8.C
Q8 Solution:-
1607 x 1607= 1607^2= $(1600+7)^2$= $1600^2 + 7^2 + 2 \times 1600 \times 7$= 2560000 + 49 +22400= 2582449

Q9.D
Q9 Solution:-
596 x 596 - 104 x 104 = $596^2 - 104^2$ = (596 + 104) x (596 - 104) = 700 x 492 = 344400

Q10.A
Q10 Solution:-
57 x 57 + 43 x 43 + 2 x 57 x 43 = $(57 + 43)^2$ = $(100)^2$ = 10000

Q11.B
Q11 Solution:-
93 x 93 + 73 x 73 - 2 x 93 x 73 = $(93 - 73)^2$ = $(20)^2$ = 400

Q12.D
Q12 Solution:-
(578 x 578 x 578 + 422 x 422 x 422)/(578 x 578 - 578 x 422 + 422 x 422)
Let's have a = 578, b = 422
Now expression is $(a^3 + b^3)/(a^2 - ab + b^2)$=$[(a+b)(a^2 - ab + b^2)]/(a^2 - ab + b^2)$= a + b= 578 + 422= 1000

Q13.A
Q13 Solution:-
(141 x 141 x 141 - 58 x 58 x 58)/(141 x 141 + 141 x 58 + 58 x 58)
Let's have a = 141, b = 58
Now expression is $(a^3-b^3)/(a^2 + ab + b^2)$=)=$[(a-b)(a^2 + ab + b^2)]/(a^2 - ab + b^2)$= a-b= 141 - 58= 83

Q14.D
Q14 Solution:-
213 x 213 + 187 x 187
Let's have a = 213, b = 187
Now expression is $a^2 + b^2$
Using following formula, $(a + b)^2 + (a-b)^2 = 2 \times (a^2 + b^2)$
$2 \times (213 \times 213 + 187 \times 187) = (213 + 187)^2 + (213 - 187)^2$
$2 \times (213 \times 213 + 187 \times 187) = 400^2 + 26^2$
$2 \times (213 \times 213 + 187 \times 187) = 160000 + 676$
213 x 213 + 187 x 187 = 160676/2 = 80338

Q15.D

Q15 Solution:-

We know

$((a + b)^2 - (a-b)^2)/ab = 4ab/ab = 4$

Q16.B

Q16 Solution:-

$((964 + 578)^2 + (964 - 578)^2) /(964 \times 964 + 578 \times 578)$

Put a = 964, b = 578

Now expression is $((a + b)^2 + (a-b)^2)/(a^2 + b^2)$

$= ((a^2 + b^2 + 2ab) + (a^2 + b^2 - 2ab))/(a^2 + b^2)$

$= (a^2 + b^2 + 2ab + a^2 + b^2 - 2ab)/(a^2 + b^2)$

$= 2(a^2 + b^2)/(a^2 + b^2)$

$= 2$

Q17.A

Q17 Solution:-

Let quotient be a and given number be b.

$b = 342a + 47$

$= (18 \times 19)a + 36 + 11$

$= (18 \times 19)a + (18 \times 2) + 11$

$= 18 \times (19a + 2) + 11$

So, if same number is divided by 18, remainder will be 11.

We've used following formulae here:

Dividend = (Divisor x Quotient) + Reminder

Q18.D

Q18 Solution:-

unit digit in (3157)754

= unit digit in $(7)^{754}$

= unit digit in $(7^4)^{188} \times 7^2$

= unit digit in (1 x 49) is 9

So Unit digit in $(3157)^{754}$ is 9.

We've used following concept here:

Unit digit in $7^1 = 7$

Unit digit in $7^2 = 9$

Unit digit in $7^3 = 3$

Unit digit in $7^4 = 1$

Unit digit in $7^5 = 7$

Unit digit in $7^6 = 9$

Unit digit in $7^7 = 3$

Unit digit in $7^8 = 1$

So pattern is 7-9-3-1. This pattern works for all numbers. So Unit digit in $((7)^4)^n)$ will be 1.

Q19.D

Q19 Solution:-

Multiply unit digits of each number.

Unit digit in 658 x 539 x 436 x 312

= Unit digit in 8 x 9 x 6 x 2.= Unit digit in 864.= 4.

Q20.A

Q20 Solution:-

357x641x763 = 7x1x3
=7x1x3 [considering last digits only]
=21
So last digit is 1

Q21.C

Q21 Solution:-

Unit digit in $7^{35} = (7^4)^8 \times 7^3$
$= 1 \times 3 = 3$
Unit digit in $3^{48} = (3^4)^{12}$
$= 1$
So, unit digit in $7^{35} - 3^{48} = 3 - 1 = 2$

Q22.D

Q22 Solution:-

Ten pens give 10 empty pens.
From 10 pens 3 more pens can be made (2 pens would be obtained from 2 pens formed by joining 8 used pens.)
So he could use 13 pens in all.

Q23.B

Q23 Solution:-

Sum of two ODD Numbers is even
Example:
p = 19, q = 37
p + q = 56 i.e. even.

Q24.A

Q24 Solution:-

$(17^{200} - 1^{200})$ is completely divisible by (x + a) when n is even.
$= (17^{200} - 1^{200})$ is completely divisible by 18 i.e.(17 + 1)
$= (17^{200} - 1)$ is completely divisible by 18.
So, the remainder is 1.

Q25.C

Q25 Solution:-

For a number of the form $a^m \times b^n \times c^r$.....
number of facrors is=(m+1)x(n+1)x(r+1).....
So, $14^{13} \times 7^3 \times 9^2 = 2^{13} \times 7^{13} \times 7^3 \times (3^2)^2 = 2^{13} \times 7^{16} \times 3^4$
So this will have
= (13 + 1) x (16 +1) x (4 + 1)= 14x17x5=1190 factors

Q26.D

Q26 Solution:-

Using formula $a^2-b^2 = (a-b)(a+b)$
$1^2 - 2^2 + 3^2 - 4^2 + ..+ 9^2 - 10^2 = (1-2)(1+2) + (3-4)(3+4) + (5-6)(5+6) + (7-8)(7+8) + (9-10)(9+10)$
$= (-3) + (-7) + (-11) + (-15) + (-19) = -[3 +7 + 11 + 15 + 19] = -55$

Q27.B

Q27 Solution:-

Using formula for sum of squares of natural numbers

$(1^2 + 2^2 + 3^2 + ... + n^2) = (1/6)n(n+1)(2n+1)$

$(11^2 + 12^2 + 13^2 + ... + 20^2) = (1^2 + 2^2 ... + 20^2) - (1^2 + 2^2 + 3^2 + ... + n^2)$

$= (1/6) \times 20 \times 21 \times 41 - (1/6) \times 10 \times 11 \times 21 = 2870 - 385 = 2485$

Q28.B

Q28 Solution:-

Find out the square root of number 351649.

Q29.B

Q29 Solution:-

let a = 2n , b = 2n + 2 $\Rightarrow (b)^2 - (a)^2 = (2n + 2))^2 - (2n)^2 = 4[(n + 1)^2 - (n)^2] = 4(2n + 1)$ Which is always divisible by 4.

Q30.B

Q30 Solution:-

$a^n + b^n$ is divisible by a + b if n is an ODD Number. So each number is divisible by (47 + 43).

Q31.C

Q31 Solution:-

Divisors of 99=1,3,9,11,33,99

Divisors of 101=1,101

Divisors of 176=1,2,4,8,11,22,44,88,176

Divisors of 182=1,2,7,13,14,26,91,182

So 176 has most number of divisors.

Q32.C

Q32 Solution:-

From 100 to 200 there are 101 numbers.

There are 100, 1's in the hundred place.

10, 1's in tens place and10, 1's in unit place.

So, the answer is 100+10+10= 120.

Q33.B

Q33 Solution:-

Ten's digit = 7 ⇒ units digit =8 ⇒ Hundred's digit =1,2,3,4,5,6.

⇒ Number of ways =1×6

Ten's digit = 6 ⇒ units digit =7,8 ⇒ Hundred's digit =1,2,3,4,5.

⇒ Number of ways =2×5

Ten's digit = 5 ⇒ units digit =6,7,8 ⇒ Hundred's digit =1,2,3,4

⇒ Number of ways =3×4

Ten's digit = 4 ⇒ units digit =5,6,7,8 ⇒ Hundred's digit =1,2,3.

⇒ Number of ways =4×3

Ten's digit = 3 ⇒ units digit =4,5,6,7,8 ⇒ Hundred's digit =1,2

⇒ Number of ways =5×2

Ten's digit = 2 ⇒ units digit =3,4,5,6,7,8 ⇒ Hundred's digit =1

⇒ Number of ways =6×1

Total number of ways =6+10+12+12+10+6= 56.

Q34.C

Q34 Solution:-

A number that has 5 factors has to be of the form p^4 where p is a prime number.
The smallest such number is $2^4=16$
So, N−1=15.
The factors of 15 are 1,3,5,15.
So, N−1 has 4 factors

Q35.C

Q35 Solution:-

Any prime number greater than 3 will be in the form of 6n+1 or 6n−1.
So, both prime number are twins:
Let first be 6n−1
and 2nd be 6n+1
Sum=12n
Putting n=1 we get it is always divisible by 12.

Q36.B

Q36 Solution:-

We are given that x=2×3×7×a=42a and y=2×2×8×b=32b
We are given that the values of both X and Y lie between 120 and 130 (not including the two).
The only multiple of 42 in this range is 42×3=126.
So, x=126 and a=3.
The only multiple of 32 in this range is 32×4=128.
So, y=128 and b=4.
So, a−b=3−4= -1

Q37.B

Q37 Solution:-

The alarm tolls together twelves times a day. So, they toll together once every 2 hours (or 120 minutes).
Since no two alarms toll at equal intervals of time, the total number of distinct factors of 120, including 1 and 120 itself $=2^3\times3\times5$
The number of factors =(3+1)×2×2=16.
The maximum value of n is 16.

Q38.B

Q38 Solution:-

The term 20! is the product of the numbers 1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19 and 20.
Only two of these numbers are divisible by 7.
The numbers are 7 and 14.
So, 20! can be expressed as the product of k×7×14, where k is not divisible by 7.
Now, since there are two 7s in 20!, the numbers 7 and 7x2 divide 20! completely.
7^3 and further powers of 7 leave a remainder when divides 20!.
So, the maximum value of m is 2.

Q39.B

Q39 Solution:-

On dividing the given number by 342, let k be the quotient and 47 as remainder.
Then,
number−342k+47=(19×18k+19×2+9)=19(18k+2)+9
⇒ The given number when divided by 19, gives 18k+2 as quotient and 9 as remainder.

Q40.D

Q40 Solution:-

Let m be a number that has a remainder of 3 when divided by any of the numbers 4, 5 and 6.
Then m−3 must be exactly divisible by all three numbers.
So, m−3 must be a multiple of the Least Common Multiple of the numbers 4, 5 and 6.
The LCM is 3×4×5=60.
So, we can suppose m−3=60p, where p is a positive integer.
Replacing p with n, we get m–3=60n.
So, m=60n+3.
Choice (D) is in the same format 120n + 3 =60(2n)+3

Q41.C

Q41 Solution:-

We are given that the numbers m and n, when divided by 6, leave remainders of 2 and 3, respectively.
So, we can represent the numbers M and n as 6p+26p+2 and 6q+36q+3, respectively, where pp and qq are suitable integers.
Now,
m−n=(6p+2)−(6q+3)=6p−6q−1=6(p−q)−1
A remainder must be positive, so let's add 6 to this expression and compensate by subtracting 6:
6(p−q)−1=6(p−q)−6+6−1=6(p−q)−6+5=6(p−q−1)+5
So, the remainder is 5

Q42.B

Q42 Solution:-

The easiest way to solve such problems for objective exam purposes is trial and error or by back substituting answers in the choices given.
101^2=10,201.
101^2−1=10,200. This is divisible by 100.
Similarly try for 101^3−1=1,030,301−1=1,030,300.
So we can conclude that (101^1−1) to (101^9−1) will be divisible by 100.
(101^{10}−1) to (101^{99}−1) will be divisible by 1000.
So, (101^{100}−1) will be divisible by 10,000.

Q43.A

Q43 Solution:-

Required unit's digit = unit's digit in $4^{102}+4^{103}$.
Now, 4^2 gives unit digit 6.
⇒ 4^{102} gives unit digit 6.
⇒ 4^{103} gives unit digit of the product 6×4 i.e., 4.
So, unit's digit in $264^{102}+264^{103}$= unit's digit in (6+4)=0

Q44.C

Q44 Solution:-

If p is a prime number and its divide any number in form of $N^{p-1,}$ remainder is always 1.
In same way 89 is prime and its dividing $2^{88}=2^{89-1}$So, 2^{89} will leave remainder 1 when divided by 89.
And if it's divide $2^{89}=2(2^{88})$ remainder will be twice i.e. 2.

Q45.B

Q45 Solution:-

Clearly Numbers of 5 and 8 willbe same.
So, we have y=z and So all we need to calculate x and y
y=280 and x=180
So, y+z-x = 2y−x= 2x280 – 180 = 560 – 180 = 380

Q46.A

Q46 Solution:-

Since the exponents are even, we can apply the property that,
If x is even $a^x – b^x$ is always divisible by (a+b).
Since last digit depends on unit digit only we can use (6+4)=10.
Now any number multiplied by 10 gives the last digit as 'zero'.

Q47.C

Q47 Solution:-

Last digit of 35^{79} is same as last digit of 5^{79}
and it is same as last digit of 5^3
that is last digit of 125 i.e. 5
So, the last digit of the given number is 5+1= 6.

Q48.D

Q48 Solution:-

X and Y are natural numbers.
We know that of any natural number p.
p^n+p is even
And, $p^n–p$ is even.
When we multiply an even number to any natural number the resultant number is even.

Q49.B

Q49 Solution:-

Each of the number can be written as a multiple of 111.
The factors of 111 are 3 and 37
So the desired answer is 3, 37 and 111

"To succeed in your mission, you must have single-minded devotion to your goal." – Abdul Kalam

DIVISIBILITY

Divisibility: If a number divides another number without leaving remainder then second is said to be divisible by first.

Following are tips to check divisibility of numbers:

1. **Divisibility by 2:**A number is divisible by 2 if its unit digit is 0,2,4,6 or 8.
   Example: 64578 is divisible by 2 or not?
   Step 1 - Unit digit is 8.
   Result: 64578 is divisible by 2.

   Example: 64575 is divisible by 2 or not?
   Step 1 - Unit digit is 5.
   Result: 64575 is not divisible by 2.

2. **Divisibility by 3**: A number is divisible by 3 if sum of its digits is completely divisible by 3.
   Example: 64578 is divisible by 3 or not?
   Step 1 - Sum of its digits is 6 + 4 + 5 + 7 + 8 = 30
   which is divisible by 3.
   Result: 64578 is divisible by 3.

   Example: 64576 is divisible by 3 or not?
   Step 1 - Sum of its digits is 6 + 4 + 5 + 7 + 6 = 28
   which is not divisible by 3.
   Result: 64576 is not divisible by 3.

3. **Divisibility by 4**: A number is divisible by 4 if number formed using its last two digits is completely divisible by 4.
   Example: 64578 is divisible by 4 or not?
   Step 1 - number formed using its last two digits is 78
   which is not divisible by 4.
   Result: 64578 is not divisible by 4.

   Example: 64580 is divisible by 4 or not?
   Step 1 - number formed using its last two digits is 80
   which is divisible by 4.
   Result: 64580 is divisible by 4.

4. **Divisibility by 5**: A number is divisible by 5 if its unit digit is 0 or 5.
   Example: 64578 is divisible by 5 or not?
   Step 1 - Unit digit is 8.
   Result: 64578 is not divisible by 5.

   Example: 64575 is divisible by 5 or not?
   Step 1 - Unit digit is 5.
   Result: 64575 is divisible by 5.

5. **Divisibility by 6:** A number is divisible by 6 if the number is divisible by both 2 and 3.
   Example: 64578 is divisible by 6 or not?
   Step 1 - Unit digit is 8. Number is divisible by 2.
   Step 2 - Sum of its digits is 6 + 4 + 5 + 7 + 8 = 30
   which is divisible by 3.
   Result: 64578 is divisible by 6.
   Example: 64578 is divisible by 6 or not?
   Step 1 - Unit digit is 6. So, Number is divisible by 2.

Step 2 - Sum of its digits is 6 + 4 + 5 + 7 + 6 = 28
which is not divisible by 3.
Result: 64576 is not divisible by 6.

6. **Divisibility by 7:**
A number of 2 digits is divisible by 7 because 3 × 6 + 3 = 21. 21 is divisible by 7.
A number of three or more digits is divisible by 7 if the sum of the numbers formed by the last two digits and twice the number formed by the remaining digits is divisible by 7.
For Example:
(i) 574 is divisible by 7 because 74 + 5 × 2 = 74 + 10 = 84 is divisible by 7.
(ii) 2268 is divisible by 7 because 68 + 22 × 2 = 68 + 44 = 112 is divisible by 7.

7. **Divisibility by 8:** A number is divisible by 8 if number formed using its last three digits is completely divisible by 8.
Example: 64578 is divisible by 8 or not?
Step 1 - number formed using its last three digits is 578
which is not divisible by 8.
Result: 64578 is not divisible by 8.

Example: 64576 is divisible by 8 or not?
Step 1 - number formed using its last three digits is 576
which is divisible by 8.
Result: 64576 is divisible by 8.

8. **Divisibility by 9:** A number is divisible by 9 if sum of its digits is completely divisible by 9.
Example: 64579 is divisible by 9 or not?
Step 1 - Sum of its digits is 6 + 4 + 5 + 7 + 9 = 31
which is not divisible by 9.
Result: 64579 is not divisible by 9.

Example: 64575 is divisible by 9 or not?
Step 1 - Sum of its digits is 6 + 4 + 5 + 7 + 5 = 27
which is divisible by 9.
Result: 64575 is divisible by 9.

9. **Divisibility by 10:** A number is divisible by 10 if its unit digit is 0.
Example: 64575 is divisible by 10 or not?
Step 1 - Unit digit is 5.
Result: 64578 is not divisible by 10.

Example: 64570 is divisible by 10 or not?
Step 1 - Unit digit is 0.
Result: 64570 is divisible by 10.

10. **Divisibility by 11:** A number is divisible by 11 if difference between sum of digits at odd places and sum of digits at even places is either 0 or is divisible by 11.
Example: 64575 is divisible by 11 or not?
Step 1.Difference between sum of digits at odd places
and sum of digits at even places = (6+5+5) - (4+7) = 5
which is not divisible by 11.
Result: 64575 is not divisible by 11.

Example: 64075 is divisible by 11 or not?
Step 1.Difference between sum of digits at odd places
and sum of digits at even places = (6+0+5) - (4+7) = 0.
Result: 64075 is divisible by 11.

Tips on Division:

1. If a number n is divisible by two co-primes numbers a, b then n is also divisible by ab.
2. $(a-b)$ always divides $(a^n - b^n)$ if n is a natural number.
3. $(a+b)$ always divides $(a^n - b^n)$ if n is an even number.
4. $(a+b)$ always divides $(a^n + b^n)$ if n is an ODD Number.

Division Algorithm:
When a number is divided by another number then
Dividend = (Divisor x Quotient) + Reminder

DIVISIBILITY

----------EXERCISE----------

Q1. What is the smallest number that should be added to 27452 to make it exactly divisible by 9?
A. 7 B. 8 C. 9 D. 10

Q2. What least whole number should be added to 532869 to make it divisible by 9?
A. 3 B. 5 C. 7 D. 9

Q3. Find the least of value of k so that the number 37k124 is divisible by 9 ?
A. 0 B. 1 C. 2 D. 3

Q4. The sum of three digit number is subtracted from the number. The Resulting number is always:
A. divisible by 6 B. divisible by 7 C. divisible by 9 D. divisible by 12

Q5. If each of the three nonzero numbers a, b and c is divisible by 3, then abc must be divisible by which one of the following the numbers?
A. 8 B. 27 C. 81 D. 121

Q6. What is the least value of x such that 7648x is divisible by 11?
A. 1 B. 2 C. 3 D. 4

Q7. What is the smallest number which must be added to 8261955 so as to obtain a sum which is divisible by 11?
A. 2 B. 4 C. 6 D. 8

Q8. If M183 is divisible by 11, find the value of the smallest natural number M ?
A. 3 B. 5 C. 7 D. 9

Q9. What is the value of M and N respectively if M39048458N is divisible by 8 and 11, where M and N are single digit integers?
A. 6, 4 B. 7, 6 C. 8,8 D. 9,2

Q10. Find the least of value of 'x' so that the number 73818x4 is divisible by 8
A. 1 B. 2 C. 3 D. 4

Q11. For a number to be divisible by 88 it should be:
A. It must be divisible by 8 and 11 B. It must be divisible by 4 and 22
C. It must be divisible by 2 and 44 D. None

Q12. Which digits should come in place of X and Y if the number 12365484XY is divisible by both 8 and 5?
A. 4, 0 B. 4, 4 C. 6,0 D. 6,8

Q13. What value of k makes the number 9724k exactly divisible by 6 ?
A. 1 B. 2 C. 3 D. 4

Q14. If 522x is a three digit number with as a digit x . If the number is divisible by 6, What is the value of the digit x is?
A. 2 B. 4 C. 6 D. 8

Q15. The product of 4 consecutive even numbers is always divisible by:
A. 384 B. 568 C. 764 D. 984

Q16. How many natural numbers below 660 are divisible by 5 and 11 but not by 3?
A. 8 B. 9 C. 10 D. 11

Q17. 2ab5 is a four-digit number divisible by 25. If the number formed from the two digits ab is a multiple of 13, then ab=

A. 10 B. 25 C. 52 D. 65

Q18. Find the sum of the digits of the least natural number P, such that the sum of the cubes of the four smallest distinct divisors of P equals 2P.

A. 7 B. 8 C. 9 D. 10

Q19. A number when divided by a divisor leaves a remainder of 24.When twice the original number is divided by the same divisor, the remainder is 11. What is the value of the divisor?

A. 13 B. 19 C. 25 D. 37

Q20. When 242 is divided by a certain divisor the remainder obtained is 8. When 698 is divided by the same divisor the remainder obtained is 9.However, when the sum of the two numbers 242 and 698 is divided by the divisor, the remainder obtained is 4.What is the value of the divisor?

A. 11 B. 17 C. 13 D. 23

Q21. A number is formed by writing first 67 natural numbers in front of each other as 34567891011.... What is the remainder when this number is divided by 8?

A. 1 B. 3 C. 5 D. 7

This chapter contains the topics and questions we discussed and created in our classes or obtained from students as their cross questions and doubts. All the questions noted, typed, redesigned and rectified by group of volunteers consisting of:

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----------ANSWERS----------

Q1.A	**Q2.A**	**Q3. B**	**Q4.C**	**Q5.B**
Q6.C	**Q7.A**	**Q8.C**	**Q9.A**	**Q10.B**
Q11.A	**Q12.A**	**Q13.B**	**Q14.C**	**Q15.A**
Q16.A	**Q17.C**	**Q18.C**	**Q19.D**	**Q20.C**
Q21.B				

----------ANSWERS WITH SOLUTION----------

Q1.A

Q1. Solution:-

If a number is divisible by 9, the sum of its digits must be a multiple of 9.
Here, 2+7+4+5+2=20, As the next multiple of 9 is 27.
7 must be added to 27452 to make it divisible by 9.

Q2.A

Q2 Solution:-

If a number is divisible by 9 , the sum of its digits must be a multiple of 9.
Here, 5+3+2+8+6+9=33, the next multiple of 9 is 36.
3 must be added to 532869 to make it divisible by 9.

Q3. B

Q3 Solution:-

if a number is divisible by 9, the sum of its digits must be a multiple of 9.
Here, 3+7+k+1+2+4=17+k
Here the value of k must be 1 because the next multiple of 9 is 18.

Q4.C

Q4 Solution:-

Let the three digit number be 439
Sum of digits =16
Difference =439−16=423 which is divisible by 9.

Q5.B

Q5 Solution:-

Let the numbers be 3x , 3y and 3z
So, abc = 3x.3y.3z=27xyz
Divisible by 27 for all values of xyz.

Q6.C

Q6 Solution:-

A number is divisible by 11 , when difference between the sum of digits at even places and at odd places is 0 or multiple of 11
The given number is 4876x.
(Sum of digits at EVEN places) – (sum of digits at ODD places)=0
(6 + 8) - (X + 7 + 4) = 0
=> 14 - (X + 11) = 0
Here the value of x must be 3 .

Q7.A

Q7 Solution:-

For divisibility by 11, the difference of sums of digits at even and odd places must be either zero or divisible by 11.

For 8261955, Difference =(8+6+9+5) -(2+1+5)=28-8=20.

The units digit is at odd place. So we add 2 to the number

=> 8261955 +2 = 8261957

Now , (8+6+9+7) -(2+1+5)=30-8=22

=> 22 is a multiple of 11 and So 8261957 is also divisible by 11.

Q8.C

Q8 Solution:-

In aptitude tests , we get questions on divisibility by 11.

A number is divisible by 11, when the difference between the sum of digits at even places and at odd places is 0 or multiple of 11

The given number is M183.

(Sum of digits at EVEN places) – (sum of digits at ODD places)=0

(8 + M)- (3+1)= 0

Or, (8 + M) - 4 = 0

Here the value of M must be 7 . .

Q9.A

Q9 Solution:-

A number is divisible by 8 , if the number formed by the last three digits is divisible by 8.

i.e 58N is divisible by 8 ⇒ N=4

Again a number is divisible by 11, if the difference between the sum of digits at even places and sum of digits at the odd places is either 0 or divisible by 11.

i.e, (M+9+4+4+8)−(3+0+8+5+N)=M−N+9=M+5

It cannot be zero So, M+5=11 ⇒ M=6.

Q10.B

Q10 Solution:-

A number is exactly divisible by 8, and then the last 3 digits of the numbers must be divisible by 83

Here the last 3 digits are 8x4.

Put each values in given options in the place of x and check it .

824 and 864 is exactly divisible by 8. So, x should be 2 or 6

So, among the given options 2 is the answer

Q11.A

Q11 Solution:-

For a number to be divisible by 88, the number must be divisible by 8 and 11.

Write 88 as product of two factors: (22 ,2),(11 ,8),(44,2)

Among these pairs , 11 and 8 are co primes. So the number must be divisible by 8 and

Q12.A

Q12 Solution:-

Since the given number is divisible by 5, so 0 or 5 must come in place of Y.

But, a number ending with 5 is never divisible by 8.

So, 0 will replace Y.

Now, the number formed by the last three digits is 4X0, which becomes divisible by 8, if X is replaced by 4.

Q13.B

Q13 Solution:-

We know divisibility by 6 requires that the number be divisible by 2 as well as 3 , i.e, the following 2 conditions must satisfy

i) Unit digit be Zero or even

ii) Sum of digits be divisible by 3

The given number is 9724k

Sum of the digits =9 +7 +2 +4 +k =22+k

The digit which on being added to 22 will give the sum divisible by 3 are

22+2 =24 and 22 +5=7.

2 and 5 satisfy the condition (ii).

k is at unit's place. So k must satisfy the condition

(i) also

Out of 2 and 5, only 2 is even.

Q14.C

Q14 Solution:-

If a number is divisible by 6 , it must be divisible by both 2 and 3

In 522x, to this number be divisible by 2, the value of x must be even. So it can be 2,4 or 6 from given options

552x is divisible by 3, If sum of its digits is a multiple of 3.

5+5+2+x =12+x ,

If put x =2 , 12+2=14 not a multiple of 3

If put x =4 , 12+6=18 is a multiple of 3

If put x =6 , 12+2=14 not a multiple of 3

The value of x is 6.

Q15.A

Q15 Solution:-

Let the numbers be 2x, 2x+2, 2x+4,2x+6

Multiplying these numbers we get:

$2x(2x+2)(2x+4)(2x+6)=16x(x+1)(x+2)(x+3)$

We know that the product of 4 consecutive numbers is always divisible by 4!.

So, $2x(2x+2)(2x+4)(2x+6)=16x(x+1)(x+2)(x+3)=16.(4!).k=384k$

So, number is always divisible by 384

Q16.A

Q16 Solution:-

If the number is divisible by 5 and 11 it must be divisible by 55.

The numbers are less than 660.

So, dividing 659 by 55 gives the number of multiples of 55 = 11 (ignoring fraction part).

The 11 multiples of 55 which are less than 660, but of these 11 multiples some can be multiples of 3.

The numbers of such, multiples is the quotient of 11 by 3.

Quotient of 11/3=3.

Out of 11 multiples of 55, 3 are multiples of 3.

So, numbers less than 660 and divisible by 5 and 11 but not by 3=11−3=8

Q17.C

Q17 Solution:-

We have given that the number 2ab5 is divisible by 25.

Any number divisible by 25 ends with the last two digits 00, 25, 50, or 75.

So, b5 should equal 25 or 75.

So, b=2 or 7.

a can be any digit from 0 through 9, ab can have multiple values with condition that ab is divisible by 13.
We have multiples of 13 as 13,26,39,52,65,7813,26,39,52,65,78 and 491.
Among these, the only number ending with 2 or 7 is 52.
So, ab=52

Q18.C
Q18 Solution:-

Let the least number be P, 1 is its least divisor.
Let 2nd,3rd and 4th least divisors be x,y and z respectively.
We consider the following values of divisor a and the corresponding values of a^3, from x,y and z exactly 1 or all 3 are odd . (P is even)

a=1 => a^3=1
a=2 => a^3=8
a=3 => a^3=27
a=4 => a^3=64
a=5 => a^3=125
a=6 => a^3=216

For x,y and z=(2,3,4), 2P=100 (i.e. P=50). But 3 is not a divisor of 50.
For x,y,z=(2,3,6), 2P=252 (i.e. P=126) and the 1,2,3,6 are four least distinct divisor of 126.
So, the required number is 126. And so the sum of digits is 9.

Q19.D
Q19 Solution:-

Let the number be A and divisor be 'D' and quotient of the division of A by D be 'X'
So, we can write the relation as a=dx+24 [As remainder is 24]
When twice the original number is divided by d,2a is divided by d.
We know that a=dx+24. So, 2a=2dx+48
The problem states that (2dx+48)/d leaves a remainder of 11.
2dx is perfectly divisible by D and will So, not leave a remainder.
The remainder of 11 was obtained by dividing 48 by D.
When 48 is divided by 37, the remainder that one will obtain is 11.
So, the divisor is 37.

Q20.C
Q20 Solution:-

Let the divisor be D.
When 242 is divided by the divisor, let the quotient be 'X' and we know that the remainder is 8.
So, 242=xd+8
Similarly, let Y be the quotient when 698 is divided by D.
Then, 698=yd+9.
242+698=940=xd+yd+8+9
940=xd+yd+17
As xd and yd are divisible by D, the remainder when 940 is divided by D should have been 17.
Here the question states that the remainder is 4, it would be possible only when 17d leaves a remainder of 4.
If the remainder obtained is 4 when 17 is divided by D, then D has to be 13

Q21.B
Q21 Solution:-

If the number formed by the last three digits of the number is divisible by 8, then the number is divisible by 8.
Here, last 3 digits in the number is 667.So, the remainder when 667 is divisible by 8 is 3.

SQUARE ROOT AND CUBE ROOT

Square Root

When $y = x^2$ then square root of y is x and it is written as $\sqrt{y} = x$.
For example, $\sqrt{9} = 3$, $\sqrt{16} = 4$ and so on.

Cube Root

When $y = x^3$ then cube root of y is x and it is written as $\sqrt[3]{y} = x$.
For example, $\sqrt[3]{8} = 2$, $\sqrt[3]{27} = 3$ and so on.

Important Formulaes:

- $\sqrt{ab} = \sqrt{a} \times \sqrt{b}$ [if a and b are real numbers]
- $\sqrt{\frac{a}{b}} = \frac{\sqrt{a}}{\sqrt{b}}$ [if a and b are real numbers]

Q1. $\sqrt{2025}$ = ?
A. 35 B. 45 C. 55 D. 65

Q2. $\sqrt{54} \times \sqrt{6}$ = ?
A. 24 B. 21 C. 18 D. 15

Q3. if $\sqrt{841} = 29$, then $\sqrt{0.00000841}$ = ?
A. 0.00029 B. 0.0029 C. 0.029 D. 0.29

Q4. $\sqrt{[248 + \sqrt{(51 + \sqrt{169})}]}$ = ?
A. 11 B. 12 C. 14 D. 16

Q5. If $\sqrt{15} = 3.88$. What is $\sqrt{\frac{5}{3}}$?
A. 1.213 B. 1.293 C. 1.321 D. 1.432

Q6. $\sqrt{0.121}$ = ?
A. 0.11 B. 0.251 C. 0.347 D. 0.411

Q7. If $\sqrt{15} = 3.8729$ then what is $\frac{\sqrt{5}+\sqrt{3}}{\sqrt{5}-\sqrt{3}}$?
A. 7.8729 B. 6.8729 C. 5.8729 D. 4.8729

Q8. What is the least number required to multiply to 9720 to make a perfact cube?
A. 55 B. 65 C. 75 D. 85

Q9. $\sqrt{0.00004761}$ = ?
A. 0.00069 B. 0.0069 C. 0.0609 D. 0.069

Q10. given that $\sqrt{3} = 1.732$, the value of $\frac{3+\sqrt{6}}{5\sqrt{3}-2\sqrt{12}-\sqrt{32}+\sqrt{50}}$ is:
A. 4.899 B. 2.551 C. 1.732 D. 1.414

Q11. $\frac{\sqrt{24}+\sqrt{216}}{\sqrt{96}}$ = ?
A. $6\sqrt{6}$ B. $3\sqrt{2}$ C. 2 D. None

Q12. $\sqrt[3]{9261}$ = ?
A. 21 B. 23 C. 29 D. 33

Q13. $\sqrt{[\sqrt{0.0001} + \sqrt{0.0064}]}$=?
A. 0.3 B. 0.23 C. $\sqrt{0.18}$ D. None

Q14. Given √2 =1.414 . The value of √8 + 2√32 - 3√128 + 4√50) is

A. 9.426 B. 8.484 C. 7.526 D. 6.876

Q15. $\sqrt{[\sqrt{2500}+\sqrt{961}]} = (?)^2$

A. 3 B. 9 C. 81 D. None

Q16. $[(\sqrt{2}+1)^2+(\sqrt{2}-1)^2/(\sqrt{2}-1)]/[(\sqrt{3}-1)^2+(\sqrt{3}+1)^2/(\sqrt{3}-1)] = ?$

A. 2 B. 4 C. 6 D. 8

Q17. $\sqrt{\frac{x}{169}} = \frac{18}{13}$ then x= ?

A. 108 B. 324 C. 2916 D. 4800

Q18. $\sqrt{\frac{25}{16}} = ?$

A. $\frac{1}{4}$ B. $\frac{2}{5}$ C. $\frac{3}{4}$ D. $1\frac{1}{4}$

Q19. If √1369 = 37 then what is √13.69 + √0.1369 + √ 0.001369 + √ 0.00001369?

A. 4.0021 B. 4.1107 C. 3.1232 D. 2.1323

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----------SOLUTION----------

Q1.B	**Q2.C**	**Q3.B**	**Q4.D**	**Q5.B**
Q6.C	**Q7.A**	**Q8.C**	**Q9.B**	**Q10.C**
Q11.C	**Q12.A**	**Q13.A**	**Q14.B**	**Q15.A**
Q16.B	**Q17.B**	**Q18.D**	**Q19.B**	

----------ANWER AND SOLUTION----------

Q1.B

Q1 Solution:-

Resolve 2025 into prime numbers first.

2025 = 5 x 5 x 3 x 3 x 3 x 3 = 52 x 32 x 32

∴ √2025 = 5 x 3 x 3 = 45

Q2.C

Q2 Solution:-

√ 54 x √ 6 = √ 54 x 6 = √ (3 x 3 x 6 x 6) = √ (32 x 62) = √ 18

Q3.B

Q3 Solution:-

√0.00000841 = √841/100000000 = 29/10000= 0.0029

Q4.D

Q4 Solution:-

√(248 + √(51 + √169)) = √(248 + √(51 + 13)) = √(248 + √(64)) = √(248 + 8) = √(256) = 16

Q5.B

Q5 Solution:-

√(5/3) = (√5/√ 3) x (√3/√ 3) = √15/3 = 3.88/3 = 1.293

Q6.C

Q6 Solution:-

√0.121 = √ 0.347 x 0.347 = 0.347

Q7.A

Q7 Solution:-

$$\frac{\sqrt{5}+\sqrt{3}}{\sqrt{5}-\sqrt{3}}$$

$$= \frac{\sqrt{5}+\sqrt{3}}{\sqrt{5}-\sqrt{3}} \times \frac{\sqrt{5}+\sqrt{3}}{\sqrt{5}+\sqrt{3}}$$

$$= \frac{5+3+2\sqrt{5}\sqrt{3}}{5-3}$$

$$= \frac{8+2\sqrt{15}}{2} = 4 + \sqrt{15} = 4 + 3.8729 = 7.8729$$

Q8.C

Q8 Solution:-

9720 = 2 x 2 x 2 x 3 x 3 x 3 x 5 x 3 x 3 = $2^3 \times 3^3 \times 3^2 \times 5$

∴ required no: 3 x 5^2 = 3 x 25 = 75

Q9.B

Q9 Solution:-

√0.00004761 = √4761/100000000 = 69/10000 = 0.0069

Q10.C

Q10 Solution:-

Given exp :

3+√6/(5√3-2√4x3-√16x2+ √25x2)

= 3+√6/(5√3-4√3-4√2+5√2)

= (3+√6)/(√3+√2)x(√3-√2)/(√3-√2)

= 3√3-3√2+√18-√12/(3-2) =(3√3-3√2+√9x2 -√4x3)= (3√3-3√2+3√2-2√3) =√3= 1.732

Q11.C

Q11 Solution:-

(√24+√216)/√96

= (√4x6 +√36x6)/√16x6 = (2√6+6√6)/4√6 = 8√6 /4√6 = 2

Q12.A

Q12 Solution:-

9261 = 3 x 3 x 3 x 7 x 7 x 7 = 3^3 x 7^3

∴ $\sqrt[3]{9261} = (3^3 \times 7^3)^{1/3}$ = 3 x 7 = 21.

Q13.A

Q13 Solution:-

√[√0.0001 + √0.0064] = √[0.01+0.08] = √0.09 = 0.3

Q14.B

Q14 Solution:-

(√8+2√32-3√128+4√50)=(√4x2+2√16x2-3√64x2+4√25x2)

=(2√2+2x4√2-3x8√2+4x5√2)

=(2√2+8√2-24√2+20√2)= 6√2 = (6x1.414)=8.484

Q15.A

Q15 Solution:-

Let √(√2500+√961) =x^2. Then x^2= √(50+31) = √81= 9.

∴ x = √9 = 3

Q16.B

Q16 Solution:-

given Expression:

$[(\sqrt{2}-1)^2+(\sqrt{2}-1)^2]/3]/[(\sqrt{3}-1)^2+(\sqrt{3}+1)^2]/4]$

=[2(2+1)]/3x[2(3+1)]/4 = 2x2 =4

Q17.B

Q17 Solution:-

Given:

$\sqrt{\frac{x}{169}} = \frac{18}{13}$

$\frac{x}{169} = \frac{18}{13} \times \frac{18}{13} = \frac{324}{169}$

⇒ x= 324

Q18.D

Q18 Solution:-

$\sqrt{(25/16)} = \sqrt{25}/\sqrt{16} = 5/4 = 1\frac{1}{4}$

Q19.B

Q19 Solution:-

$\sqrt{13.69} + \sqrt{0.1369} + \sqrt{0.001369} + \sqrt{0.00001369}$

$= \sqrt{(1369/100)} + \sqrt{(1369/10000)} + \sqrt{(1369/1000000)} + \sqrt{(1369/100000000)}$

$= \sqrt{1369}/\sqrt{100} + \sqrt{1369}/\sqrt{10000} + \sqrt{1369}/\sqrt{1000000} + \sqrt{1369}/\sqrt{100000000}$

$= 37/10 + 37/100 + 37/1000 + 37/10000$

$= 3.7 + 0.37 + 0.037 + 0.0037$

$= 4.1107$

"No real change in history has ever been achieved by discussions." Subhash chandra bose

PROGRESSION

Sequence: A sequence represents numbers formed in succession and arranged in a fixed order defined by a certain rule.

Airthmetic Progression (A.P.): It is a type of sequence where each number/term(except first term) differs from its preceding number by a constant. This constant is termed as common difference.

A.P. Terminologies:

- First number is denoted as 'a'.
- Common difference is denoted as 'd'.
- n^{th} number is denoted as 'T_n'.
- Sum of n number is denoted as 'S_n'.

A.P. Examples:

- 1, 3, 5, 7, ... is an A.P. where a = 1 and d = 3 - 1 = 2.
- 7, 5, 3, 1, - 1 ... is an A.P. where a = 7 and d = 5 - 7 = -2.

General term of A.P: $T_n = a + (n - 1)d$ Where a is first term, n is count of terms and d is the difference between two terms.

Sum of n terms of A.P: $S_n = \frac{n}{2}[2a + (n - 1)d]$ Where a is first term, n is count of terms and d is the difference between two terms. There is another

$S_n = \frac{n}{2}(a + l)$ Where a is first term, n is count of terms, l is the last term.

Geometrical Progression(G.P.): It is a type of sequence where each number/term(except first term) bears a constant ratio from its preceding number. This constant is termed as common ratio.

G.P. Terminogies:

- First number is denoted as 'a'.
- Common ratio is denoted as 'r'.
- n^{th} number is denoted as 'T_n'.
- Sum of n number is denoted as 'S_n'.

G.P. Examples:

- 3, 9, 27, 81, ... is a G.P. where a = 3 and r = $\frac{9}{3}$= 3.
- 81, 27, 9, 3, 1 ... is a G.P. where a = 81 and r = $\frac{27}{81} = \frac{1}{3}$.

General term of G.P: $T_n = ar^{n-1}$ Where a is first term, n is count of terms, r is the common ratio

Sum of n terms of G.P.: $S_n = a(1 - r^n)/(1 - r)$ Where a is first term, n is count of terms, r is the common ratio and r < 1. There is another variation of the same formula:

$S_n = a(r^n - 1)/(r - 1)$ Where a is first term, n is count of terms, r is the common ratio and r > 1.

Arithmetic Mean: Arithmetic mean of two numbers a and b is $\frac{a+b}{2}$

Geometric Mean: Geometric mean of two numbers a and b is $\sqrt{ab}$

General Formulaes:

$1 + 2 + 3 + ... + n = \frac{n}{2}(n+1)$

$1^2 + 2^2 + 3^2 + ... + n^2 = \frac{n}{6}(n+1)(2n+1)$

$1^3 + 2^3 + 3^3 + ... + n^3 = [\frac{n}{2}(n+1)]^2$

----------**EXERCISE**----------

Q1. Find the sum of the first 50 terms of the sequence: 1,3,5,7,9,.....

A 5600 B 2800 C 2500 D 1500

Q2. Find the sum of the series: 1+3.5+6+8.5+.....+101

A 2091 B 2601 C 3018 D 3605

Q3. What are the three numbers in A.P. if their sum is 15 and product is 80?

A. 3,5, 7, B. 2, 5, 8 C. 6, 5, 4 D None

Q4. How many terms are present in the A.P. 7, 13, 19, ... 205?

A 31 B 32 C 33 D 34

Q5. Which of the following is the 16th term of A.P. 5, 8, 11, 14, 17, ...?

A 50 B 51 C 52 D 53

Q6. Which of the following is the sum of first 17 term of A.P. 5, 9, 13, 17, ...?

A 626 B 627 C 628 D 629

Q7. Which of the following is the sum of the series 2, 5, 8, ..., 182?

A 5612 B 5613 C 5614 D 5615

Q8. How many terms are there in 2,4,8,16.....1024?

A 10 B 12 C 15 D 19

Q9. What is the 16th term of A.P. 3, 5, 7, 9 ...?

A 28 B 28 C 33 D 35

Q10. How many terms are there in the geometric progression: 2,4,8,...,128?

A 5 B 6 C 7 D 8

Q11. Find the sum of the geometric series if there are 6 terms in the series: 2+6+18+54+...

A 491 B 583 C 684 D 728

Q12. What is the 8th term of G.P. 2, 6, 18,.....?

A 2365 B 3598 C 4374 D 5124

Q13. Which of the following is the 9^{th} term of G.P. 3, 6 , 12, 18...?

A 656 B 768 C 872 D 944

Q14. Which of the following term of A.P. 4, 9, 14, 19, 24, ... is 109?

A. 20^{th} B. 21^{st} C. 22^{nd} D 23^{rd}

Q15. Which of the following is the first term of A.P. if 6th term is 12 and 8th term is 22?

A -13 B -8 C -2 D -1

Q16. Which of the following is the 16^{th} term of A.P. if 6^{th} term is 12 and 8th term is 22?

A 60 B 61 C 62 D 63

Q17. If an A.P. has it's 6^{th} term is 12 and 8^{th} term is 22. Find the common difference:

A 4 B 5 C 6 D 7

Q18. An arithmetic progression has 3 as its first term. Also, the sum of the first 8 terms is twice thesum of the first 5 terms. Find the common difference.

A $\frac{1}{2}$ B $\frac{2}{3}$ C $\frac{3}{4}$ D $\frac{11}{25}$

Q19. Which of the following is the first term of G.P. if 4^{th} term is 54 and 9^{th} term is 13122?

A 2 B 3 C 4 D 6

Q20. Which of the following is the 6th term of G.P. if 4^{th} term is 54 and 9^{th} term is 13122?

A 484 B 485 C 486 D 487

Q21. The sum of even numbers between 1 and 21 is?

A 110 B 100 C 70 D 30

Q22. In a group of tourists, member's ages are in A.P. with common difference of 3 months. If youngest member is 7 years old and sum of ages of all members is 250 years then how many members are there in the club?

A 15 B 20 C 25 D 30

Q23. How many odd numbered pages are present in a book of 1089 pages?

A 542 B 543 C 544 D 545

Q24. What is the number if its third part is greater than its fifth part by 16?

A 120 B 150 C 180 D 210

Q25. Sum of two numbers is 80. If three times of first number is same as five times of the second number, what are the numbers?

A. 50, 30 B. 60, 20 C. 70, 10 D 75, 5

Q26. Find the smallest of three numbers if numbers are in ratio of 3:2:5 and sum of their squares is 1862.

A 13 B 14 C 15 D 16

Q27. Find is the positive integer if fifteen times of it is less than its square by 16.

A 13 B 14 C 15 D 16

Q28. Find is the positive integer if twenty-three times of it is more than twice of it's square by 63.

A 7 B 8 C 9 D 10

Q29. $(1^3 + 2^3 + 3^3 + ... + 15^3) - (1 + 2 + 3 + ... + 15) = ?$

A 12280 B 13280 C 14280 D 14400

Q30. What is the largest number among the three consecutive multiples of 3 if there sum is 90?

A 21 B 30 C 33 D 36

Q31. The terms a, 1, and b are in AP and the terms 1, a and b are in GP. Find the values of a and b, where $a \neq b$.

A. -2, 4 B. -2, 5 C. -3, 5 D. None

Q32. How many numbers between 11 and 90 are divisible by 7 ?

A 11 B 12 C 13 D 14

Q33. $1^2 + 2^2 ... + x^2 = \frac{1}{6}[x(x+1)(2x+1)]$. What is $1^2 + 3^2 + ... + 15^2$?

A 680 B 760 C 824 D 960

Q34. Find the sum of all 2 digit numbers divisible by 3.

A 1315 B 1425 C 1535 D 1665

Q35. How many 3-digits numbers are there which are completely divisible by 6?

A 102 B 150 C 151 D 156

Q36. Find the sum of all odd numbers upto 100.

A 1300 B 1800 C 2500 D 3160

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----------ANSWERS ----------

Q1.C	**Q2.A**	**Q3.B**	**Q4.D**	**Q5.A**
Q6.D	**Q7.A**	**Q8.A**	**Q9.C**	**Q10.C**
Q11.D	**Q12.C**	**Q13.B**	**Q14.C**	**Q15.A**
Q16.C	**Q17.B**	**Q18.C**	**Q19.A**	**Q20.C**
Q21.A	**Q22.C**	**Q23.D**	**Q24.A**	**Q25.A**
Q26.B	**Q27.D**	**Q28.A**	**Q29.C**	**Q30.C**
Q31.A	**Q32.A**	**Q33.A**	**Q34.D**	**Q35.B**
Q36.C				

----------ANSWERS WITH SOLUTION----------

Q1.C

Q1 Solution:-

This is an arithmetic progression, and we can write down
a=1 ,d=2 , n=50 .
We now use the formula, so that
$S_n = \frac{n}{2}[2a + (n - 1)d]$
$S_{50} = \frac{50}{2}(2\times1+(50-1)\times2)$
$=25\times(2+49\times2)=25\times(2+98)=2500$.

Q2.A

Q2 Solution:-

This is an arithmetic series, because the difference between the terms is a constant value, 2.5
We also know that the first term is 1, and the last term is 101. But we do not know how many terms are in the series. So we will need to use the formula for the last term of an arithmetic progression, $l=a+(n-1)d$
to give us
$101=1+(n-1)\times2.5$
Now this is just an equation for n, the number of terms in the series, and we can solve it. If we subtract 1 from each side we get
$100=(n-1)\times2.5$
and then dividing both sides by 2.5 gives us $40=n-1$ so that $n=41$. Now we can use the formula or the sum of an arithmetic progression, in the version using l, to give us
$S_n = \frac{n}{2}(a+l)$
$S_{41} = \frac{41}{2}\times(1+101)$
$= \frac{41}{2}\times102=41\times51$
$=2091$

Q3.B

Q3 Solution:-

Let the numbers are a-d, a and a + d
Then a- d + a + a + d = 15
=> 3a = 15
=> a = 5
Now (a- d)a(a + d) = 80
=> (5 - d) x 5 x (5 + d) = 80
=> $25 - d^2 = 16$
=> $d^2 = 9$
=> d = +3 or -3
∴ numbers are either 2, 5, 8 or 8, 5, 2.

Q4.D

Q4 Solution:-

Here a = 7, d = 13 - 7 = 6, T_n = 205

Using formula $T_n = a + (n - 1)d$

$T_n = 7 + (n - 1) \times 6 = 205$ where 205 is the nth term.

=> $7 + 6n - 6 = 205$

=> $6n = 205 - 1$

=> $n = 204/6 = 34$

Q5.A

Q5 Solution:-

Here a = 5, d = 8 - 5 = 3, n = 16

Using formula $T_n = a + (n - 1)d$

$T_{16} = 5 + (16 - 1) \times 3 = 50$

Q6.D

Q6 Solution:-

Here a = 5, d = 9 - 5 = 4, n = 17

Using formula $S_n = \frac{n}{2}[2a + (n - 1)d]$

$S_{17} = \frac{17}{2}[2 \times 5 + (17 - 1) \times 4]$

$= \frac{17}{2}(10 + 64)$

$= \frac{17 \times 74}{2} = 629$

Q7.A

Q7 Solution:-

Here a = 2, d = 5 - 2 = 3, T_n = 182

Using formula $T_n = a + (n - 1)d$

$a + (n - 1)d = 182$

=> $2 + (n - 1) \times 3 = 182$

=> $3n = 183$

=> $n = 61$.

Using formula $S_n = \frac{n}{2}[2a + (n - 1)d]$

$S_{61} = \frac{61}{2}[2a + (n - 1)d]$

$= (\frac{61}{2})[2 \times 2 + (61 - 1) \times 3]$

$= (\frac{61}{2})(4 + 180) = \frac{61 \times 184}{2} = 61 \times 92 = 5612$

Q8.A

Q8 Solution:-

Clearly 2,4,8,16.....1024 form a GP. With a=2 and $r = T_2 / T_1 = 4/2 = 2$.

Let the number of terms be n . Then

$2 \times 2n-1 = 1024$ or $2n-1 = 512 = 29$.

=> $n-1=9$ or $n=10$.

Q9.C

Q9 Solution:-

Here a = 3, d = 5 - 3 = 2, n = 16

Using formula $T_n = a + (n - 1)d$

$T_{16} = 3 + (16 - 1) \times 2 = 33$

Q10.C

Q10 Solution:-

In this sequence a=2 and r=2. We also know that the n-th term is 128. But the formula for the n-th term is arn−1arn−1

so $128=2\times2^{n-1}$

$64=2\times2^{n-1}$

6=n−1

n=7 .

So there are 7 terms in this geometric progression.

Q11.D

Q11 Solution:-

For this series, we have:

a=2,r=3 and n=6. So

$S_n=a(r^n - 1)/(r - 1)$

$S_6=2(3^6 - 1)/(3-1)$

$S_6=728$

Q12.C

Q12 Solution:-

Here a = 2, r = 3, n = 8.

Using formula $T_n = a(r^n - 1)$

$T_n = 2 \times 3(8-1) = 2 \times 37 = 2 \times 2187 = 4374$

Q13.B

Q13 Solution:-

Here a = 3, r = 6 / 3 = 2, T_9 = ?

Using formula $T_n = ar^{(n - 1)}$

$T_9 = 3 \times 2^{9 - 1}$

$=3 \times 2^8$

$=3 \times 256$

=768

Q14.C

Q14 Solution:-

Here a = 4, d = 9 - 4 = 5

Using formula $T_n = a + (n - 1)d$

$T_n = 4 + (n - 1) \times 5 = 109$ where 109 is the n^{th} term.

=> $4 + 5n - 5 = 109$

=> $5n = 109 + 1$

=> $n = \frac{110}{5}$

$= 22$

Q15.A

Q15 Solution:-

Using formula $T_n = a + (n - 1)d$

$T_6 = a + (6 - 1)d = 12$ ...(i)

$T_8 = a + (8 - 1)d = 22$ ...(ii)

Substract (i) from (ii)

=> $2d = 10$

=> $d = 5$

Using (i)

$a = 12 - 5d$

$= 12 - 25$

$= -13$

Q16.C

Q16 Solution:-

Using formula $T_n = a + (n - 1)d$

$T_6 = a + (6 - 1)d = 12$ ----------(i)

$T_8 = a + (8 - 1)d = 22$ ----------(ii)

Substract (i) from (ii)

=> $2d = 10$

=> $d = 5$

Using (i) and (ii)

$a = 12 - 5d$

$= 12 - 25$

$= -13$

∴ $T_{16} = -13 + (16 - 1) \times 5 = 75 - 13 = 62$

Q17.B

Q17 Solution:-

Using formula $T_n = a + (n - 1)d$

$T_6 = a + (6 - 1)d = 12$ ...(i)

$T_8 = a + (8 - 1)d = 22$ ...(ii)

Substract (i) from (ii)

=> $2d = 10$

=> $d = 5$

Q18.C

Q18 Solution:-

We are given that a=3. We are also given some information about the sums S_8 and S_5, and we want to find the common difference. So we shall use the formula

$S_n = \frac{n}{2}[2a + (n - 1)d]$

for the sum of the first nn terms. This tells us that

$S_8 = \frac{8}{2}(6+7d)$

$S_8=4\times(6+7d)$

$S_5= \frac{5}{2}(6+4d)$

So, using the given fact that $S_8=2S_5$, we see that

$4\times(6+7d)=2\times\frac{5}{2}\times(6+4d)$

$24+28d=30+20d$

$8d=6$

$4d=3$

$d = \frac{3}{4}$

Q19.A

Q19 Solution:-

Using formula $T_n = ar^{(n-1)}$

$T_4 = ar^{(4-1)} = 54$

=> $ar^3 = 54$ ----------(i)

$T_9 = ar^{(9-1)} = 13122$

=> $ar^8 = 13122$ ----------(ii)

Dividing (ii) by (i)

=> $r^5 = \frac{13122}{54} = 243 = 3^5$

=> r = 3

Using (i)

a x 27 = 54

=> a = 2

Q20.C

Q20 Solution:-

Using formula $T_n = ar^{(n-1)}$

$T_4 = ar^{(4-1)} = 5^4$

=> $ar^3 = 5^4$ ----------(i)

$T_9 = ar^{(9-1)} = 13122$

=> $ar^8 = 13122$ ----------(ii)

Dividing (ii) by (i)

=> $r^5 = 13122 / 54 = 243 = (3)^5$

=> r = 3

Using (i)

a x 27 = 54

=> a = 2

∴ $T_6 = ar^{(6-1)} = 2 \times (3)^5$

= 2 x 243

= 486

Q21.A

Q21 Solution:-

A.P a = 2, l = 20

=> a + (n - 1)d = 20

=> 2 + (n – 1) x 2 = 20

=> n = 10 i.e. terms = 10

$S_2 = \frac{n}{2}(a + l)$

$= \frac{10}{2} \times (2 + 20)$

$= \frac{10}{2} \times 22$

=10x11

= 110

Q22.C

Q22 Solution:-

let the ages be 7 , 7.25, 7.5 and so on

Here a = 7, d = $\frac{1}{4}$, S_n = 250

Using formula $S_n = \frac{n}{2}[2a + (n - 1)d]$

=> $\frac{n}{2}[14+(n-1)(1/4)] = 250$

=> n[14 + (n-1)/4] = 500
=> n[56 + (n-1)] = 2000
=> n[n + 55] = 2000
=> n^2 + 55n - 2000 = 0
=> n^2 + 80n -25n - 2000 = 0
=> n(n-80) -25(n-80) = 0
=> (n-80)(n-25) = 0
=> n = 25 or n = 80

Q23.D

Q23 Solution:-

Here pages are 1, 3, ..., 1089 which is an A.P. Here a = 1, d = 2, l = 1089

Using formula T_n = a + (n - 1)d

T_n = 1 + (n - 1) x 2 = 1089

=> 2n -1 = 1089

=> n = $\frac{1090}{2}$ = 545

Q24.A

Q24 Solution:-

Let the number be y.

Then ATP:

$\frac{Y}{3} - \frac{Y}{5}$ = 16

=> 5y - 3y = 16 x 15 = 240
=> 2y = 240
∴ y = 120

Q25.A

Q25 Solution:-

Let the numbers are y and 80 - y.

Then 3y = 5(80-y)

=> 8y = 400
∴ y = 50

and second number = 80 - 50 = 30.

Q26.B

Q26 Solution:-

Let've number as 3y, 2y and 5y.

Then $9y^2 + 4y^2 + 25y^2$ = 1862.

=> $38y^2$ = 1862
=> y^2 = 1862 / 38 = 49
=> y = 7
∴ smallest number = 2y = 2 x 7 = 14.

Q27.D

Q27 Solution:-

Let the positive integer by y.

Then $y^2 - 15y = 16$

=> $y^2 - 15y - 16 = 0$

=> $y^2 - 16y + y - 16 = 0$

=> $y(y-16) + (y-16) = 0$

=> $(y+1)(y-16) = 0$

∴ y = 16. as -1 is not a positive integer.

Q28.A

Q28 Solution:-

Let the positive integer by y.

Then $23y - 2y^2 = 63$

=> $23y - 2y^2 - 63 = 0$

=> $2y^2 - 23y + 63 = 0$

=> $2y^2 - 14y - 9y + 63 = 0$

=> $2y(y-7) - 9(y-7) = 0$

=> $(2y-9)(y-7) = 0$

∴ y = 7. as 9/2 is not an integer.

Q29.C

Q29 Solution:-

Using formula $1^3 + 2^3 + 3^3 + ... + n^3 = \left[\frac{n}{2}(n+1)\right]^2$

$(1^3 + 2^3 ... + 15^3) = \left[\frac{15x16}{2}\right]^2$

$= 120^2 = 14400$

Using formula $(1 + 2 + ... n) = \frac{n}{2}(n+1)$

∴ $(1^3 + 2^3 ... + 15^3) - (1 + 2 + ... + 15)$

$= 14400 - \frac{15}{2} x\ 15 \times 16 = 14400 - 120$

$= 14280$

Q30.C

Q30 Solution:-

Let the numbers be 3y , 3y + 3, 3y + 6

Now 3y + 3y + 3 + 3y + 6 = 90

=> 9y = 81

=> y = 9

=> largest number = 3y + 6 = 3 x 9 + 6 = 33

Q31.A

Q31 Solution:

AP or Arithmetic Progression of three terms specifies that the difference between any two consecutive terms will be a constant. Thus from the first expression we get,

ATP

1−a=b−1

Or, a+b=2 ----------(i)

Again ATP

a/1=b/a ----------(ii)

Or, a^2=b.

=> $a^2 = 2-a$
Solving we get a=1 or -2
Putting in Equation (i) we get b=1 or 4
So answer is (1,1) or (-2,4)
Since a≠b
So our answer will be -2, 4

Q32.A
Q32 Solution:-
The required numbers are 14, 21, 28, 35, ... 77, 84.
This is an A.P. with a = 14 and d = (21 - 14) = 7.
Let it contain n terms.
Then, $T_n = 84$ => a + (n - 1) d = 84
=> 14 + (n - 1) x 7 = 84 or n = 11.
=> Required number of terms = 11.

Q33.A
Q33 Solution:-
$(1^2 + 3^2 ... + 15^2) = (1^2 + 2^2 ... + 15^2) - (2^2 + 4^2 ... + 14^2)$
Using formula: $1^2 + 2^2 + 3^2 + ... + n^2 = \frac{n}{6}(n+1)(2n+1)$
$\frac{15}{6}(15+1)(30+1) - (1 \times 2^2 + 2^2 \times 2^2 + 2^2x3^2 + ... + 2^2x7^2)$
$= 1240 - 2^2(1^2 + 2^2 + ... + 7^2)$
$= 1240 - 4[\frac{7}{6}x(7+1)x(14+1)]$
= 1240 - 560
= 680

Q34.D
Q34 Solution:-
All 2 digit numbers divisible by 3 are :
12, 51, 18, 21, ..., 99.
This is an A.P. with a = 12 and d = 3.
Let it contain n terms. Then,
12 + (n - 1) x 3 = 99 or n = 30.
=> Required sum = 30 x (12+99) = 1665.

Q35.B
Q35 Solution:-
Here numbers are 102, 108, ..., 996 which is an A.P.
Here a = 102, $d = T_2 - T_1 = 108 - 102 = 6$,
Using formula $T_n = a + (n - 1)d$
$T_n = 102 + (n - 1) \times 6 = 996$
=> 96 - 6n = 996
=> $n = \frac{900}{6} = 150$

Q36.C
Q36 Solution:-
The given numbers are 1, 3, 5, 7, ..., 99.
This is an A.P. with a = 1 and d = 2.
Let it contain n terms. Then,
1 + (n - 1) x 2 = 99 or n = 50.
=> Required sum = n (first term + last term)/2
= 50 (1 + 99) = 2500.

AVERAGE

Average: Average is commonly known as average. The average of a given set of numbers is called the Average, or simply, the mean of the given numbers. So , the Average of a group of bservations is defined as

$$\text{Mean} = \frac{\text{Sum of observations}}{\text{Number of observations}}$$

x is the symbol of the Average.

So , the mean of n observation $x_1, x_2, \ldots, x_n$, is given by

Properties of Average:

Property 1: If x is the Average of n observations $x_1, x_2, x_3, \ldots x_n$; then

$(x_1 - x) + (x_2 - x) + (x_3 - x) + \ldots + (x_n - x) = 0.$

Property 2: The mean of n observations $x_1, x_2, x_3, \ldots x_n$ is x. If each observation is increased by p, the mean of the new observations is (x + p).

Property 3: The mean of n observations $x_1, x_2, x_3, \ldots x_n$ is x. If each observation is decreased by p, the mean of the new observations is (x - p).

Property 4: The mean of n observations $x_1, x_2, x_3, \ldots x_n$ is x. If each observation is multiplied by a nonzero number p, the mean of the new observations is px.

Property 5: The mean of n observations $x_1, x_2, x_3, \ldots x_n$ is x. If each observation is divided by a nonzero number p, the mean of the new observations is $\frac{x}{p}$

Problems based on average:

1. The heights of five runners are 164 cm, 137 cm, 149 cm, 149 cm and 161 cm respectively. Find the mean height per runner.

Solution:

Mean height = Sum of the heights of the runners/number of runners

$$= \frac{164 + 137 + 149 + 149 + 161}{5}$$

$$= \frac{760}{5} \text{ cm}$$

= 152 cm.

So, the mean height is 152 cm.

2. Find the mean of the first six prime numbers.

Solution:

The first six prime numbers are 2, 3, 5, 7 ,11 and13.

$$\text{Mean} = \frac{\text{Sum of the first six prime numbers}}{\text{number of prime numbers}}$$

$$= \frac{2+3+5+7+11+13}{6}$$

= 41/6

= 6.833

So, their mean is 6.833

3. Find the mean of the first six multiples of 4.

Solution:

The first six multiples of 4 are 4, 8, 12, 16, 20 and 24.

Mean = $\frac{\text{Sum of the first six multiples of 4}}{\text{number of multiples}}$

$= \frac{4+8+12+16+20+24}{6}$

$= \frac{84}{6}$

= 14.

So, their mean is 14.

4. Find the Average of the first 7 natural numbers.

Solution:

The first 8 natural numbers are 1, 2, 3, 4, 5, 6 ,7 and 8.

Let x denote their Average.

Then mean = Sum of the first 7 natural numbers/number of natural numbers

$x = \frac{1+2+3+4+5+6+7+8}{8}$

$= \frac{36}{8}$

= 4.5

So, their mean is 4.5

5. If the mean of 9, 8, 10, x, 12 is 15, find the value of x.

Solution:

Mean of the given numbers = (9 + 8 + 10 + x + 12)/5 = (39 + x)/5

According to the problem, mean = 15 (given).

So, (39 + x)/5 = 15

⇒ 39 + x = 15 × 5

⇒ 39 + x = 75

⇒ 39 + x = 75 - 39

⇒ x = 36

So, x = 36.

6. The mean of 40 numbers was found to be 38. Later on, it was detected that a number 56 was misread as 36. Find the correct mean of given numbers.

Solution:

Calculated mean of 40 numbers = 38.

So, calculated sum of these numbers = (38 × 40) = 1520.

Correct sum of these numbers

= [1520 - (wrong item) + (correct item)]

= (1520 - 36 + 56)

= 1540.

So, the correct mean = 1540/40 = 38.5.

7. The mean of the heights of 6 males is 152 cm. If the individual heights of five of them are 151 cm, 153 cm, 155 cm, 149 cm and 154 cm, find the height of the sixth boy.

Solution:

Mean height of 6 males = 152 cm.
Sum of the heights of 6 males = (152 × 6) = 912 cm
Sum of the heights of 5 males = (151 + 153 + 155 + 149 + 154) cm = 762 cm.
Height of the sixth boy
= (sum of the heights of 6 males) - (sum of the heights of 5 males)
= (912 - 762) cm = 150 cm.
So, the height of the sixth female is 150 cm.

8. The mean weight of a group of seven males is 56 kg. The individual weights (in kg) of six of them are 52, 57, 55, 60, 59 and 55. Find the weight of the seventh boy.

Solution:

Mean weight of 7 males = 56 kg.
Total weight of 7 males = (56 × 7) kg = 392 kg.
Total weight of 6 males = (52 + 57 + 55 + 60 + 59 + 55) kg
= 338 kg.
Weight of the 7th boy = (total weight of 7 males) - (total weight of 6 males)
= (392 - 338) kg
= 54 kg.
So, the weight of the seventh boy is 54 kg.

9. A cricketer has a mean score of 58 runs in nine innings. Find out how many runs are to be scored by him in the tenth innings to raise the mean score to 61.

Solution:

Mean score of 9 innings = 58 runs.
Total score of 9 innings = (58 x 9) runs = 522 runs.
Required mean score of 10 innings = 61 runs.
Required total score of 10 innings = (61 x 10) runs = 610 runs.
Number of runs to be scored in the 10th innings
= (total score of 10 innings) - (total score of 9 innings)
= (610 -522) = 88.
So, the number of runs to be scored in the 10th innings = 88.

10. The average height of 30 males was calculated to be 150 cm. It was detected later that one value of 165 cm was wrongly copied as 135 cm for the computation of the mean. Find the correct mean.

Solution:

Calculated average height of 30 males = 150 cm.
Incorrect sum of the heights of 30 males
= (150 × 30)cm
= 4500 cm.
Correct sum of the heights of 30 males
= (incorrect sum) - (wrongly copied item) + (actual item)
= (4500 - 135 + 165) cm
= 4530 cm.
Correct mean = correct sum/number of males
= (4530/30) cm
= 151 cm.
So, the correct mean height is 151 cm.

11. The mean of 16 items was found to be 30. On rechecking, it was found that two items were wrongly taken as 22 and 18 instead of 32 and 28 respectively. Find the correct mean.

Solution:

Calculated mean of 16 items = 30.
Incorrect sum of these 16 items = (30 × 16) = 480.
Correct sum of these 16 items
= (incorrect sum) - (sum of incorrect items) + (sum of actual items)
= [480 - (22 + 18) + (32 + 28)]
= 500.
So, correct mean = 500/16 = 31.25.
So, the correct mean is 31.25.

AVERAGE

----------**EXERCISE**----------

Q1. The average of first five multiples of 3 is:

A. 7 B. 9 C. 11 D. None

Q2. The average of six numbers is z and the average of three of these is y. If the average of the remaining three number is w, then which of following holds?

A. 2z = y + w B. $z = \frac{2y+3w}{3}$ C. z = 2y + w D. y=z+w

Q3. Out of 9 persons, 8 persons spent Rs. 30 each for their meals. The ninth one spent Rs. 20 more than the average expenditure of all the nine. The total money spent by all of them was?

A. 290 B. 292.50 C. 294.60 D. 296.70

Q4. The average of 50 numbers is 30. If two numbers, 35 and 40 are discarded, then the average of the remaining numbers will be:

A. 26.28 B. 27.58 C. 28.38 D. 29.68

Q5. The average score of a cricketer for ten matches is 38.9 runs. If the average for the first six matches is 42, then find the average for the last four s.

A. 33.25 B. 34.25 C. 35.75 D. 36

Q6. A Batsman makes a score of 87 runs in the 17^{th} inning and so increases his average by 3. Find his average after 17th inning.

A. 21 B. 30 C. 39 D. 48

Q7. The average height of 30 males was calculated to be 150 cm. It was detected later that one value of 165 cm was wrongly copied as 135 cm for the computation of the mean. Find the correct mean.

A. 150 cm B. 151 cm C. 152 cm D. 153 cm

Q8. A car owner buys petrol at Rs. 75, Rs. 80 and Rs. 85 per litre for three successive years. What approximately is the average cost per litre of petrol if he spends Rs. 40000 each year?

A. 7.98 B. 8 C. 8.50 D. 9

Q9. Agniwesh obtained 76, 65, 82, 67 and 85 marks (out of 100) in English, mathematics, physics, chemistry and biology. What is his average marks?

A. 65 B. 69 C. 75 D. None of above

Q10. The average of score of a cricket player of 10 matches was 32. How many runs should he score in his next match so as to increase his average of score by 4?

A. 72 B. 74 C. 75 D. 76

Q11. The average salary of a worker for 15 working days was Rs.90 per day. During the first 7 days, his average salary was Rs.87/day and for the last 7 days average salary was Rs.92 /day. What was his salary on the 8th day?

A. 84 B. 89 C. 92 D. 97

Q12. The average temperature on Wednesday, Thursday and Friday was 25C.G. The average temperature on Thursday, Friday and Saturday was 24C.G. If the temperature on Saturday was 27C.G. what was the temperature on Wednesday?

A. 21◦ B. 24◦ C. 27◦ D. 30◦

Q13. When a employee weighing 45 kgs left a Company, the average weight of the remaining 59 employees decreased by 200 g. What is the average weight of the remaining 59 employees?

A. 57 B. 58.8 C. 59.2 D. 60

Q14. The difference between two angles of a triangle is 24 degree.. The average of the same two angles is 54 degree .Which one of the following is the value of the greatest angle of the triangle?

A. 54∘ B. 60∘ C. 66∘ D. 72∘

Q15. The average age of a family of 5 members is 20 years. If the age of the youngest member be 10 years then what was the average age of the family at the time of the birth of the youngest member?

A. 11 B. 11.5 C. 12 D. 12.5

Q16. Which one of the following numbers can be removed from the set S = {0, 2, 4, 5, 9} without changing the average of set S?

A. 0 B. 2 C. 4 D. 5

Q17. Average cost of 5 apples and 4 mangoes is Rs. 36. The average cost of 7 apples and 8 mangoes is Rs. 48. Find the total cost of 24 apples and 24 mangoes.

A. 1024 B. 1576 C. 2088 D. 2524

Q18. Average of ten positive numbers is x. If each number is increased by 10%, then x will:

A. increase B. decrease C. unchange D. increase by 10%

Q19. The average weight of 3 males A,Band C is 54 kg, while the average weight of 3 males B, D and E is 53 kg. What is the average weight of A,B,C,Dand E?

A. 52.6 kg B. 53.7 kg C. 54.8 kg D. CBD

Q20. The average salary of all the workers in a workshop is Rs.8000. The average salary of 7 technicians is Rs.12000 and the average salary of the rest is Rs.6000. The total number of workers in the workshop:

A. 20 B. 21 C. 22 D. 23

Q21. 40 year is the average of the company. 32 years is the average of the company if 12 new employees also add in this company. Find out the number of employees in the company?

A. 10 B. 11 C. 12 D. 13

Q22. The heights of five runners are 160 cm, 137 cm, 149 cm, 153 cm and 161 cm respectively. Find the mean height per runner.

A. 151 B. 152 C. 153 D. 154

Q23. In a set of 3 numbers, the average of first two numbers is 2, the average of the last two numbers is 3, and the average of the first and the last numbers is 4. What is the average of 3 numbers?

A. 2 B. 2.5 C. 3 D. 3.5

Q24. Of the 3 numbers, the first is twice the second and the second is twice the third. The average of the reciprocal of the numbers is 7/72 .The numbers are:

A. 16, 8, 4 B. 20, 10, 5 C. 24, 12, 6 D. 36, 18, 9

Q25. The average of all the two-digit numbers, which remain the same when the digits interchange their positions, is?

A. 33 B. 44 C. 55 D. 66

Q26. The average weight of 3 men Anish, Manu, Rahul is 84 kg. If Suman joins them the average becomes 80kg. If Vikrant, whose weight is 3 kg more than that of Suman, replaces Anish, then the average weight of Manu, Rahul, Suman, and Vikrant becomes 79kg. The Anish weigh?

A. 72 B. 75 C. 78 D. 80

Q27. A cricketer has an average score of 58 runs in nine innings. Find out how many runs are to be scored by him in the tenth innings to have an average of 61.

A. 88 B. 92 C. 96 D. 98

Q28. The mean of five numbers is 28. If one of the numbers is excluded, the mean gets reduced by 2. Find the excluded number.

A. 33 B. 36 C. 39 D. 42

Q29. Dipa finds the average of 10 two 2 digit numbers. If she interchanges the digits of one number (like 18 for 81) she finds average decreases by 1.8 from original. What was the difference of the two digits of the number?

A. 8 B. 4 C. 2 D. 1

Q30. The average of four consecutive even numbers is 27. find the largest of these numbers?

A. 19 B. 27 C. 30 D. 41

Q31. If there are two sections A and B of a class consisting of 36 and 44 students respectively. If the average weight of section A is 40kg and that of section B is 35kg, find the average weight of the whole class?

A. 19 B. 28.5 C. 37.25 D. 46.25

Q32. Nine persons went to a hotel for taking their meals 8 of them spent Rs.12 each on their meals and the ninth spent Rs.8 more than the average expenditure of all the nine.What was the total money spent by them?

A. 117 B. 132 C. 143 D. 154

Q33. If the mean of five observations x, x + 4, x + 6, x + 8 and x + 12 is 16, find the value of x.

A. 10 B. 11 C. 12 D. 15

Q34. Of the three numbers, second is twice the first and is also thrice the third. If the average of the three numbers is 44.Find the largest number.

A. 61 B. 72 C. 83 D. 94

Q35. The average of 25 result is 18.The average of 1st 12 of them is 14 & that of last 12is 17. Find the 13th result.

A. 61 B. 72 C. 78 D. 84

Q36. The Average of 11 results is 60, if the average of the 1st 6 results is 58 & that of thelast 63. Find the 6th result.

A. 41 B. 52 C. 66 D. 74

Q37. The mean of eight numbers is 37. If 17 is subtracted from each number, what will be the new mean?

A. 16 B. 18 C. 20 D. 22

Q38. If the average of 5 observation x, x + 2, x + 4, x + 6 and x + 8 is 11, then the average of the last three observation is?

A. 11 B. 13 C. 15 D. 17

Q39. The mean weight of a company of 35 employees is 45 kg. If the weight of the owner of company is included, the average weight increases by ½ kg. Find the weight of the teacher.
A. 61 B. 62 C. 63 D. 64

Q40. The mean weight of a group of seven members is 56 kg. The individual weights of six of them are 52, 57, 55, 60, 59 and 55 kilograms . Find the weight of the seventh member.
A. 48 B. 50 C. 52 D. 54 kg

Q41. Find the average of all prime numbers between 30 and 50?
A. 31 B. 37 C. 39.8 D. 41

Q42. Find the average of first 40 natural numbers?
A. 10.5 B. 20.5 C. 23.5 D. 24

Q43. Find the average of first 20 multiples of 7?
A. 73.5 B. 82.7 C. 93.8 D. 104

Q44. The average of a non-zero number and its square is 5 times the number. The number is?
A. 9 B. 18 C. 27 D. 36

Q45. The average of 7 consecutive numbers is 20. The largest of these numbers is?
A. 21 B. 22 C. 23 D. 24

Q46. The average of five consecutive odd numbers is 61. What is the difference between the highest and lowest numbers?
A. 7 B. 8 C. 9 D. 10

Q47. The sum of three consecutive odd numbers is 38 more than the average of these numbers. What is the first of these numbers?
A. 17 B. 18 C. 19 D. 20

Q48. The average age of the males in a company is 36 years and that of the females is 35 years. The average age of the employees of the company is
A. 15 yearsB. 15.5 years C. 16 years D. CBD

Q49. The average annual income (in Rs.) of certain agricultural workers is S and that of other workers is T. The number of agriculture workers is 11 times that of other workers. Then the average monthly income (in Rs.) of all the workers is?
A. S + T/2 B. 11S + T/12 C. 1 +/11ST D. S + 11T/2

Q50. A family consists of grandparents, parents and three grandchildren. The average age of the grandparents is 67 years, that of the parent is 35 years and that of the grandchildren is 6 years. What is the average age of the family?
A. 222/7 B. 230/7 C. 251/7 D. None

This chapter contains the questions I discussed and created in our classes or obtained from students as their doubts. All the questions noted, typed, redesigned and rectified by group of volunteers consisting of:

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----------ANSWERS----------

Q1.B	**Q2.A**	**Q3.C**	**Q4.D**	**Q5.B**
Q6.C	**Q7.B**	**Q8.A**	**Q9.C**	**Q10.D**
Q11.D	**Q12.D**	**Q13.A**	**Q14.D**	**Q15.D**
Q16.C	**Q17.C**	**Q18.D**	**Q19.D**	**Q20.B**
Q21.C	**Q22.B**	**Q23.C**	**Q24.C**	**Q25.C**
Q26.B	**Q27.A**	**Q28.B**	**Q29.C**	**Q30.C**
Q31.C	**Q32.A**	**Q33.A**	**Q34.B**	**Q35.C**
Q36.C	**Q37.C**	**Q38.B**	**Q39.C**	**Q40. D**
Q41.C	**Q42.B**	**Q43.A**	**Q44. A**	**Q45.C**
Q46.B	**Q47.A**	**Q48.D**	**Q49.B**	**Q50.A**

----------ANSWERS AND SOLUTION----------

Q1.B

Q1 Solution:-

First five multiples of 3 are 3,6,9,12,15

Average of these five numbers = (3+6+9+12+15)/5 = 45/5 = 9

Alternative approach(usefull for bigger series):-

Basic Formula: 1,2,3...n

If n is odd, the formula is (n+1)/2th term

The five multiples of 3 is 3,6,9,12,15

(n+1)/2

⇒ $(6/2)^{th}$= 3rd term

Here 3rd term is 9

Q2.A

Q2 Solution:-

Clearly, we have: $z = \frac{3y+3w}{6}$

Or, 2z = y + w.

Q3.C

Q3 Solution:-

Let the average expenditure be Rs k then,

9k = 8 x 30 + (k + 20) or 9k = k + 260 or 8k = 260 or k = 32.50.

So total money spent = 9k = Rs. (9 x 32.50) = Rs. 292.50.

Q4.D

Q4 Solution:-

sum of 50 numbers =(50×30)

Total sum of 48 numbers =(50×30)−(35+40) [sum of fifty terms - sum of two terms]=1500−75=1425

Average =(1425/48)= 29.68

Q5.B

Q5 Solution:-

Total sum of last 4 matches

=(10×38.9)−(6×42)

=389−252=137

Average=137/4=34.25

Q6.C

Q6 Solution:-

Let the average after 17th matches = x
Then average after 16th matches = (x−3)
So 16.(x−3)+87=17x
So x=39

Q7.B

Q7 Solution:-

Calculated average height of 30 males = 150 cm.
Incorrect sum of the heights of 30 males
= (150 × 30)cm = 4500 cm.
Correct sum of the heights of 30 males
= (incorrect sum) - (wrongly copied item) + (actual item)
= (4500 - 135 + 165) cm = 4530 cm.
Correct mean = correct sum/number of males= (4530/30) cm = 151 cm.
So , the correct mean height is 151 cm.

Q8.A

Q8 Solution:-

Total quantity of petrol consumed in 3 years.
= (40000/75 + 40000/80 + 40000/85 litres
= 40000x(1/75 + 1/80 +1/85) =8000x(1/15+1/16+1/17) =8000x(272+255+240)/4080
=8000x767/4080 =100x767/51 = 76700/51
Also, Total amount spent = Rs. (3 x 4000) = Rs 12000
So Average cost = Rs. 12000 x 51/76700 = 120x51/767= Rs. 7.98.

Q9.C

Q9 Solution:-

Average =(76+65+82+67+85)/5 =375/5 =75

Q10.D

Q10 Solution:-

Average after 11 matches = 36
Required number of score = (36×11)−(32×10)=396−320= 76

Q11.D

Q11 Solution:-

The total salary earned during the 15 days that the worker worked =15×90=Rs.1350.
The total salary earned during the first 7 days = 7×87 = Rs. 609.
The total salary earned during the last 7 days = 7×92 = Rs. 644.
Total salary earned during the 15 days = salary during first 7 days + salary on 8th day + salary during the last 7 days.
1350=609 + salary on 8^{th} day +644
salary on 8^{th} day = 1350−609−644 = Rs. 97

Q12.D

Q12 Solution:-

Total temperature on Wednesday, Thursday and Friday was 25×3=75∘
Total temperature on Thursday, Friday and Saturday was 24×3=72∘
So , difference between the temperature on Wednesday and Saturday= 3∘
If Saturday temperature =27∘, then Wednesday's temperature =27∘+3∘=30∘

Q13.A

Q13 Solution:-

Let the average weight of the 59 employees be A.
So, the total weight of the 59 of them will be 59 A.
The questions states that when the weight of this employee who left is added, the total weight of the Company = 59A+45
When this employee is also included, the average weight decreases by 0.2 kgs.
(59A+45)/60=A−0.2
⇒ 59A+45=60A−12
⇒ 45+12=60A−59A
⇒ A=57

Q14.D

Q14 Solution:-

Let A and B be the two angles in the question, with a>b. We are given that the difference between the angles is 24∘
⇒a - b=24.
Since the average of the two angles is 54∘, we have (a+b)/2=54
Solving for B in the first equation yields b=a-24, and substituting this into the second equation yields
[a+(a-24)]/2=54
(2a−24)/2=54
2a−24=54×2
2a−24=108
2a=108+24
2a=132
a=66
Also,
b=a−24=66−24=42.
Now, let C be the third angle of the triangle. Since the sum of the angles in the triangle is 180∘, a+b+c=180.
Putting the values of a and b we get 66+42+c=180. i.e. c=72
So , the greatest of the 3 angles A,B and C is C, which equals 72∘.

Q15.D

Q15 Solution:-

At present the total age of the family = 5×20=100
The total age of the family at the time of the birth of the youngest member:
=100−10 (age of youngest)−(10×4) 10 years × remaining family members=50=[100−10 age of youngest−(10×4) 10 years × remaining family members]=50
So, average age of the family at the time of birth of the youngest member =50/4=12.5

Q16.C

Q16 Solution:-

The average of the elements in the original set S is(0+2+4+5+9)/5=4
If we remove an element that equals the average, then the average of the new set will remain unchanged. The new set after removing 4 is {0, 2, 5, 9}.
The average of the elements is (0+2+5+9)/4=4

Q17.C

Q17 Solution:-

Average cost of 5 apples and 4 mangoes = Rs. 36

Total cost = 36×9=324

Average cost of 7 apples and 8 mangoes = 48

Total cost = 48×15=720

Total cost of 12 apples and 12 mangoes = 324+720=1044

So, cost of 24 apples and 24 mangoes = 1044×2= 2088

Q18.D

Q18 Solution:-

Let 10 numbers be $x_1,x_2,x_3.....x_{10}$

According to question average of these 10 numbers is 10.

⇒ $(x_1+x_2+x_3+.....+x_{10})/10=x$

Now if each number is increased by 10%, then new average, say y,

$y=(1.1x_1+1.1x_2+1.1x_3+.....+1.1x_{10})/10$

⇒ $y=1.1\times((x_1+x_2+x_3+.....+x_{10})/10)$

⇒ $y=1.1x$

⇒ y is 10% increased.

Q19.D

Q19 Solution:-

In this question, sum of numbers is provided, but required sum (i.e. A+B+C+D+E) cannot be calculated by the given data.

So the answer is CBD [Can't be decided]

Q20.B

Q20 Solution:-

Let there be x number of workers.

So total salary of employees = 8000x. [Given Average of all workers=8000]

salary of 7 members 7×12000=84000 [[Given Average of all workers=12000]

Salary of remaining workers = 6000⇒6000×(x–7)

⇒6000x–42000 [[Given Average of all workers=8000]

ATP

8000x=84000+6000x–42000

2000x=42000

x=21

So total number of workers in the workshop is = 21.

Q21.C

Q21 Solution:-

Let k is the strength of the company.

40k+12x32 = 36x (k+12) ⇒ 4k =(432 - 384) = 48 ⇒ k = 12

∴ original strength = 12

Q22.B

Q22 Solution:-

Mean height = Sum of the heights of the runners/number of runners

= (160 + 137 + 149 + 153 + 161)/5 cm= 760/5 cm= 152 cm.

So , the mean height is 152 cm.

Q23.C

Q23 Solution:-

Let the 3 numbers be x,y and z. We are given that
(x+y)/2=2
(y+z)/2=3
(x+z)/2=4
Summing the 3 equations yields
(x+y)/2+(y+z)/2+(x+z)/2=2+3+4
x+y+z=9
The average of the 3 numbers is: (x+y+z)/3=9/3=3

Q24.C

Q24 Solution:-

Let 3 numbers be x,y,z
ATP
x=2y⇒x=4z;y=2z;z=z----------(i)
So (1/x+1/y+1/z)/3=7/72 [As the average of reciprocal numbers is 7/72]
(xy+yz+zy)/3xyz=7/72
$(2z^2+4z^2+8z^{2)}/(3.4z.2z.z)=7/72$ [Putting values from Equation (i)]
$14z^2/24z^3=7/72$
1/z=(7x24)/(72x14)
z=6
⇒ x=4×6 = 24

Q25.C

Q25 Solution:-

Clearly the average of numbers and number formed by reversing its digit will remain same it has both digits same. So these numbers are 11,22,33,44,55,66,77,88 and 99
So their Average is = (11 + 22 + 33 + 44 + 55 + 66 + 77 + 88 + 99)⁄9 = (495⁄9) = 55

Q26.B

Q26 Solution:-

Let A, B, C, D and E represent their respective weights. Then,
A + B + C = (84 x 3) = 252 kg,
A + B + C + D = (80 x 4) = 320 kg.
D = (320 - 252)kg = 68 kg,
E = (68 + 3)kg = 71 kg.
B + C + D + E = (79 x 4) = 316 kg
Now, (A + B + C + D) - (B + C + D + E) = (320 . 316)kg = 4 kg
A - E = 4
A = (4 + E) = 75 kg.

Q27.A

Q27 Solution:-

Mean score of 9 innings = 58 runs.
Total score of 9 innings = (58 x 9) runs = 522 runs.
Required mean score of 10 innings = 61 runs.
Required total score of 10 innings = (61 x 10) runs = 610 runs.
Number of runs to be scored in the 10th innings
= (total score of 10 innings) - (total score of 9 innings) = (610 - 522) = 88.
So , the number of runs to be scored in the 10th innings = 88.

Q28.B

Q28Solution:

Mean of 5 numbers = 28.
Sum of these 5 numbers = (28 x 5) = 140.
Mean of the remaining 4 numbers = (28 - 2) =26.
Sum of these remaining 4 numbers = (26 × 4) = 104.
Excluded number
= (sum of the given 5 numbers) - (sum of the remaining 4 numbers)= (140 - 104)= 36.
So, the excluded number is 36.

Q29.C

Q29 Solution:-

Let the a be in tens place and b at unit place in original number
Then number is (10a+b).
After interchanging the digits, the new number becomes (10b+a).
ATP
The average of 10 numbers has become 1.8 less than the original average.
So, the sum of the original 10 numbers will be 10×1.8 more than the sum of the 10 numbers with the digits interchanged.
i.e., 10a+b=10b+a+18
9a−9b=18
a−b = 2

Q30.C

Q30 Solution:-

let the numbers be x,x+2,x+4 andx+6. then,
[x+(x+2)+(x+4)+(x+6)]/4) = 27
⇨ (4x+12)/4 = 27
⇨ x+3=27
⇨ x=24.
So the largest number=(x+6)=24+6=30.

Q31.C

Q31 Solution:-

Total weight of(36+44) students=(36x40+44x35)kg =2980kg.
So weight of the total class=(2980/80)kg =37.25kg.

Q32.A

Q32 Solution:-

Let the average ekpenditure of all nine be Rs.k
Then 12x8+(k+8)=9k or 8k=104 or k=13.
Total money spent = 9k=Rs.(9x13)=Rs.117.

Q33.A

Q33 Solution:

Mean of the given observations
= x + (x + 4) + (x + 6) + (x + 8) + (x + 12)/5= (5x + 30)/5
According to the problem, mean = 16 (given).
So, (5x + 30)/5 = 16
⇒ 5x + 30 = 16 × 5
⇒ 5x + 30 = 80
⇒ 5x + 30 - 30 = 80 - 30

⇒ 5x = 50
⇒ x = 50/5
⇒ x = 10
So, x = 10.

Q34.B
Q34 Solution:-
Let the third number be k.
Then second number = 3k.
First number=3k/2.
So k+3k+(3k/2)=(44x3) or k=24
So largest number= 2nd number=3k=72.

Q35.C
Q35 Solution:-
Clearly 13th result=(sum of 25 results)-(sum of 24 results)
=(18x25)-(14x12)+(17x12)=450-(168+204)=450-372=78.

Q36.C
Q36 Solution:-
6^{th} result = (58x6+63x6-60x11)=66

Q37.C
Q37 Solution:
Let the given numbers be $x_1, x_2, x_3, \ldots x_8$.
Then, the mean of these numbers = $(x_1 + x_2 + \ldots + x_8)/8$.
So, $(x_1 + x_2 + \ldots + x_8)/8 = 37$
⇒ $(x_1 + x_2 + \ldots + x_8) = 296$ ---------- (i)
The new numbers are $(x_1 - 17), (x_2 - 17), \ldots\ldots, (x_8 - 17)$
Mean of the new numbers = $[(x_1 - 17) + (x_2 - 17) + \ldots\ldots + (x_8 - 17)]/8$
$= [(x_1 + x_2 + \ldots + x_8) - 136]/8$
= (296 - 136)/8, [using equation (i)]
= 160/8 = 20
So, the new mean is 20.

Q38.B
Q38 Solution:-
we have : (x + (x + 2) + (x + 4) + (x + 6) + (x + 8))/5 = 11 or 5x + 20 = 55 or x = 7.
So the numbers are 7, 9, 11, 13, 15.
So required mean = (11 + 13 + 15)/3 = 39/3 = 13.

Q39.C

Q39 Solution:

Mean weight of 35 employees = 45 kg.
Total weight of 35 employees = (45 × 35) kg = 1575 kg.
Mean weight of 35 employees and the teacher (45 + 0.5) kg = 45.5 kg.
Total weight of 35 employees and the teacher = (45.5 × 36) kg = 1638 kg.
Weight of the teacher = (1638 - 1575) kg = 63 kg.
So, the weight of the teacher is 63 kg.

Q40. D

Q40 Solution:-

Mean weight of 7 members = 56 kg.
Total weight of 7 members = (56 × 7) kg = 392 kg.
Total weight of 6 members = (52 + 57 + 55 + 60 + 59 + 55) kg = 338 kg.
Weight of the 7th boy = (total weight of 7 members) - (total weight of 6 members)
= (392 - 338) kg = 54 kg.
So , the weight of the seventh boy is 54 kg.

Q41.C

Q41 Solution:-

The five prime numbers between 30 and 50 are 31,37,41,43 and 47.
So the required average=(31+37+41+43+47)/5 =199/5 = 39.8.

Q42.B

Q42 Solution:-

Sum of first n natural numbers=n(n+1)/2;
So,sum of 40 natural numbers=(40x41)/2 = 820.
So the required average=(820/40) = 20.5.

Q43.A

Q43 Solution:-

Required average =7(1+2+3+…….+20)/20 = (7x20x21)/(20x2) = (147/2)=73.5.

Q44. A

Q44 Solution:-

Let the number be z. then,
$(z + z^2)/2 = 5z$
=> $z^2 + z = 10z$
=> $z^2 - 9z = 0$
=> $z (z - 9) = 0$
=> $z = 0$ or $z = 9$
so the number is 9.

Q45.C

Q45 Solution:-

Let the number be z, z + 1, z + 2, z + 3 ,z + 4, z + 5 ,z + 6.
then,ATP
$[z + (z + 1) + (z + 2) + (z + 3) + (z + 4) + (z + 5) + (z + 6)]/7 = 20$
7z + 21 = 140 or 7z = 119 or z = 17
Largest number = z + 6 = 17 + 6 = 23

Q46.B

Q46 Solution:-

Let the number be z, z + 2, z + 4, z + 6 and z + 8.
Then,ATP
$[(z + (z + 2) + (z + 4) + (z + 6) + (z + 8)]/5 = 61$
5z + 20 = 305 or z = 57
so the required number is = (57 + 8) - 57 = 8

Q47.A

Q47 Solution:-

Let the number be z, z + 2, and z + 4.
then,ATP
(z + z + 2 + z + 4)/3 + 38 = z + z + 2 + z + 4
(3z + 6)/3 + 38 = 3z + 6
z + 2 + 38 = 3z + 6
Or, 2z = 34 or z = 17.

Q48.D

Q48 Solution:-

Clearly to find the average we should be given the number of males, females or employees in the company neither of which is given. So, data is inadequate.
So, answer is CBD [Can't be decided]

Q49.B

Q49 Solution:-

Let the number of other workers be z.
then, number of agricultural workers = 11z
Total number of workers = 12z
So Average monthly salary = S x 11z + T x z/12z = 11S + T/12

Q50.A

Q50 Solution:-

Required average = $\frac{67 \times 2 + 35 \times 2 + 6 \times 3}{2+2+3} = \frac{134 + 70 + 18}{7} = \frac{222}{7} = 31\frac{5}{7}$

"All that we are is the result of what we have thought. The mind is everything. What we think we become." – Gautama Buddha.

RATIO

1. RATIO:

A ratio is simply a fraction. The following notations all express the ratio of x to y

=> x:y , x÷y , or x/y.

In the ratio x:y, we call x as the first term or antecedent and y the second term or consequent.

Writing two numbers as a ratio provides a convenient way to compare their sizes. For example, since 3<π, we know that 3 is less than π .

A ratio compares two numbers. Just as you cannot compare mangoes and pineapples, so the numbers you are comparing must have the same units.

For example, you cannot form the ratio of 2 feet to 4 meters because the two numbers are expressed in different units. feet vs. meters.

Example 1:

4 : 5 = 8 : 10 = 12 : 15.

Also, 4 : 6 = 2 : 3.

2. PROPORTION:

The equality of two ratios (fractions) is called proportion. If a : b = c : d, we write a : b :: c : d and we say that a, b, c, d are in proportion.

Here a and d are called extremes, while b and c are called mean terms.

Product of means=Product of extremes

So,

a:b::c:d⟺(bxc)=(axd)

2.1 FOURTH PROPORTIONAL:

If a:b=c:d, then d is called the fourth proportional to a,b,c.

2.2 THIRD PROPORTIONAL:

a:b=c:d, then c is called the third proportional to A and B.

2.3 MEAN PROPORTIONAL:

Mean proportional between a and b is √ab.

2.4 COMPARISON OF RATIOS:

We say that (a:b)>(c:d) we say ad>bc

2.5 COMPOUNDED RATIO:

The compounded ratio of the ratios: (a:b),(c:d),(e:f) is (ace:bdf)

2.6 DUPLICATES RATIOS:

Duplicates ratio of (a:b) is (a^2:b^2)

2.7 SUBDUPLICATES RATIOS:

Sub-duplicates ratio of (a:b) is ($a^{1/2}$:$b^{1/2}$)

2.8 TRIPLICATE RATIOS:

Triplicates ratio of (a:b) is (a^3:b^3)

2.9 SUBTRIPLICATE RATIOS:

Sub-triplicates ratio of (a:b) is ($a^{1/3}$:$b^{1/3}$)

If ab=cd then, a+b/a−b=c+d/c−d [Componendo and Dividendo]

----------EXERCISE----------

Q1. If it's given that a:b=2:3 and b:c=5:7, find a:c.

A. 10:11 B. 10:21 C. 21:10 D. 31:10

Q2. If it's given that a:b=2:3 and b:c=5:7, find a:b:c.

A. 10:15:21 B. 10:21:15 C. 15:10:21 D. 15:10:21

Q3. If it's given that 4a = 5b and 8b = 9c, find a:b:c.

A. 45:36:32 B. 45:32:36 C. 32:45:36 D. 32:36:45

Q4. If it's given that a/8 = b/9 = c/12, find a:b:c.

A. 8:12:9 B. 8:9:12 C. 12:8:12 D. 9:8:12

Q5. If a:b =1:3, b:c = 5:7 and c:d = 9:8 ,find a:b:c:d.

A. 45:15:63:56 B. 63:45:15:56 C. 15:45:63:56 D. 15:63:45:56

Q6. If (5x+3y): (5x-3y) =3:1, then x:y=?

A. 6:5 B. 7:8 C. 8:9 D. 9:11

Q7. If x:y= 5:3 ,then $\frac{8x-5y}{8x+5y}$= ?

A. 2:3 B. 3:4 C. 4:5 D. 5:11

Q8. Find the fourth proportional of 4,5 and 12.

A. 12 B. 15 C. 16 D. 18

Q9. Find the third proportinal corresponding to 9 and 12.

A. 18 B. 16 C. 14 D. 12

Q10. Find the mean relative somewhere around 49 and 64.

A. 58 B. 56 C. 54 D. 52

Q11. If Rs. 391 has been divided between P,Q and R in the proportion $\frac{1}{2}:\frac{2}{3}:\frac{3}{4}$, find the share of P.

A. 102 B. 108 C. 116 D. 126

Q12. A bag contains one rupees, fifty paisa and 25 paisa in the ratio of 8:9:11, if the total amount in the bag is 122, find the no. of coins of each type.

A. 24,27,33 B. 32,36,44 C. 40,45,55 D. 64,72,88

Q13. A solution contains milk and water in the proportion 4:3, if 7 liter of water is added to the solution, the proportion of milk and water gets to be 3:4. Find the amount of milk in the solution.

A. 12 Litres B. 13 Litres C. 14 Litres D. 15 Litres

Q14. If a : b = 5 : 9 and b : c = 4: 7, find a : b : c.

A. 20:36:63 B. 20:36:65 C. 20:32:63 D. 25:36:63

Q15. If x : y = 3 : 4, find $\frac{4x+5y}{5x-2y}$

A. 31/7 B. 32/7 C. 33/7 D. 34/7

Q16. A bag contains 50 p, 25 P and 10 p coins in the ratio 5: 9: 4, amounting to Rs. 206. Find the number of 10 Paise coins.

A. 140 B. 150 C. 160 D. 170

Q17. Anumita and Ruby together have Rs.1210. If $4/15^{th}$ of Anumita's money is equal to $2/5^{th}$ of Ruby's , then what amount does Ruby has?

A. 484 B. 284 C. 384 D. 584

Q18. If (x+y): (x-y)= 4:1,then (x^2+y^2): (x^2-y^2)=?

A. 17/8 B. 19/8 C. 15/8 D. 13/8

Q19. If $(4x^2-3y^2)$:($2x^2+5y^2$)= 12:19 , then x:y=?

A. 2:1 B. 3:2 C. 4:1 D. 5:2

Q20. if $x^2+4y^2 = 4xy$,then x:y = ?

A. 2:1 B. 3:2 C. 4:1 D. 5:2

Q21. Divide Rs. 1500 among A,B,C,D so that A and B together get thrice as much as C and D together, B gets four times of what C gets and C gets 1.5 times as much as D. So B gets Rs

A. 600 B. 700 C. 800 D. 900

Q22. The difference of two positive numbers is 20 and their ratio is 3:2. So the product of the two numbers is:-

A. 800 B. 1200 C. 1500 D. 1800

Q23. A mixture contains alcohol and water in the ratio 4 : 3. If 5 litres of water is added to the mixture, the ratio becomes 4: 5. Find the quantity of alcohol in the given mixture

A. 10 litres B. 11 litres C. 12 litres D. 13 litres

Q24. if 0.4 :1.4 ::1.4:x , then x= ?

A. 49 B. 4.9 C. 0.49 D. 0.4

Q25. What no. must be added to every term of 3:5 to make the proportion 5:6 ?

A. 6 B. 7 C. 12 D. 13

Q26. The salary of A and B are in the ratio of 2:3 and their monthly expenses are in the proportion 5:9. If both of them save Rs 600 every month, then their salary.

A. 1200, 1800 B. 1500, 2250 C. 1600, 2400 D. 1800, 2700

Q27. 94 is isolated into two sections in a way that fifth piece of the first Furthermore, eighth piece of the second are in the proportion 3:4.the first part is:

A. 27 B. 30 C. 36 D. 48

Q28. There are three numbers in the ratio of 3:4:5. The sum of largest and the smallest numbers 52 more than middle number. Then the smallest number is?

A. 20 B. 27 C. 39 D. 52

Q29. Rs. 53 is isolated among A, B and C in a way that A gets Rs.7 more than what B gets and B gets Rs. 8 more than what C gets. The proportion of their offer is:

A. 20:15:9 B. 25:18:10 C. 28:21:12 D. 35:24:15

Q30. 3 equivalent jar are filled with solution of spirit and water. The proportion of sprit and water in first jar is 3:4 , second jar is 4:5 , and in third jar is 5:6 The solutions of these 3 jars are mixed into a bigger jar. What is the ratio of acid to water in the bigger jar?

A. 820:1149 B. 920:1159 C. 1010 :1159 D. 1120 :1133

Q31. There are some coins of Rs.1 coins, 50p coins and 25p coins in a bag that can be expressed by 3 consecutive odd prime numbers that are in ascending order. The total value of coins in the bag is Rs 58. If the number of Rs.1, 50p, 25p coins are reversed, find the new total value of coins in the pocket of A?

A. Rs 65 B. Rs 70 C. Rs 75 D. Rs 82

Q32. Abhilash, Laxman and Sumant are batsman of a cricket team. The ratio of scores Abhilash to Laxman and Laxman to Sumant is 3:2. Their total score is 342 runs. What was the score of Abhilash?

A. 124 B. 148 C. 162 D. None

Q33. The ratio of sum of first n natural numbers to square of sum of first n natural numbers is 3:31 The value of n is:

A. 7 B. 11 C. 15 D. 21

Q34. Rs 4830 is divided among Ruby, Anumita and Tripti such that if Ruby's share decreases by Rs 5, Anumita's share decreases by Rs 10 and Tripti's share decreases by Rs 15, their shares will be in the ratio 5:4:3 Find the Anumita's original share

A. 1610 B. 2010 C. 2410 D. 2810

Q35. The proportion of milk and water in 3 samples is 2:1, 3:2 and 5:3. A mixture comprising of equal quantities of all 3 samples is made. The proportion of milk and water in the mixture is :

A. 227:133 B. 115:125 C. 199:261 D. 227:243

Q36. A sum of money is to be distributed among Agniwesh, Bikram, Chandana and Dipa in the proportion of 5:2:4:3. If Chandana gets Rs. 1000 more than Dipa, then what is share of Bikram?

A. Rs. 500 B. Rs. 1500 C. Rs. 2000 D. None

Q37. Ruby and Tripti together have Rs. 1210. If $4/5^{th}$ of Ruby's money is equal to $2/5^{th}$ of Tripti's amount, what amount does Tripti has?

A. Rs 460 B. Rs 484 C. Rs 550 D. Rs 664

Q38. A sum of Rs.312 was divided among 100 men and women in such a way that the man gets Rs.3.60 and each woman Rs.2.40 the number of women is

A. 35 B. 40 C. 45 D. 50

Q39. In a mixture 60 litres, the ratio of milk and water 2:1. If the this ratio is to be 1:2, then the quantity of water to be further added is:

A. 20 litres B. 30 litres C. 40 litres D. 60 litres

Q40. A dog chases a cat and takes 5 leaps for every 12 leaps of the cat, but 2 leaps of the dog are equal to 3 leaps of the cat. Compare the speeds of the dog and the cat.

A. 5:8 B. 5:9 C. 7:15 D. 5:12

Q41. A cat takes 5 leaps for every 4 leaps of dog but 3 leaps of dog are equal to 4 leaps of cat. What is ratio between speed of cat to dog?

A. 11:16 B. 15:16 C. 3:8 D. 4:3

Q42. A sum of Rs. 36.90 is made up of 180 coins which are either 10 paise coins or 25 p coins. The number of 10 p coins is:

A. 48 B. 54 C. 56 D. 60

Q43. The wages A, B, C are in the ratio 2:3:5. If the increases of 15%, 10% and 20% are allowed respectively in their wages, then what will be new ratio of their wages?

A. 3:3:10 B. 10:11:20C. C. 23:33:60 D. CBD

Q44. Manu, Rajat and Bikram have some stones. Five times the number of stones with Rajat is equal to seven times the number of stones with Manu while five times the number of stones with Manu equals seven times the number of stones with Bikram. What is the minimum number of stones that can be there with all of them taking together?

A. 113 B. 109 C. 93 D. 97

Q45. If daily incomes of Kanchan and Priya are in the ratio 4:5,If their daily expense are in the ratio 5 : 6. If Kanchan saves Rs.25 per month and Priya saves Rs.50 per month, what are their daily incomes?

A. Rs.450 and Rs.550 B. Rs.290 and Rs.360
C. Rs.370 and Rs.480 D. Rs.400 and Rs.500

Q46. Wages of Khushboo and Meghna are in the ratio 2:3 If the salary of each is increased by Rs. 4000, the new ratio becomes 40:57. What is Meghna's initial salary?

A. Rs. 17,000 B. Rs. 20,000 C. Rs. 34,000 D. Rs. 38,000

Q47. If 0.75:x::5:8, then X is equal to:

A. 1.12 B. 1.20 C. 1.25 D. 1.30

Q48. The sum of 3 numbers is 98. If the ratio of the first to second is 2:3 and that of the second to the third is 5:8, then the second number is:

A. 20 B. 30 C. 48 D. 58

Q49. If Rs. 782 be divided into3 parts, proportional to 1/2 , 2/3, 3/4 then find first part:

A. Rs. 204 B. Rs. 196 C. Rs. 096 D. Rs. 274

Q50. Rs.432 is divided amongst 3 partners Laxmi, Nikky and Ruby such that 8 times Laxmi's share is equal to 12 times Nikky's share which is equal to 6 times Ruby's share. So Share of Laxmi is-

A. Rs.196 B. Rs.144 C. Rs.104 D. Rs.228

---ANSWERS ---

Q1.B	**Q2.A**	**Q3.A**	**Q4.B**	**Q5.C**	**Q6.A**
Q7.D	**Q8.B**	**Q9.B**	**Q10.B**	**Q11.A**	**Q12.D**
Q13.A	**Q14.A**	**Q15.B**	**Q16.C**	**Q17.A**	**Q18.A**
Q19.B	**Q20.A**	**Q21.D**	**Q22.A**	**Q23.A**	**Q24.B**
Q25.B	**Q26.C**	**Q27.B**	**Q28.C**	**Q29.B**	**Q30.B**
Q31.D	**Q32.C**	**Q33.C**	**Q34.A**	**Q35.A**	**Q36.C**
Q37.B	**Q38.B**	**Q39.D**	**Q40.A**	**Q41.B**	**Q42.B**
Q43.C	**Q44.B**	**Q45.D**	**Q46.C**	**Q47.B**	**Q48.B**
Q49.A	**Q50.B**				

---ANSWERS AND SOLUTION---

Q1.B

Q1Solution:-

We have a/b = 2/3 and b/c = 5/7
So a/c = (a/bxb/c) = (2/3x5/7) = 10/21
So its demonstrate that a:c = 10:21

Q2.A

Q2 Solution:-

Here a/b = 2/3 ----------x 5/5
and b/c = 5/7 ----------x 3/3 (equating b)
=> a/b = 10:15
and b/c = 15:21
combining these two we get a:b:c:=10:15:21

Q3.A

Q3 Solution:-

4a = 5b
=> a/b=5/4
and 8b = 9c
=> b/c=9/8
So a:b = 5:4 and b:c = 9:8
Equate b and find the ans.
It will be,a:b:c = 45:36:32.

Q4.B

Q4 Solution:-

Let a/8 = b/9 =c/12 =k.
Then a=8k ,b=9k and c=12k.
So a:b:c = 8k:9k:12k =8:9:12.
So,a:b:c = 8:9:12.

Q5.C

Q5 Solution:-

We have a:b = 1:3, b:c = 5:7 and c:d = 9:8
=> a:b = 5:15, b:c = 15:21, c:d =(21/9)x9 : (21/9)x8
=> a:b = 5:15, b:c = 15:21, c:d = 21:56/3
=> a:b:c:d =5:15:21:56/3 = 15:45:63:56
Consequently, a:b:c:d = 15:45:63:56

Q6.A

Q6 Solution:-

Here (5x+3y)/(5x-3y) = 3/1
=> 5x+3y = 15x-9y
=> 10x = 12y
=> Sx/y = 12/10 = 6/5
So x:y =6:5

Q7.D
Q7 Solution:-

Given x/y = 5/3
We have $\frac{8x-5y}{8x+5y}$= = [8(x/y) – 5]/[8(x/y) + 5] [Dividing numerator and ddenominator by y]
= [8x(5/3)-5]/[8x(5/3)+5]
= (40-15)/(40+15)
= 25/55
= 5/11
then $\frac{8x-5y}{8x+5y} = \frac{5}{11}$

Q8.B
Q8 Solution:-

Let 4:5::12:x.
=> 4.x = 5.12
=> x = 5.(12/4)=5.3
= 15
So the fourth relative to 4,5,12 is 15.

Q9.B
Q9 Solution:-

Third relative to 9 and 12 is equivalent to fourth corresponding to 9,12 and 12.
Give it a chance to be x at that point
=> 9:12::12:x
=> 9x = 12.12
=> x = 12.(12/9)
=16
So the third relative is 16.

Q10.B
Q10 Solution:-

Mean relative somewhere around 49 and 64 is √(49x64) = (7x8) = 56.

Q11.A
Q11 Solution:-

We have P : Q : R =1/2:2/3:3/4= 6:8:9.
P share = (391x6/23) = 102 rs.
Q offer = (391x8/23) = 136 rs.
R offer = (391x9/23) = 153 rs.

Q12.D
Q12 Solution:-

Let the quantity of one rupeese, 50-p and 25-p coins be 8x, 9x and 11x individually.
At that point, 8x + 9x/2 + 11x/4 =122
=> 32x + 18x + 11x = 488
=> 61x =488
=> x = 8

No. of one rupeese coins = 8x8= 64
No. of 50p coins =9x8= 72
No. of 25p coins =11x8 =88

Q13.A
Q13 Solution:-

Let the amount of milk and water be 4x liter and 3x liter separately.
At that point , 4x/3x + 7 = 3/4
=> 16x = 9x+21
=> 7x = 21
so estimation of x is 3
Amount of milk in the solution is = 4x3 =12 Litres.

Q14.A
Q14 Solution:-

a:b=5:9 and b:c=4:7= (4X9/4): (7x9/4) = 9:63/4
a:b:c = 5:9:63/4 =20:36:63.

Q15.B
Q15 Solution:-

X/Y=3/4
=> (4x+5y)/(5x+2y)= (4(x/y)+5)/(5 (x/y)-2) [Dividing numerator and denominator by y]
=(4(3/4)+5)/(5(3/4)-2)
=(3+5)/(7/4)=32/7

Q16.C
Q16 Solution:-

Let the number of 50 p, 25 P and 10 p coins be 5x, 9x and 4x respectively.
(5x/2)+(9x/ 4)+(4x/10)=206
=> 50x + 45x + 8x = 4120
=> 103x = 4120
=> x=40.
Number of 50 p coins = (5 x 40) = 200; Number of 25 p coins = (9 x 40) = 360;
Number of 10 p coins = (4 x 40) = 160.

Q17.A
Q17 Solution:-

Let Anumita has a and Ruby has b.
So (4/15)a = (2/5)b = x
then a = 15x/4 and b = 5x/2
So. 15x/4 + 5x/2 =1210
=> 15x + 10x = 4840
=> 25x = 4840
=> x=193.6
So. Ruby has amount = (5/2x193.6) = 484
So Ruby has Rs. 484.

Q18.A
Q18 Solution:-

(x + y)/(x - y)= 4/1
=> x + y = 4x-4y
=> 3x = 5y
=> x/y = 5/3

=> $x^2/y^2=25/9$ [squaring]
Now $(x^2+y^2)/(x^2-y^2)=(25+9)/(25-9)$
= 34/16 = 17/8

Q19.B
Q19 Solution:-
$(4x^2-3y^2)/(2x^2+5y^2) = 12/19$
=> $76x^2-57y^2 = 24x^2+60y^2$
=> $52x^2 = 117y^2$
=> $x^2/y^2 = 117/52 = 9/4$
=> $(x/y)^2=(3/2)^2$
=> x/y = 3/2.
=> x:y = 3:2

Q20.A
Q20 Solution:-
As $x^2+4y^2 = 4xy$
=> $x^2 + 4y^2 - 4xy = 0$
=> $(x-2y)^2 = 0$
=> x-2y=0
=> x = 2y
=> x/y = 2/1.
=> x:y = 2:1.

Q21.D
Q21 Solution:-
A+B+C+D=1500 ------ (1)
Here A+B=3(C+D)
From (1)
And 4(C+D) =1500
=> C+D=375
A+B=1125
Given that B=4C & C=1.5D
=> 2.5D = 375
=> D=150
=> B=4x1.5xX=900

Q22.A
Q22 Solution:-
Let the numbers be X and Y
Difference between the numbers is 20
=> X-Y=20 ------- (i)
Ratio of the numbers is 3:2
=> X/Y=3/2 -------- (ii)
From equation (i) & (ii) We get : 3/2 Y-Y=20
=> Y=20 & X=40
XxY=800

Q23.A
Q23 Solution:-
Let the quantity of alcohol and water be 4x litres and 3x litres respectively
4x/(3x+5)=4/5

=> 20x=4(3x+5)
=> 8x=20
=> x=2.5
Quantity of alcohol = (4 x 2.5) litres = 10 litres.

Q24.B
Q24 Solution:-
0.4xX =1.4 x1.4
=> X=1.4x1.4/0.4
=14x14/10x4
=49/10= 4.9

Q25.B
Q25 Solution:-
Let the number to be included be X , Then ,
(3+x)/(5+x) = 5/6
=> 6(3+x)= 5(5+x)
=> x=25-18 = 7.
So, the no. to be included is 7.

Q26.C
Q26 Solution:-
Let the incomes of A and B be Rs 2x and Rs 3x respectively and their Expenditures are Rs 5y and Rs 9y respectively. Then,
2x-5y=600 ---------- (i) and
3x-9y=600
=> x- 3y=200 ----------(ii)
Solving these two equations , we get x =800.
So, their incomes are Rs.1600 and Rs.2400 respectively.

Q27.B
Q27 Solution:-
(1/5)a :(1/8)b= 3:4
=> (1/5)a/(1/8)b=3/4
=> 8a/5b=3/4
=> a/b={3/4 x5/8}= 15/32
=> First part ={94x15/47) =30.

Q28.C
Q28 Solution:-
Let the numbers be 3x, 4x and 5x.
(5x+3x) = 4x+52
=> 4x =52
=> x=13
So numbers are 3x, 4x, 5x = (3x13), 4x13 , 5x13 = 39, 52, 65
So, smallest of them is 39.

Q29.B
Q29 Solution:-
Let C=x Then, B= (x+8) and A =(x+15)
∴ x+15+x+8+x =53
=> 3x =30
=> x=10

∴ A:B:C=25:18:10.

Q30.B

Q30 Solution:-

Let 693 unit of each is taken. [lcm of sums of antecedant and consequent of each ratio

Then,

Ist jar has ratio of 297 : 396

IInd jar has ratio of 298 : 385

Ist jar has ratio of 315 : 378

Adding antecedent and consequent we get

920 : 1159

Q31.D

Q31 Solution:-

As the ratio of the number of Rs. 1, 50p and 25p coins can be represented by 3 consecutive odd prime numbers, the only possibility for this condition is 3:5:7.

Let the number of Re1, 50p and 25p coins be 3k,5k and 7k respectively.

So, total value of coins in paisa

=> 100×3k+50×5k+25×7k=725k = 5800

⇒ k=8.

If the number of coins of Rs. 1,50p and 25p is reversed, the total value of coins in the Bag (in paisa)=100×7k+50×5k+25×3k=1025k (In above we find the value of k).

⇒ 8200p=Rs. 82..

Q32.C

Q32 Solution:-

Abhilash:Laxman=3:2=9:6

Laxman: Sumant=3:2=6:4 (equating B)

So, Abhilash : Laxman : Sumant = 9:6:4

So, the runs made by Abhilash= 342x9/19=162

Q33.C

Q33 Solution:-

Sum of first n natural numbers:- n(n+1)/2----------(i)

Sum squares of first n natural numbers:- n(n+1)(2n+1)/6----------(ii)

As given (i) : (ii) :: 3/31

So, (n(n+1)/2) / (n(n+1)(2n+1)/6) = 3/31

=> 3/(2n+1)=3/31

=> 2n + 1 = 31

=> 2n = 30

=> n = 15

Q34.A

Q34 Solution:-

Let the share of Ruby, Anumita and Tripti be R, A and T respectively.

R+A+T=4830

If Ruby's, Anumita's and Tripti's share are diminished by Rs 5, Rs 10 and Rs 15, their net share will be Rs.4830 – (5 +10 +15) = 4800.

Now Anumita's share = 4/12×4800=Rs 1600

So Anumita actual share =Rs 1600+Rs 10= Rs 1610.

Q35.A

Q35 Solution:-

Taking the amount of each sample as 120 unit (LCM 2+1,3+2 and 5+8)

	Milk	Water
Sample-1	80	40
Sample-2	72	48
Sample-3	75	45
Total	227	133

So new ratio is 227:133

Q36.C

Q36 Solution:-

Let the shares of Agniwesh, Bikram, Chandana and Dipa be Rs. 5x, Rs. 2x, Rs. 4x and Rs. 3x respectively.

Then, ATP:

$4x-3x=1000$

$\Rightarrow$ $x=1000$

Bikram's share $=Rs.2x=Rs.(2\times1000)=$ Rs. 2000

Q37.B

Q37 Solution:-

Let Ruby has x Rs and Tripti has y Rs

Then ATP

4/5x=2/5y ----------(1)

And x + y = 1210 ----------(2)

Solving we get y= 484

That is tripti has Rs 484.

Q38.B

Q38 Solution:-

Let the number of men be x and the number of women be y.

ATP

x+y=100----------(i)

3.6x+2.4y=312----------(ii) [As A man gets Rs. 3.60 and a woman gets Rs. 2.40 and total amount is Rs. 312]

So

3.6x+3.6y=360--------(iii) [multiplying equation (i) by 3.6]

subtracting equation (ii) from equation (iii) we get

1.20y=48

y=40

The number of women is 40.

Q39.D

Q39 Solution:-

Quantity of milk = 60×2/3 =40 litres.

Quantity of water =60x1/3 =20 litres.

New ratio =1:2

Let, the required quantity of water to be added is x litres.

So that milk : water = 40/(20+x)=1/2

Solving we get

x=60

Q40.A

Q40 Solution:-

Let the number of leaps of dog be 5x so number of leaps of cat is 12x

Let the length of leaps of dog be 3y so length of leaps of cat is 2y
[since they cover equal distance so lenth of leaps are always inverse proportiona]
So at aparticlar time distance covered by them will be 5x.3y and 12x.2y
So ratio of speeds will be = 15xy/24xy = 5/8
So answer is 5:8

Q41.B
Q41 Solution:-

A cat takes 5 leaps in the time a dog takes 4
Change this to multiples of equal distance (4 cat leaps = 3 dog leaps)
A cat takes 5/4 in time a dog takes 4/3
That is 5/4 : 4/3
=> 15 : 16.

Q42.B
Q42 Solution:-

Let x be number of 10p coins and y be number of 25p coins
Then, ATP:
x+y=180 ----------(i) [As total number of coins is 180]
10x+25y=36.9Rs=3690p ----------(ii) [As 10p coins and 25p coins make the sum = Rs. 36.90]
Solving equation (i) and (ii)
We get:
x=54 and y=126
So number of 10p coins = 54

Q43.C
Q43 Solution:-

Let A=200k, B=300k and C=500k
A's new salary = (115/100×200k)=230k
B's new salary = (110/100×30k)=330k
C's new salary = (120/100×500k)=600k
⇒ New ratio=(230k:330k:600k)=23:33:60

Q44.B
Q44 Solution:-

Let Manu, rajat and Bikram has m,r and b stones respectively.
So ATP
5r=7m and 5m=7b
⇒ 25r=35m and 35m=49b
⇒ 25r=35m=49b
⇒ r/49=m/35=b/25 [dividing each term by 1225 i.e.LCM of 25,35 and 49]
So the least possible integral values for r,m,b should be r=49, m=35 and b=25
⇒ Total=49+35+25=109

Q45.D
Q45 Solution:-

Let Their incomes be 4x and 5x
And expenses be 5y and 6y
So, ATP
4x – 5y = 25 ----------(i) x6
and 5x – 6y=50 ----------(ii) x5

24x – 30y = 150

25x – 30y = 250
(-) (+0)

= -x = -100
So, their incomes are 4x and 5x that is 4x100 and 5x100 = 400 and 500

Q46.C
Q46 Solution:-
Let the original wages of Khushboo and Meghna be Rs. 2x and Rs. 3x respectively.
So ATP
(2x+4000)/(3x+4000)=40/57
Solving we get
X = 34000.

Q47.B
Q47 Solution:-
0.75/x=5/8
Solving we get
x=1.2

Q48.B
Q48 Solution:-
Let the3 parts be A, B, C. Then,
A:B=2:3 ----------(i) x 5(multiplying by 5)
B:C=5:8 ----------(ii) x 3(multiplying by 3)
A:B=10:15 ----------(i)
B:C=15:24 ----------(ii)
Now A:B:C=10:15:24
A=10k,B=15k,C=24k
A+B+C=10k+15k+24k=98(given)
Solving we get the value of k and answer.

Q49.A
Q49 Solution:-
Given ratio = 1/2:2/3:3/4=6:8:9
The first part is Rs 782×6/23=Rs 204.

Q50.B
Q50 Solution:-
Let the share of Laxni, Nikky and Ruby is x , y and z.
So ATP
8x = 12y = 6z
Divide each term by 24 we get
8x/24 = 12y/24 = 6z/24
x/3 = y/2 = z/4
Let x/3 = y/2 = z/4 = k
So we get x = 3k, y = 2k and z =4k
The sum of the total wages
=3k+2k+4k=432
9k=432 or k=48.
So share of Laxmi is 3×48= Rs 144

PARTNERSHIP

Partnership : An association of two or more persons who invest their money together in order to carry on a certain business is known as partnership and after a certain period of time , they share the profit or loss of the business in the ratio of their investment
Persons who have entered into partnership with one another are individually called partners and collectively called a firm and the name under which their business is carried on is called the firm name .

Partnership can be classified in two types:

1 . Simple Partnership
2 . Compound Partnership

Simple Partnership : If all the partners invest their capital for the same time period, such partnership is know as the simple partnership. In this partnership , the profit or loss of the business is distributed among the investors in the ratio of their capitals.

Important Points to be remembered:

1. When investments of all the partners are for the same time, the gain or loss is distributed among the partners in the ratio of their investments.

2. When investments are for different time, then equivalent capitals are calculated for a unit of time by taking (capital x number of units of time). Now gain or loss is divided in the ratio of these capitals.

Example : If the capital C1 invested for the time period T1 ,and the capital C2 is invested for the time period T 2 and capital C 3 is invested for the time period T 3 , then
ratio of the profits = C 1 T 1 : C 2 T 2 : C 3 T 3

3. If the capital C 1 is invested for the time period T 1 and capital C 2 is invested for the time period T 2 , then P1/P2 = C1T1/C2T2
A: B = 12000: 15000
= 3: 4
When all investor invested their money for the different durations then calculation of investment will be as follows: (investment x number of unit time)
If Agniwesh invest 12000 Rs . for 5 month and Vikrant invested 15000 rs. for 8 month. Then the profit/loss will be divided in the following ratio :
A: B = 12000x5 : 15000x8
= 60000: 120000
= 1 : 2

Example : Let three partners A,B and C invested Rs 12000, Rs 15000 and Rs 18000 respectively in a business.In the end of the year , the profit will be distributed among them in the ratio of their invested money
i.e, 12000 : 15000: 18000 or 4:5:6

Compound Partnership: If the capitals of the partners are invested for different time periods ,the partnership is known as compound partnership . In this type of partnership, profit or loss of the business is distributed in the ratio of product of their investments and time for which capital is invested

Example: A started a business by investing Rs 40000.After 3 months B became partner by investing Rs Rs 30000. In the end of the year ,the profit is distributed between A and B in the ratio of product of time and their invested money
i.e, 40000 x 12 : 30000 x 9 or 16: 9

----------EXERCISE----------

Q1. A, B and C started a business by investing Rs. 1,20,000, Rs. 1,35,000 and ,Rs.1,50,000 respectively. Find the share of C, If annual profit is Rs. 56,700.

A 30000 B 24000 C 21000 D 18000

Q2. A, B and C invested Rs 18000 , Rs 24000 and Rs.36000 in a business respectively. What is the ratio of shares of their profits ?

A. 3 : 4 : 6 B. 2 : 3 :5 C. 3 : 6 : 5 D. 2 : 3 :6

Q3. A and B enter into partnership. A invests Rs 16000 and B invests Rs 20000. If the profit at the end of the year amounts to Rs 27000. what would be the share of B in the profit ?

A. Rs 8000 B. Rs 10000 C. Rs 12000 D. Rs 15000

Q4. A and B Started a business by investing Rs. 90000 and Rs. 165000 respectively. Find the share of A, out of an annual profit of Rs.85000

A. Rs 30000 B. Rs 35000 C. Rs 55000 D. Rs 60000

Q5. A, B and C invested Rs 40000, Rs 100000 and Rs 80000 respectively in a business. The net proift for the years was Rs 24200 which was divided in proportion to their investments. Find the amount of profit C earned ?

A. Rs 2200 B. Rs 4400 C. Rs 6600 D. Rs 8800

Q6. A , B and C enter into a partnership . A invests Rs 7200 for 4 months, B invests Rs 2400 for whole year and C invests Rs 3600 for 8 months. The share of B in the profit is Rs 2300. What is the total profit?

A. Rs 6300 B. Rs 6900 C. Rs 7400 D. Rs 8100

Q7. A , B enter into a partnership and together start a business with contributions of Rs 30000 and Rs 40000 respectively. After 4 months , C also joins them with contribution of Rs45000. After 9 months B withdraws his contribution. At the end of the year , the profit is Rs 24000. What is the share of B in the total profit ?

A. Rs 5000 B. Rs 5500 C. Rs 6000 D. None

Q8. Agniwesh and Bikram invested amount of Rs. 100000 and 150000 respectively. If at the end of year total profit was Rs. 24000 than what should be their share?

A Rs 8600, Rs 12400 B Rs 9600, Rs 14400
C Rs 10600, Rs 15400 D Rs 11600, Rs 16400

Q9. Amarjeet and Ashish invested amount of Rs. 20000 and Rs. 25000 in a business. But Ashish left the business and Chandana joined the business with the investment of Rs. 15000 after the period of 4 month . At the end of year total profit was Rs. 46000 what should be the share of Chandana?

A Rs. 12000 B Rs. 11000 C Rs. 10000 D Rs. 9000

Q10. Vikrant started a business with an amount of Rs. 21000 . But after some time , Uttam joined the business by investing amount of Rs. 36000. If profit of the firm divided equally between them. Then after how many month B joined the business?

A 1 B 3 C 5 D 7

Q11. If Abhilash,Baipotu and Laxman hires a garrage for Rs. 1460. Abhilash keeps 10 Autorickshaw for20 days,Baipotu 30 Auto rickshaw for 8 days and Laxman 16 Autorickshaw for 9 days. what rent paid by each of them?

A 300, 400, 660 B 400, 360, 700 C 500, 600, 360 D 600,560, 300

Q12. If the the total investment of a business is an amount of Rs. 50000. Avinash invested Rs. 4000 more than that of of Manish and Manish invested 5000 more than that of of Nehal . At the end of the year, total profit was Rs. 35000 then what should be the profit share of Avinash?

A Rs. 14700 B Rs. 15000 C Rs. 16800 D Rs. 17880

Q13. An amount of Rs. 27000, 81000 and 72000 invested by A, B and C. Rs. 36000 was the share in profit of B , then find out the total profit of the firm at the end of the year?

A Rs. 60000 B Rs. 70000 C Rs. 80000 D Rs. 90000

Q14. Manu ,Rahul and Sudip invested in the ratio of 5:7:6. If 26% , 20% and 15% investment increased by them respectively in the next year. What should be the ratio of profit in second year?

A 21:28:23 B 22:21:15 C 23:24:21 D none of these

Q15. In a partnership business, Niraj invests Rs 2400 for 4 years, Ranjan invests Rs 2800 for 8 years and Sukant invests Rs 2000 for 10 years. They earn Rs 1170. Find the share of their profit.

A 213, 450, 550 B 214, 502, 450 C 215, 503, 400 D 216, 504, 450

Q16. Khushboo ,Priya and Savitri enter into a partnership with investments in the ratio 3:2:1. After 4 months, Khushboo leaves the business and after 4 more months Priya also leaves the business and Savitri continues till the end of the year. If R takes 10 of the profit for managing the business, then what part of the profit does R get?

A. 37% B. 35% C. 33% D. 31%

Q17. Avinash , Manish and Nehal started a business and they all invested Rs. 20000 . After the period of 4 month Avinash withdraw Rs. 5000, Manish and Nehal both add 6000 each in their invested investment. An amount of Rs. 69900 recorded as a profit in the firm. What should be the share of Manish in profit?

A Rs. 18000 B Rs. 21200 C Rs. 24000 D Rs. 27000

Q18. An amount of money is to be divided among Mohan, Rajat and Sujit in the ratio of 5:11:23 respectively. If the difference between the total share of Mohan and Rajat together and Sujit share is Rs. 2800, what is the difference between Rajat and Sujit's share?

A Rs 3000 B Rs 3900 C Rs 4800 D Rs. 5600

Q19. Abhilash invests Rs. 10,000 in a partnership business. At the end of 4 months he withdraws Rs.2000. At the end of another 5 months, he withdraws another Rs.3000.If his other partner Udit receives Rs.9600 as his share from the total profit of Rs.19,100 for the year, how much did Udit invest in the business?

A. Rs. 10,000 B. Rs. 8,000 C. Rs. 6,000 D. Rs. 4,000

Q20. A, Band C start a business each investing Rs. 20000. After 5 months A withdrew Rs. 5000, B withdrew Rs. 4000 and C invests Rs. 6000 more. At the end of the year, a total profit of Rs. 69900 was recorded. What is the share of B in the profit ?

A. Rs 21200 B. Rs 21500 C. Rs 21800 D. Rs 22500

Q21. Laxmi invested Rs. 76,000 in a business. After few months, Priya joined her with investment of Rs. 57,000. At the end of the year, the total profit was divided between them in ratio 2 :1. Then for how long Priya was in business?

A 2 B 5 C 8 D 11

Q22. A, Band C enter into a partnership by investing in the ratio of 3 : 2: 4. After 1 year, B invests another Rs. 2,70,000 and C, at the end of 2 years, also invests Rs.2,70,000. At the end of three years, profits are shared in the ratio of 3 : 4 : 5. Find initial investment of C.

A 3,60,000 B 2,80,000 C 2,50,000 D 1,50,000

Q23. Pratap, Rohit and Shekhar enter into a business with investment of Rs.25000, Rs. 30000 and Rs. 15000 respectively. A is the working partner and he gets 30% of the profit for managing the business. The balance profit is distributed in proportion to their investment investments. At the year-end Pratap gets Rs. 200 more than Rohit and Shekhar together. Find the total profit and the share of each.

A 2000, 1100, 600, 300 B 3000, 2100, 600, 300

C 2500, 1500, 400, 600 D 2000, 600, 500, 900

Q24. A starts a business with Rs Rs 4,50,000. After 4 months , B joined the business. At the end of the year, they shared the profits in the ratio 9 : 4 . What is the capital of B?

A. Rs 200000 B. Rs 300000 C. Rs 400000 D. Rs 500000

Q25. A and B are partners in a business. A invests Rs 20000 for 8 months and B invests Rs 30000 for 6 months. They gains 6800 . What is the share share of B ?

A. Rs 3000 B. Rs 3600 C. Rs 4000 D. Rs 4500

Q26. Rs 10400 is to be divided among the partners A,B and C. The ratio of their investments is 1/2 :1/3:1/4. Then what is share of B ?

A. Rs 2400 B. Rs 2800 C. Rs 3200 D. Rs 3600

Q27. A invested an amount of Rs 50,000 to start a business. After 6 months, B joined him with an amount of Rs 80,000 .At the end of 3 years, they got a profit of Rs 24,500. What is the share of A?

A. Rs 10,500 B. Rs 11,500 C. Rs 12,500 D. Rs 13,500

Q28. A , B, C and D started a partnership business. A invests 1/3 of the capital, B puts 1/4 of capital ,C invests 1/5 of the capital and D invests the remaining capital. Find the share of D out of a profit of Rs 18000 ?

A. Rs 3900 B. Rs 4400 C. Rs 4900 D. 5400

Q29. A , B and C rented a pasture. A puts in 6 oxen for 12 months , B puts in 7 oxen for 8 months and C puts in 8 oxen for 6 months. If the rent of the filed is Rs 792, What rend is paid by C ?

A. Rs 204 B. Rs 216 C. Rs 224 D. Rs 240

Q30. A started a business by investing Rs. 55000.After 3 months B joined him by investing Rs. 60000. Out of an annual profit of Rs. 42000, find the share A ?

A. Rs 18000 B. Rs 21000 C. Rs 23100 D. Rs 24900

Q31. A,B and C invested their capitals in the ratio of 2:5:8. At the end of the year, the difference between the shares of A and C is Rs 3600, the what is the is the share of B ?

A. Rs 1000 B. Rs 3000 C. Rs 5000 D. Rs 7000

Q32. Avinash started a business investing Rs. 45,000. After 3 months Bikram joined him with a capital of Rs. 60,000. After another 6 months, Chandana joined them with a capital of Rs. 90,000. At the end of the year, total profit earned was Rs. 16,500. Find the share part of Chandana.

A 3600 B 3300 C 2800 D 2500

Q33. A, Band C start a business each investing Rs. 20,000. After 5 months A withdrew Rs.6000 B withdrew Rs. 4000 and C invests Rs. 6000 more. At the end of the year, total profit earned was Rs. 69,900. Then whats was share of A.

A 20500 B 21200 C 22200 D 23200

Q34. A, Band C enter into partnership. A invests 3 times as much as B and B invests two-third as of C invests. At the end of the year, total profit earned is Rs. 6600. What is the share of C ?

A 1500 B 1600 C 1700 D 1800

Q35. Four person A,B,C and D started a business. A invested 24 units for 3 months; B 10 units for 5 months; C 35 units for 4 months and D 21 units for 3 months. If A's share of profit is Rs.7200, find the total profit earned of the field.

A 32500 B 28000 C 25000 D 15000

Q36. Agniwesh, Abhilash and Bikram are 3 partners in a business. Their investments are respectively Rs 4,000, Rs 8,000 and Rs 6,000. Agniwesh gets 20% of total profit for managing the business. The remaining profit is divided among them in the ratio of their investments. At the end of the year, the profit of Agniwesh is Rs 2200 less than the sum of the profit of Abhilash and Bikram. What amount of income will Bikram get?

A. Rs 2100 B. Rs 2400 C. Rs 2700 D. Rs 3000

Q37. What should be the ratio of the investment by Jyoti, Meghna and Ruby if half of Meghna's investment is equal to Jyoti's investment and Ruby's investment is 1/3rd of Meghna's investment.

A 6:1:3 B 6:3:1 C 3:6:1 D 1:3:6

Q38. In a partnership firm Khushboo invested Rs. 16000 for the period of 8 month and rest of the investment done by Nikky till the end of year. Find out the Share of Nikky if she claims $2/7^{th}$ part of the profit ?

A Rs. 1190 B Rs. 10500 C Rs. 13600 D Rs. 12800

Q39. Annu Nikky and Ruby are the partners of a firm. Twice the investment of A is equal to thrice the investment of B and the investment of B is four times of the C's investment. What is the share in profit of B if the total profit is Rs. 29700?

A Rs. 10800 B Rs. 20000 C Rs. 5000 D Rs. 3000

This chapter contains the topics and questions I discussed and created in our classes or obtained from students as their doubts. All the questions noted, typed, redesigned and rectified by group of volunteers consisting of:

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----------ANSWERS ----------

Q1.C	**Q2.A**	**Q3.D**	**Q4.A**	**Q5.D**
Q6.B	**Q7.C**	**Q8.B**	**Q9.A**	**Q10.C**
Q11.C	**Q12.A**	**Q13.C**	**Q14. A**	**Q15.D**
Q16.A	**Q17.B**	**Q18. C**	**Q19.B**	**Q20.A**
Q21.C	**Q22.A**	**Q23.A**	**Q24.B**	**Q25.B**
Q26.C	**Q27.A**	**Q28.A**	**Q29.B**	**Q30.C**
Q31.B	**Q32.B**	**Q33.A**	**Q34.D**	**Q35.A**
Q36.B	**Q37.B**	**Q38.D**	**Q39.A**	

----------ANSWERS WITH SOLUTION----------

Q1.C

Q1 Solution:-

Ratio of shares of A, Band C = Ratio of their investments
= 120000 : 135000 : 150000 = 8 : 9 : 10.
A's share = Rs. (56700 x (8/27))= Rs. 16800.
B's share = Rs. (56700 x (9/27)) = Rs. 18900.
C's share = Rs. (56700 x (10/27))=Rs. 21000.

Q2.A

Q2 Solution:-

Ratio of Profits = Ratio of the sums invested= 18000: 24000 : 36000= 3 : 4 : 6

Q3.D

Q3 Solution:-

The ratio of the investment of capitals of A and B is 16000 : 20000 = 4 : 5
So they have to share the profit in the ratio of 4 : 5
B's share of profit = 5/9 X 27000 = 15000

Q4.A

Q4 Solution:-

Ratio of their shares in the profit = 90000: 165000= 6: 11
∴ A' s share = Rs. [85000X6/17]= Rs. 30000

Q5.D

Q5 Solution:-

Ratio of profits = Ratio of the capitals= 40000 : 100000 : 80000= 2 : 5 : 4
Share of C in the annual profit Rs 24200 = 24200 X 4/11 = Rs 8800

Q6.B

Q6 Solution:-

If the capital C_1 invested for the time period T_1 ,and the capital C_2 is invested for the time period T_2 and capital C_3 is invested for the time periodT3 , then
Ratio of the profits = $C_1T_1 : C_2T_2 : C_3T_3$
So, the ratio of profits A : B : C = 7200 X 4 : 2400 X 12 : 3600 X 8= 28800 : 28800 : 28800= 1 : 1 : 1
Share of B= 1x = 2300
Total Profit = 1x +1x +1x =, 3x = 3 X 2300 =Rs 6900

Q7.C

Q7 Solution:-

If the capital C_1 invested for the time period T_1 ,and the capital C_2 is invested for the time period T_2 and capital C_3 is invested for the time periodT_3 , then

ratio of the profits = $C_1T_1 : C_2T_2 : C_3T_3$

The ratio of profits = 30000 x 12 : 40000 x 9 : 90000 : 8= 36000 : 36000 : 72000= 1 : 1 : 2

Share of B in the total profit = 24000 x $\frac{1}{4}$ =Rs 6000

Q8.B

Q8 Solution:-

Ratio of investment of Agniwesh and Bikram = 100000 : 150000 = 2:3

Share of Agniwesh = (24000x2/5) = Rs. 9600

Share of Bikram = (24000x3/5) = Rs. 14400

Q9.A

Q Solution:-

Amarjeet: Ashish: Chandana = (2000x12): (25000x12): (15000x8)= 12:5:6

Share of Chandana = (46000x 6/23) = Rs. 12000

Q10.C

Q10 Solution:-

We assume that after the period of n month B joined the business.

Investment of Vikrant = (21000x12)= Rs. 252000

Investment of Uttam = {36000x (12-n) }= Rs. (432000-36000n)

252000= 432000- 36000n

⇒ 36000n= 180000

⇒ n= 5

So, Uttam joined after 5 months.

Q11.C

Q11 Solution:-

Abhilash, Baipotu and Laxman paid rent in the ratio = (10x20): (30x8): (16x9) = 25:30:18

Rent paid by Abhilash = Rs.(1460x 25/73) = Rs. 500

Rent paid by Baipotu = Rs. (1460x30/730= Rs. 600

Rent paid By Laxman = Rs. (1460x 18/73) = Rs. 360

Q12.A

Q12 Solution:-

If we can assume that the C , B and A have the investment of Rs. I ,

(I+5000) and Rs. (I+9000) respectively. Then,

I+(I+5000)+(I+9000) =50000 ⇒ 3I = 36000 ⇒ I =12000.

C =Rs. 12000 , B = Rs. 17000 and C = Rs. 21000

A : B : C = 21000 : 17000: 12000 = 21: 17: 12

Share of A = Rs. (35000x 21/50) = Rs. 14700

Q13.C

Q13 Solution:-

A:B:C = 27000 : 81000: 72000 = 3: 9: 8

If P is the total profit of the year .

Then , the share of B in profit = Rs. (Px 9/20)

∴ 9P/20 = 36000 ⇒ P = 36000x20/ 9 = 80000.

So, Rs. 80000 earned by B as a profit.

Q14. A

Q14 Solution:-

If rs. 5x,7x and 6x is the investment in the first year by Manu: Rahul:Sudip . then the investment in the second year by Manu ,Rahul and Sudip = (126% of 5x), (120% of 7x) and (115% of 6x) = 630 : 840: 690 = 21: 28: 23

Q15.D

Q15 Solution:-

Rs 2400 investment in 4 years earns as much as Rs 2400x4 = Rs 9600 in 1 year
Similary, Rs 2800x8 = Rs 22400 in 1 year
And Rs 2000x10 = Rs 20000 in 1 year.
Ratio for profit to be shared = 9600 : 22400 : 20000= 12 : 28 : 25
So,
Niraj's share = 12/65 x 1170 = Rs 216
Ranjan's share = 28/65 x 1170 = Rs 504
Sukant's share = 25/65 x 1170 = Rs 450

Q16. A

Q16 Solution:-

Let Rs 100 be the profit.
Rs 90 is to be divided in the ratio 12:16:12. i.e 3:4:3
Savitr gets 310×90=27 and 10 for managing
So 27+10=37%

Q17.B

Q17 Solution:-

Avinash : Manish: Nehal = (20000x5+15000x7) : (20000x5+ 16000x7) :(20000x5+26000x7)
= 205000: 212000 : 262000 = 205 : 212: 282
Share of B in profit = Rs. (69900x 212/699) = Rs. 21200

Q18. C

Q18 Solution:-

According to the question,
23k (5k + 11k) = 2800
Or, 23k 16k = 2800
Or, 7k = 2800
Or, k = 400
Difference between share of Rajat and Sujit = 23k - 11k = 12k = 12x400 = Rs. 4800

Q19.B

Q19Solution:-

The total profit for the year is 19100. Of this Udit gets Rs.9600. So, Abhilash would get (19100−9600) =Rs. 9500
The partners split their profits in the ratio of their investments.
So, the ratio of the investments of,
Abhilah : Udit=9500:9600=95:96.
Abhilash invested Rs.10000 initially for a period of 4 months. Then, he withdrew Rs.2000.
So, his investment has reduced to Rs.8000 (for the next 5 months).
Then he withdraws another Rs.3000. So, his investment will stand reduced to Rs.5000 during the last3 months.
So, the amount of money that he had invested in the company on a money-month basis will be,

=4×10000+5×8000+3×5000=40000+40000+15000=95000
If Abhilash had 95000 money months invested in the company, Udit would have had 96,000 money months invested in the company (as the ratio of their investments is 95:96).
If Udit had 96,000 money-months invested in the company, he has invested 96000/12=Rs. 8000

Q20.A
Q20. Solution:-
Ratio of the capitals of A, B and C.
=(20000 x 5 + 15000 x 7) : (20000 x 5 + 16000 x 7) :(20000 x 5 + 26000 x 7)= 205000 : 212000 : 282000
= 205 : 212 : 282
B's share = Rs. 69900 x 212/699 = Rs. 21200

Q21.C
Q21 Solution:-
Suppose Priya joined after x months. Then, Priya's money was invested for (12 - x) month
Then ATP:

$$\frac{76000 \times 12}{57000 \times (12-x)} = \frac{2}{1}$$

=> $\frac{912000}{684000 - 57000x} = \frac{2}{1}$

=> $\frac{912}{684 - 57x} = \frac{2}{1}$

=> 12-x=8

=> x=4
So, she joined after 4 months.

Q22.A
Q22 Solution:-
Let the initial investments of A, Band C be Rs. 3x, Rs. 2x and Rs. 4x respectively.
Then, (3x x 36) : [(2x x 12) + (2x + 270000) x 24] : [(4x x 24) + (4x +270000) x 12]=3:4:5
1O8x : (72x + 6480000) : (144x + 3240000) = 3 : 4 : 5
108x /(72x+6480000)=3/4
=> 432x = 216x + 19440000
=> 216x = 19440000
x=90000
C's initial investment = 4x = Rs. 3,60,000.

Q23,A
Q23 Solution:-
Let the total profit be Rs. 100.
Pratap's share for managing the business = 30% of profit = Rs. 30
Balance profit = (100 - 30) = Rs. 70
Ratio of investment investment = 25000 : 30000 : 15000= 5 : 6 : 3
Pratap's share of profit = 5/14 x 70 = Rs. 25
Rohit's share of profit = 6/14 x 70 = Rs. 30
Shekhar's share of profit = 3/14 x 70 = Rs. 15
Pratap's total share = Rs. (30 + 25) = Rs. 55
Pratap's share of profit - (Rohit's share of profit + Shekhar's share of profit)
= Rs. 55 - (Re 30 + Rs. 15)= Rs. 55 - Rs. 45= Rs. 10
When the difference is 10, total profit = Rs. 100

When the difference is 200, total profit = Rs. 2000
Now, 30% of Rs. 2000 = 30/100 x 2000 = Rs. 600
Balance profit = 2000 600 = Rs. 1400
Re 1400/(5+6+3) = Rs. 100
Pratap's actual share = Rs. 600 + Rs. (5x100) = Rs. 1100
Rohit's actual share = Rs. 100 x 6 = Rs. 600
Shekhar's actual share = Rs. 100 x 3 = Rs. 300

Q24.B
Q24.Solution:-

They share the profits at the end of the year .
A started the business and stayed in the business for 12 months.
B joined the business after 4 months , means he stayed in the business for 8 months.
Let the capital of B be x.
=> x= Rs 300000
The capital of B is Rs 300000

Q25.B
Q25 Solution:-

A and B invested their capital C 1 and C2 for the time periods T 2 and C2 , then
ratio of their profits = C 1 T 1 : C2 T2
A invests Rs 20000 for 8 months and B invests Rs 30000 for 6 months
The ratio of their profits = 20000 X 8 : 30000 X 6
=8 :9
Share of B = 9/17 X 6800 = Rs 3600

Q26.C
Q26 Solution:-

The ratio of the investments = 1/2 : 1/3 : 1/4.
=6/12 : 4/12 : 3/12
(Here 12 is the LCM of 2,3 and 4)
= 6 : 4 : 3
So ratio of profits = 6 : 4 : 3
Share of B in total profit Rs 10400 = 10400 x 6/13 = Rs 3200

Q27.A
Q27 Solution:-

At the of 3 years , they shared profits.
A started the business . So he is in the business for 36 months.
B joined the business after 6 months . So he is in the business for 30 months
Then ratio of their capitals = 36 x 50000 : 30 x 80000
= 3 : 4
A's share in the profit of Rs 24,500 = Rs 24,500 x 3/7 = Rs 10,500

Q28.A
Q28 Solution:-

T otal capital invested by A + B + C = 1/3 + 1/4 + 1/5 = 47/60
D's capital = 1 - 47/60 = 13/60
The ratio of capitals of A,B,C and D = 1/3 : 1/4 : 1/5 : 13/60
= 20 : 15 : 12 : 13
So share of D = Rs 18000 X 13 /60
= Rs 3900

Q29.B

Q29 Solution:-

A puts 6 oxen for 12months
B puts 7 oxen for 8 months
C puts 8 oxen for 6 months.
So ratio of rents = 6 X 12 : 7 X 8 : 8 X 6
= 72 : 56 :48
= 9 : 7 : 6
Rent paid by C = Rs 792 X 6/22 = 216

Q30.C

Q30 Solution:-

Ratio of their capitals = 55000 x 12 : 60000 x 9
= 660000: 540000.
= 11: 9
Share of A = Rs 42000 x 11/20 = Rs 23100

Q31.B

Q31 Solution:-

Ratio of Profits = 2:5:8
A's profit = 2x B's profit= 5x and C's profit = 8x
Difference between the share of A and C = 8x-2x = 6x= Rs 3600 => x=Rs 600
So , Total Profit = 2x +5x +8x =15x= 15 X 600 = Rs 9000
B's share = 5x = 5 X 600 = Rs 3000.

Q32.B

Q32 Solution:-

Clearly, Avinash invested his capital for 12 months, Bikram for 9 months and Chandana for 3 months.
So, ratio of their capitals = (45000 x 12) : (60000 x 9) : (90000 x 3)
= 540000 : 540000 : 270000 = 2 : 2 : 1.
Avinash's share = Rs. (16500 x (2/5)) = Rs. 6600
Bikram's share = Rs. (16500 x (2/5)) = Rs. 6600
Chandana's share = Rs. (16500 x (1/5)) = Rs. 3300.

Q33.A

Q33 Solution:-

Ratio of the capitals of A, Band C
= (20000 x 5 + 15000 x 7) : (20000 x 5 + 16000 x 7) : (20000 x 5 + 26000 x 7)
= 205000:212000 : 282000 = 205 : 212 : 282.
A's share = Rs. 69900 x (205/699) = Rs. 20500

Q34.D

Q34 Solution:-

Let C's capital = Rs. x. Then, B's capital = Rs. (2/3)x
A's capital = Rs. (3 x (2/3).x) = Rs. 2x.
Ratio of their capitals = 2x : (2/3)x :x = 6 : 2 : 3.
So, C's share = Rs. (6600 x (3/11))= Rs. 1800.

Q35.A

Q35 Solution:-

Ratio of shares of A, B, C, D = (24 x 3) : (10 x 5) : (35 x 4) : (21 x 3) = 72 : 50 : 140: 63.

Let total rent be Rs. x. Then, A's share = Rs. (72x)/325

(72x)/325=7200

=> x=(7200 x 325)/72 = 32500

So, total rent of the field is Rs. 32500.

Q36.B

Q36 Solution:-

The ratio of profit of Agniwesh, Abhilash and Bikram is 4000:6000:8000=2:4:3.

Let the a nual profit be P.

Then, Agniwesh will get 0.2p for managing the business.

And, remaining 0.8p will be distributed in the ratio of their investment.

So, from the remaining investment, Agniwesh will get,

=22+4+3×0.8p=29×0.8p

Abhilash gets=42+4+3×0.8p=49×0.8p

and Bikram Gets=32+4+3×0.8p=39×0.8p

So Agniwesh's total profit=0.2p+29×0.8p

Given, at the end of the year, the profit of Agniwesh is Rs 2200 less than the sum of the profit of Abhilash and Bikram.

⇒ 49×0.8p+39×0.8p−2200=0.2p+29×0.8p

⇒ 79×0.8p−29×0.8p−0.2p=2200

⇒ p=9,000

So, Bikram's share=39×0.8p=39×0.8×9,000=Rs 2400

Q37.B

Q37 Solution:-

If 6x is the investment of Jyoti , then Meghna and Ruby investment will be 3x and x . Then the investment invested ratio between Jyoti: Meghna: Ruby is 6:3:1

Q38.D

Q38 Solution:-

Let total profit of the firm = 1

Share of Nikky in profit = (1-2/7) = 5/7

Ratio of profit = 5 : 2

Contribution of Nikky = k then (16000x8)/ 4k = 5/2

⇒ 20k = 256000

⇒ k= 12800.

So, She contributed Rs. 12800.

Q39.A

Q39 Solution:-

Let investment of Anumita be A, Nikky be B and Ruby be C.

Then ATP

2A = 3B and B = 4C and So, 3B = 12 C

∴ 2A =3B = 12C = k

⇒ A = k/2 , B = k/3 , C= k/12

∴ A:B:C = k/2 : k/3 : k/12

= 1/2 : 1/3: 1/12 = 6:4:1

So, share of B = (297000k 4/11) = Rs. 10800.

HCF AND LCM

FACTOR: If a number P divides another number Q exactly, we say that P is a factor of Q i.e. Q is a multiple of P.

H.C.F: The H.C.F of two or more than two numbers is the greatest number that divides each of them exactly.

L.C.M: The least number which is exactly divisible by each one of the given numbers is called their L.C.M

Product of two numbers=Product of their H.C.F and L.C.M

Co-primes: Two numbers are co-primes if their H.C.F is 1.

H.C.F and L.C.M of fractions:

1. $\text{H.C.F} = \frac{\text{H.C.F of Numerators}}{\text{L.C.M of Denominator}}$

2. $\text{L.C.M} = \frac{\text{L.C.M.of Numerators}}{\text{H.C.F of Denominator}}$

----------**EXERCISE**----------

Q1. Find the least number which is exactly divisible by each one of the numbers 12, 15, 20 and 27.

A	540	B	530	C	520	D	510

Q2. Find the L.C.M of 15, 18, 24, 27, 56:

A	7260	B	7360	C	7460	D	7560

Q3. Find the H.C.F of 108, 288, and 360:

A	34	B	36	C	38	D	40

Q4. Find the H.C.F of 108, 360 and 600.

A	12	B	13	C	14	D	15

Q5. Three big drums contain 36 litres, 45 litres and 72 litres of oil. What is the biggest measure that can be used to measure all the different quantities exactly?

A	9 litres	B	10 litres	C	11 litres	D	12 litres

Q6. What is the greatest length possible of a scale that can be used to measure exactly 3m , 5m 10 cm and 12m 90 cm length?

A	10 cm	B	20 cm	C	25 cm	D	30 cm

Q7. Compute H.C.F of $(2^2x2^3x5x7^4)$, $(2^3x3^2x5^2x7^3)$ and $(2^2x5^3x7^5)$.

A	6760	B	6860	C	6960	D	7060

Q8. Find the L.C.M of (2^2x3^2x5x7) , $(2^3x3x5^2x7^2)$ and (2x3x7x11):

A	970200	B	97020	C	9702	D	970

Q9. The H.C.F of 1/2 , 2/3 , 3/4 , 4/5 is:

A	1/120	B	12/5	C	100/3	D	10/3

Q10. The H.C.F of 2/3, 8/9, 10/27 , 32/81:

A	160/81	B	160/3	C	2/81	D	2/3

Q11. The number of prime factors in the expression $2^5x2^6x3^6x5^3$:

A 10 B 20 C 40 D 80

Q12. Find the greatest natural number which can divide the product of any 4 consecutive natural numbers.

A 23 B 24 C 25 D 26

Q13. Which of the following is a pair of Co-primes:

A (14, 35) B (18, 25) C (31, 93) D (32,62)

Q14. Find the L.C.M of 2/3 , 8/9 , 10/27 and 16/81:

A 10/3 B 20/3 C 40/3 D 80/3

Q15. Find the H.C.F of 204, 1190 and 1445:

A 16 B 17 C 18 D 19

Q16. Find the least number which if divided by 6, 7, 8, 9, 12 leaves the same remainder 2 in each case.

A 506 B 504 C 502 D 500

Q17. Find the greatest number that will divide 43, 91, and 183 so as to leave the same remainder in each case:

A 1 B 2 C 4 D 8

Q18. Find the greatest number of four digits exactly divisible by 12,15,18 and 27.

A. 1980 B. 4280 C. 7320 D. 9720

Q19. A milk vendor has three kinds of milk: 68 litres, 119 litres and 153 litres. Find the least number of measuring pot of equal size required to store all the milk without mixing.

A 15 B 20 C 25 D 30

Q20. Find the greatest number which divides 62, 132 and 237 leaving the same remainder in each case.

A. 15 B. 25 C. 35 D. 45

Q21. Reduce 391/667 to lowest terms:

A 7/29 B 27/29 C 17/29 D 37/29

Q22. Find the least number of five digits exactly divisible by 16,24,36 and 54.

A. 10368 B. 11654 C. 12480 D. 13506

Q23. If H.C. F of two numbers is 7 and their L.C.M is 210. And If one of the numbers is 35, find the other:

A 32 B 42 C 52 D 62

Q24. What will be the least number which when doubled will be exactly divisible by 12, 18, 21 and 30:

A 510 B 630 C 760 D 1120

Q25. Two numbers are in the ratio 8:11 . Considering their H.C.f as 6, find the numbers:

A 58,79 B 48,66 C 38,56 D 28,33

Q26. Four electronic devices make a beep after duration of 30 minutes, 1 hour, 3/2 hours and 1 hour 45 min. respectively. If all the devices beeped together at 12 noon at what time will they beep together again?

A 9 a.m. B 9:30 a.m. C 10 a.m. D 10:30 a.m.

Q27. The sum of two numbers is 75 and their difference is $1/5^{th}$ of their sum. What is their L.C.M:

A 90 B 120 C 150 D 180

Q28. Find the H.C.F of 148 and 185:

A 37 B 38 C 39 D 40

Q29. Find the least number which if divided by 35, 45 and 55 leaves the remainder 18, 28 and 38 respectively.

A 3448 B 3458 C 3468 D 3478

Q30. If the sum of two numbers is 55 and the H.C.F and L.C.M of these numbers are 5 and 120 respectively then the sum of the reciprocals of the numbers is equal to:

A 11/120 B 55/601 C 601/55 D 120/11

Q31. Find the least number which when divided by 5,6,7, and 8 leaves a remainder 3, but when divided by 9 leaves no remainder .

A. 1683 B. 2346 C. 3286 D. 4596

Q32. The least number which should be added to 2497 so that the sum is exactly divisible by 5,6,4 and 3 is:

A 20 B 23 C 25 D 30

Q33. A red light flashes 3 times per minute and a Green light flashes 5 times in two minutes at regular intervals. If both lights start flashing at the same time, how many times do they flash together in each hour?

A. 29 B. 30 C. 31 D. 32

Q34. H.C.F and L.C.M of two numbers x and y are 3 and 60 respectively. If x+y=18 then figure out $\frac{1}{x}+\frac{1}{y}$.

A 4/35 B 3/28 C 2/19 D 1/10

Q35. The traffic lights at three different road crossings change after every 48 seconds,72 seconds and 108 seconds respectively .If they all change together at 8:20:00 hours,then at what time they would again change together .

A. 8:21:12 B. 8:27:12 C. 8:37:12 D. 8:46:12

Q36. If a person makes a row of toys of 20 each, there would be 15 toys left. If he arranges them in rows of 25 each, there would be 20 toys left, If he arranges them in rows of 38 each, there would be 33 toys left and If he arranges them in rows of 40 each, there would be 35 toys left. What is the minimum number of toys the person have?

A. 3,255 B. 3,505 C. 3,655 D. 3,795

Q37. What is the minimum number of square bricks required to make a floor of length 5 metres 78 cm and width 3 metres 74 cm?

A. 176 B. 187 C. 194 D. 201

Q38. There are 2 numbers such that a > b, HCF (a, b) = h and LCM (a, b) = l. What is the LCM of a+b and a-b?

A. $(a^2 - b^2)/h$ B. (ab)/h C. (a+b)b/ h D. h/(ab)

Q39. Find the greatest number which can exactly divide 513, 783 and 1107 leaving same remainder.

A 23 B 25 C 27 D 29

Q40. Find the least number which when divided by 20,25,35 and 40 leaves remainders 14,19,29 and 34 respectively.

A. 1394 B. 1406 C. 1578 D. 1624

Q41. There are 2 numbers such that a > b, HCF (a, b) = h and LCM (a, b) = l. What is the LCM of axb and a/b?

A. $(a^2 - b^2)/h$ B. ah C. (ab) b / h D. h (ab)

Q42. There are 2 numbers such that a > b, HCF (a, b) = h and LCM (a, b) = l. What is the LCM of a+b and ab?

A. $(a^2 - b^2)/h$ B. (ab) b C. $(a + b)ab/h^2$ D. h (ab)

Q43. The LCM of two numbers is 280 and their ratio is 7:8. The two numbers are

A. 70, 80 B. 35, 40 C. 42, 48 D. 28,32

Q44. A call centre observes that it gets a call at an interval of 10 minutes from Kolkata, at every 12 minutes from Mumbai, at the interval of 20 minutes from Delhi and after interval 25 minutes it gets the call from Chennai. If in the early morning at 5:00 a.m. it receives calls from all the four cities, then at which time it will receive the calls at a time from all places on the same day?

A. 08:00 am B. 10:00 am C. 2:00 pm D. Both (A) and (B)

Q45. A room 5m 55cm long and 3m 74 cm broad is to be paved with square tiles. Find the least number of square tiles required to cover the floor.

A. 176 B. 194 C. 249 D. 316

This chapter contains the topics and questions I discussed and created in our classes or obtained from students as their doubts. All the questions noted, typed, redesigned and rectified by group of volunteers consisting of:

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----------ANSWERS----------

Q1.A	**Q2.D**	**Q3.B**	**Q4.A**	**Q5.A**	**Q6.D**
Q7.B	**Q8.A**	**Q9.A**	**Q10.C**	**Q11.B**	**Q12.B**
Q13.B	**Q14.D**	**Q15.B**	**Q16.A**	**Q17.C**	**Q18.D**
Q19.B	**Q20.C**	**Q21.C**	**Q22.A**	**Q23.B**	**Q24.B**
Q25.B	**Q26.A**	**Q27.A**	**Q28.A**	**Q29.A**	**Q30.A**
Q31.A	**Q32.B**	**Q33.B**	**Q34.D**	**Q35.B**	**Q36.D**
Q37.B	**Q38.A**	**Q39.C**	**Q40.A**	**Q41.B**	**Q42.C**
Q43.B	**Q44.B**	**Q45.A**			

----------ANSWERS WITH SOLUTION----------

Q1.A

Q1 Solution:-

Required no. = L.C.M of 12,15, 20 and 27

= (3x2x2x5x9) = 540

Q2.D

Q2 Solution:-

15 = 3 x 5

18 = 2x 3 x 3 = 2 x 3^2

24 = 2 x2 x 2 x 3 = 2^3 x 3

27 = 3 x 3 x 3 = 3^3

56 = 2 x 2 x 2 x 7 = 2^3 x 7

L.C.M = Product of terms containing highest powers of (2,3,5,7) =2^3 x 3^3 x 5 x 7 = 7560

Q3.B

Q3 Solution:-

108 = 2^3 x 3^3

288 = 2^5 x 3^2

360 = 2^3 x 3^2 x 5

So H.C.F = 2^2 x 3^2 = 36

Q4.A

Q4 Solution:-

108 = (2^2x3^3) , 360 = (2^3x3^2x5) and 600 = (2^3x5^2x3)

∴ H.C.F = (2^2x 3) = (4x 3)=12

Q5.A

Q5 Solution:-

Required measure = H.C.F of 36 L, 45 L, and 72 L

36 = 2^2x3^2

45 = 3^2x5

72 = 2^3x 3^2

So, HCF= (3^2) litres = 9 litres

Q6.D

Q6 Solution:-

Required length = H.C.F of 300 cm, 510 cm, 1290 cm =30 cm

Q7.B

Q7 Solution:-

Prime numbers which are common to all the given numbers are 2,5 ,7.
∴ H.C.F = (2^2x5x7^3)= (4x5x343) = 6860

Q8.A
Q8 Solution:-
We have L.C.M = product of terms containing highest powers of (2,3,5,7,11)
= $(2^3x\ 3^2x\ 5^2x7^2x11)$ = (8x9x25x11x49)= 970200

Q9.A
Q9 Solution:-
H.C.F = (H.C.F of 1,2,3,4)/ (L.C.M of 2,3,4,5) = 1/120

Q10.C
Q10 Solution:-
H.C.F = H.C.F of 2, 8,10, 32/ L.C.M of 3,9, 27, 81 = 2/81

Q11.B
Q11 Solution:-
2, 3, 5 are the prime numbers and the given expression is $2^5x2^6x3^6x5^3$.
So the total would be the sum of powers in the expression that is 5+6+6+3=20

Q12.B
Q12 Solution:-
(1x2x3x4) = 24
∴ Required number = 24

Q13.B
Q13 Solution:-
H.C.F of 18 and 25 is 1.
∴ 18 and 25 are co-primes.

Q14.D
Q14 Solution:-
H.C.F of 2,8,10,16 = 2
L.C.M of 3,9,27,81 = 81
H.C.f = H.C.F of 2,8,10,16/L.C.M of 3,9,27,81 = 2/81
L.C.M = L.C.M of 2,8,10,16/H.C.F of 3,9, 27,81 = 80/3

Q15.B
Q15 Solution:-
Remainder of 1190/204 = 170
Remainder of 204/170 = 34
Remainder of 170/34 = 0
∴ H.C.F. of 204, 1190 = 34
Remainder of 1145/34 = 17
Remainder of 34/17 = 0
∴ H.C.F. of 204, 1190 and 1145 = 17

Q16.A
Q16 Solution:-
Required number = (L.C.M of 6,7,8,9,12)+2 = (2x3x2x7x2x3)+ 2 = (504+2)= 506.

Q17.C
Q17 Solution:-
Required number = H.C.F of (91 - 43), (183 - 91) and (183 - 43) = H.C.F of 48, 92, and 140 = 4

Q18.D
Q18 Solution:-
The Greatest number of four digits is 9999.
Required number must be divisible by L.C.M. of 12,15,18,27 i.e. 540.
On dividing 9999 by 540,we get 279 as remainder .
So, Required number = (9999-279) = 9720.

Q19.B
Q19 Solution:-
Size of the measuring pot (G.C.D. of 68,119 and 153) =17
Number of measuring pot =68/17+119/17+153/17=20

Q20.C
Q20 Solution:-
Required number = H.C.F. of (132 - 62), (237 - 132) and (237 - 62)
= H.C.F. of 70, 105 and 175 = 35.

Q21.C
Q21 Solution:-
First we find the H.C.F of 391 and 667.
Remainder of 667/391 = 276
Remainder of 391/276 =115
Remainder of 276/115 = 46
Remainder of 115/46 = 23
Remainder of 46/23= 0
∴ H.C.F. of 391, 667 = 23
∴ 391/667 =(391/23)/ (667/23)= 17/29

Q22.A
Q22 Solution:-
Least number of five digits is 10000.
Required number must be divisible by L.C.M. of 16,24,36,54 i.e 432,
On dividing 10000 by 432,we get 64 as remainder.
Required number = 10000 +(432 – 64) = 10368.

Q23.B
Q23 Solution:-
Let the Other number be X. then,
Product of numbers = product of their H.C .F and L.C.M
35xx= 7x 210 ⇒ x= 7x210/35 = 42
So, the other number is 42.

Q24.B
Q24 Solution:-
L.C.M of 12, 18, 21, 30 = 2 x 3 x 2 x 3 x 7 x 5 = 1260.
Required number =(1260⁄2) = 630

Q25.B
Q25 Solution:-
Let the numbers be 8x and 11 x. then, their H.C.F = x
So, the numbers are (8x6), (11x6) i.e 48 and 66.

Q26.A
Q26 Solution:-
Intervals of beeping 30 min, 60 min, 90 min, 105 min.
Interval of beeping together= L.C.M of 30 min. 60 min. 90 min. 105 min
= (3x5x2x2x3x7) min. = 1260 min = 21 hrs.
So, they will beep together again next morning at 9 am.

Q27.A
Q27 Solution:-
Let the numbers be x and y . Then,
{x+y=745 , x= (1/9x75)= 5
⇒ x =45, y =30
L.C.M of 45 and 30 = (3x5x3x2)= 90

Q28.A
Q28 Solution:-
Remainder of 185/148 = 37
Remainder of 148/37 = 0
∴ H.C.F. = 37

Q29.A
Q29 Solution:-
Here (35-18) = 17 , (45-28)= 17 and (55- 38) = 17
Required number = (L.C.M of 35,45, 55)- 17 = (3465 -17) = 3448

Q30.A
Q30 Solution:-
Let the numbers be a and b. Then a + b = 55 and a x b = 5 x 120 = 600
So Required sum = 1⁄a + 1⁄b = a + b⁄a x b
55⁄600 = 11⁄120

Q31.A
Q31 Solution:-
L.C.M. of 5,6,7,8 = 840.
Required number is of the form 840k + 3
Least value of k for which (840k + 3) is divisible by 9 is k = 2.
Required number = (840 X 2 + 3)=1683

Q32.B
Q32 Solution:-
L.C.M of 5,6,4 and 3 = 60

On dividing 2497 by 60, remainder is 37.
So Number to be added = (60 - 37) = 23.

Q33.B

Q33 Solution:-

Red light flashes every 20 seconds
Green light flashes every 24 seconds
So, they will flash together every 120 seconds
In every hour, they will flash = 3600/120=30 times

Q34D

Q34 Solution:-

We have: product of numbers= product of HCF an LCM

=> xy =3 x60

⇒ xy = 180

∴ $\frac{x+y}{xy} = \frac{18}{180} = \frac{1}{10}$

⇒ $\frac{1}{x} + \frac{1}{y} = \frac{1}{10}$.

Q35.B

Q35 Solution:-

Interval of change = (L.C.M of 48,72,108)seconds=432seconds
So, the lights will agin change together after every 432 seconds i.e,7 min.12sec
So , next simultaneous change will take place at 8:27:12 hrs.

Q36.D

Q36 Solution:-

Required number of toys =LCM(20,25,28,38 and 40)−5

Q37.B

Q37 Solution:-

The bricks used to make the floor are square bricks.
As we have to use whole number of bricks, HCF of both 5 m 78 cm and 3m 74. And it should be the highest factor of 5 m 78 cm and 3m 74.
5 m 78 cm = 578 cm
3 m 74 cm = 374 cm.
The HCF of 578 and 374 = 34.
So, the side of the square is 34.
The number of such square bricks required,
=578×374/(34×34)
=17×11= 187 bricks

Q38.A

Q38 Solution:-

Let a=hx => x=a/h
b=hy => y=b/h [h is HCF and x , y are some integer]
So LCM is hxy=l
a+b=hx+hy=h(x+y)
a-b=hx – hy=h(x-y)
so LCM of a+b and a-b is h(x+y)(x-y)putting values of x and y we get
h(a/h+b/h)(a/h-b/h)=(a+b)(a-b)/h

Q39.C

Q39 Solution:-

`Remainder of 783 - 513 = 270

Remainder of 513 - 270 =243

∴ H.C.F. of 270 and 243 = 27

So the number is 27.

Q40.A

Q40 Solution:-

Here,(20-14) = 6,(25 – 19)=6,(35-29)=6 and (40-34)=6.

Required number = (L.C.M. of 20,25,35,40) – 6 =1394.

Q41.B

Q41 Solution:-

Let a=hx => x=a/h

b=hy => y=b/h [h is HCF and x , y are some integer]

So LCM is hxy=l

$a.b=hx.hy=h^2xy$

a/b=hx/hy=x/y

so LCM of ab and a/b is $x.(h^2xy.x/y) = h^2x$ putting values of x and y we get $(a/h).h^2=ah$

Q42.C

Q42 Solution:-

Let a=hx => x=a/h

B=hy => y=b/h [h is HCF and x , y are some integer]

So LCM is hxy=l

a+b=hx+hy=h(x+y)

ab=hx.hy=hxy

so LCM of a+b and ab is h(x+y)xy putting values of x and y we get

$h(a/h+b/h)(a/h.b/h)=(a+b)ab/h^2$

Q43.B

Q43 Solution:-

Let the number be 7x and 8x

HCF =x

So, HCF × LCM=7x.8x

⇒ 280x=56x.x

⇒ x=5

So numbers are 35 and 40.

Q44.B

Q44 Solution:-

Call centre gets calls from all the cities after an interval of time(LCM of 10, 12, 20 and 25 which is 300).So, the next calls from all cities together will be received after 300 minutes or after 5 hours or at 10:00 a.m.

Q45.A

Q45 Solution:-

Area of the room = (544 x 374) cm^2.

Size of greatest square tile = H.C.F. of 544 cm and 374 cm = 34 cm.

Area of 1 tile = (34 x 34) cm^2.

Number of tiles required = $\frac{544x374}{34x34}$ = 176

TIME AND DISTANCE

Distance : The length of the path travelled by an object or a body or a person between two places is known as distance. It is measured in meters or kilometres.

Speed : The distance travelled by any object or person in unit time is knows as speed of the object or speed of a person. It is measured in meter per second or kilometre per hour.

Speed : Distance / Time
Distance : Speed x Time
Time : Distance / Speed

Average Speed : Total Distance Covered / Total Time Taken

Average Speed when an object travels equal distances with different speeds:

1. If a person covers two equal distances with speed of x and y units respectively, then the average speed of the man for complete journey = $\frac{2xy}{x+y}$
2. A person travels 3 equal distances with speeds x, y and z units, then his average speed = $\frac{3xyz}{xy+yz+zx}$

Conversion of Units :

1.From km/h to m/s :
To convert the speed of an object from km/h to mtr/s, multiply the speed by 5/18
S km/h = S x $\frac{5}{18}$ mps

2. from mtr/s to km/h:
To convert the speed of an object from mtr/s to km/h, multiply the speed by 18 / 5
S mps= S x $\frac{18}{5}$ km/h

Relation between spped and time of two object: The ratio of the speeds of two person to cover a distance is x:y, then the ratio of time taken by them to cover same distance will be y :x.

Example1: Anumita travelled a distance of 95 kilometres in 5 hours.
So distance travelled by Anumita in 1 hour =$\frac{95}{5}$ km = 19 km
So, speed of Anumita = 19kmph

Example2: 72 km/h = 72 x 5 / 18 = 20 m/s
From m/s to km/h.

Example3: Convert 30 mtr/s into km/h
30 x18 / 5= 108 km/h

Example4: A person travels 80 km in 6 hours and next 30 km in 5 hours. What is his average speed?
Total distance covered = 80 km + 30 km = 110 km
Total time taken = 6 hours + 5 hours = 11 hours.
Average Speed =Total Distance Covered / Total Time Taken = 110 / 11 = 10 km/h

Example5: Rahul covers a half of the distance with speed of 40 km/h and remaining half of the distance with speed of 60 km/h. What is his average speed?

Answer : He travelled two equal distance with speeds 40kmph and 60kmph
Average Speed =2 x 40 x 60 / (40+60) = 48km/h

Example6: Avinash travels 1/3 of his journey at 10 km/h , next 1/3 at 30km/h and remaining 1/3 at 60km/h. What is his average speed during the journey?

A. 15 km/h B. 20 km/h C. 25km/h D. 30km/h

Answer : Avinash travels 3 equal distances at speeds of 10 km/h, 20 km/h and 30 km/h
Average Speed =3xyz/(xy + yz + zx)=3 x 10 x 30 x 60 /(10x30 + 30+60 + 60+10)= 20 km/h
Concept of Relative Speed :
Objects moving in the same direction : If two objects are moving in same direction at speeds of x and y , then their relative speed = x-y
For example, if the two bikes A and B move in the same direction at speeds of 520kmph and 40 km/h , then their relative speed of A with respect to B is (50-40)=10 km/h.

Example7: Abhilash and Agniwesh start walking in the same direction at 12km/h and 10 km/h respectively. In how many hours will they be 16km apart?

A. 4 hours B. 5 hours C. 6 hours D. 8 hours

Answer : Time =Distance / Speed
Here both are moving in same direction, so the relative speed is 12-10 = 2 km/h
Time =16 / 2= 8 hours
Objects moving in opposite direction : If two objects are moving in opposite directions at speeds of x and y, then their relative speed = x+y.
If two cars are travelling towards each other at speeds of 30 km/h and 40 km/h respectively, then their relative speed = 30+40 = 70 km/h.

Example8: Anumita and Ruby walking in opposite directions at 12km/h and 10 km/h respectively. In how many hours will they be 66 km apart?

A. 6 hours B. 33 hours C. 3 hours D. 5 hours

Answer : Anumita and Ruby are walking in opposite direction , their relative speed is sum of their speeds = 12+10 =22 km/h
Time =Distance / Time=66 / 22= 3 hours

Note : The ratio of speeds of two objects is a:b, then to cover same distance, the ratio of time taken will be b:a

Example9: The ratio between the speeds of A and B is 5 :7 and A takes 35 minutes to cover a distance. In what time does B covers the same distance?

A. 10 min B. 15 min C. 25 min D. 30min

Answer : The ratio of between the speeds of A and B is 5:7
Then ratio of the times taken by A and B = 7:5
Time taken by A to cover a distance is 7x = 35 minutes
So, time taken by B to cover same distance = 5x = 5x5 = 25 minutes

TIME AND DISTANCE

----------EXERCISE----------

Q1. Abhilash covers a distance of 900 meters in 3 minutes. Find his speed in km/h?
A. 12 km/h B. 18 km/h C. 24 km/h D. None

Q2. The speed of a Car is 54 km/h. What distance will it cover in 18 seconds?
A. 210m B. 230m C. 250m D. 270m

Q3. A Car can cover a distance of 270 km in 5 hours. What is its speed in m/s ?
A. 12.5 km/h B. 13.3 km/h C. 15 km/h D. 20 km/h

Q4. A car travels at a speed of 30 km/h . How much distance it can cover in 1 hour 40 minutes?
A. 30 km B. 40 km C. 50 km D. 60 km

Q5. The speed of a car is 60 km/h. A boy runs at one fourth the speed of car and reaches his school from his house in 20 minutes. What is the distance between school and house?
A. 3 km B. 4 km C. 5km D. 6km

Q6. Agniwesh goes to his office from his house with speed of 6 km/h and returns with speed of 8 km/h on his motorcycle. What is his average speed of whole journey?
A. 6.2 km/h B. 6.8 km/h C. 7.2 km/h D. 8 km/h

Q7. A car covers first half of certain journey with speed of 50 km/h and second half journey with speed of 40 km/h. If it takes 9 hours to cover total distance. What is the distance covered in whole journey?
A. 200 km B. 300 km C. 400 km D. 500 km

Q8. A car covers 100 km at a speed of 20 km/h and then further travels 210 km at a speed of 70 km/h .What is the average speed of the car?
A. 37.75 km/h B. 38.25 km/h C. 38.75 km/h D. 39.25 km/h

Q9. Car A takes 40 minutes to cover a distance of 120km. If the speed of Car B 25% faster than Car A , it will cover the same distance in
A. 24 min B. 28 min C. 32 min D. 36 min

Q10. If Ankit travels with speed $2/7^{th}$ of his actual speed, he reaches his office 25 minutes late, then actual time to reach office with his actual speed is
A. 10 minutes B. 18 minutes C. 24 minutes D. 36 minutes

Q11. If Bikash travels 3/7th of his journey at 30 km/h and remaining 4/7 th journey at 20 km/h. If the total distance travelled is 210km , what is his average speed during the whole journey?
A. 23 km/h B. 23.3 km/h C. 27.95 km/h D. 30.25 km/h

Q12. The ratio of the speed a car to that or a bullet is 5:7. Also a yamaha covered a distance of 840km in 12 hours. The speed of the car is $4/7^{th}$ the speeds of the yamaha.How much distance will the bullet cover in 6 hours?
A. 312 km B. 324 km C. 336 km D. 348 km

Q13. A person covers a distance of 72 km in 9 hours on motorbike. How much distance will the person cover on car in 5 hours, if he drives the car at 4 times the speed of the motorbike?
A. 120 km B. 135 km C. 150 km D. 160km

Q14. Sudeep is running at a speed of p km/hr to cover a distance of 1 km. in any case, But due to tiredness, his speed is lessened by q km/hr (p>q). If he takes r hours to cover that distance, then
A. $1/r = (p-q)$ B. $r = (p-q)$ C. $1/r = (p+q)$ D. $r = (p+q)$

Q15. Sujeet goes to his office by car at a speed of 40 km/h and reaches 8 minutes earlier. If he goes at a speed of 30 km/h , he reaches 4 minutes late. What is the distance from his house to office?

A. 8 km B. 14 km C. 24 km D. 34km

Q16. Car A covers a certain distance in 8 hours at the speed of 63 km/h. What is the average speed of another Car B which travels a distance of 60 km more than the car in the same time?

A. 60 km/h B. 70 km/h C. 85 km/h D. 90 km/h

Q17. Aarif drives his car at a speed of 40 km/h and reaches his destination in 5 hours and Sudeep covers the same distance in 8 hours. If Aarif increases his speed by by 10 km/h and Sudeep increases by by 15 km/h, then find the difference between the times taken by them to cover the same distance?

A. 1/2 hour B. 1 hours C. 3/2 minutes D. 2 hours

Q18. Average speed of A is 60 km/h and average speed of B is 25% more than that A. What is the distance travelled by B in 6 hours ?

A. 350 km B. 400 km C. 450 km D. 500 km

Q19. The ratio of speed of a yamaha, bullet and car is 5: 9: 6. The speed of the bullet is 150% the speed of the car . The car can cover a distance of 480 km in 16 hours. What is average speed of yamaha and bullet together?

A. 25 km/h B. 35 km/h C. 40 km/h D. 45 km/h

Q20. Anumita rides a Car at a speed of 75 km/h and covers her journey in 6 hours.If she wants to cover same distance in 5 hours, by how much the speed will she have to increase.

A. 12 km/h B. 15 km/h C. 18 km/h D. 20 km/h

Q21. A monkey could climb 3 meters of a round wet pole in the first minute but slipped down 1 meter in next minute .The climbing and slipped occurs every alternate minute. What time will the monkey take to reach the top of the pole which is 31 meters long?

A. 29 minutes B. 31 minutes C. 33 minutes D. 35 minutes

Q22. Manu takes 8 hours to go to a certain place and come back partly by cycle and partly by motorcycle. He saved 2 hours by using motorcycle both ways. What time he will take if he uses only cyle?

A. 9 hours B. 10 hours C. 11 hours D. 12 hours

Q23. Two cars P and Q start from the same point and move in opposite direction at speeds of 35 km/h and 30 km/h. After how much time they will meet, if the distance between the P and Q is 357.5 kilometers?

A. 4 hours B. 5 hours C. 5 hours 30 minutes D. 6 hours

Q24. A and B are travelling in the same direction and A is 200 meters ahead of B.And speed of A is 12 m/s and speed of B is 8m/s.How much would be the distance between them after 15 more seconds?

A. 160m B. 140 m C. 260m D. 300m

Q25. The distance between Bangalore and Kakinada is 1000 km. A car starts from Bangalore towards Kakinada at 6 a.m at an average speed of 60 km/h. Another car starts from Kakinada towards Bangalore at the same time at an average speed of 40 km/h. How far from Bangalore will the two cars meet?

A. 400 km B. 500 km C. 550 km D. 600 km

Q26. Two Car s A and B are travelling towards each other from two different places 198 kms apart. The ratio of the speed of the Car s A and B is 5:6 and the speed of the Car A is 60 km/h. After what time will the two Car s meet each other?

A. 30 min B. 45 min C. 1 hour D. 1 hour 30 minutes

Q27. A thief steals a Santro car at 8 a.m and rides the bike at an average speed of 40 km/h. The theft was found at 9.30 a.m and the policeman started chasing on bike at a speed of 70kmph. When will he catch the thief ?

A. 10.30 a.m B. 11.30 a.m C. 12 noon D. He cannot catch him

Q28. Avinash wants to cover 80 km in 10 hours. If he covers half of the distance in $3/5^{th}$ of the time, what speed should he maintain to cover the remaining distance in the remaining time?

A. 7 km/hr B. 8 km/hr C. 9 km/hr D. 10 km/hr

Q29. Rahul wants to cover a distance of 45 km on his motorcycle and his speed is 15 km/h. After 9 km, he takes rest for 15 min. How long will he take to cover the whole distance ?

A. 3 hours B. 4 hours C. 5 hours D. 6 hours

Q30. Car A starts from P to Q and another Car B starts from Q to P. Both Car s meet each other at midpoint of P and Q. After they meet each other, they complete their remaining journey in 3 hours and 2 hours respectively. What is the ratio of the time taken by both Car s for whole journey ?

A. 3:2 B. 3:4 C. 3:5 D. 5:4

Q31. Two guns were fired from the same place at interval of 15 minutes. Laxman travelling in car that was approaching the place hears the 2 nd 13 minutes after the 1 st. Find the speed of the car , if the sound travels at 80 m/s.

A. 12 m/s B. 12.3 m/s C. 12.5 m/s D. 13.5 m/s

Q32. Vikrant driving in the morning fog passes Uttam who was walking at the rate of 2 km/h in the same direction. Uttam can see the car for 6 minutes and upto distance of 0.8 km. Find the speed of the car ?

A. 8kmph B. 10 km/h C. 12 km/h D. 12.5 km/h

Q33. A car starts from A towards B and another starts from B towards A. The distance between A and B is 180 km. If the two cars travel in same direction from A towards B they meet after 6 hours and if they travel in opposite direction, they will meet after 2 hours. What is the speed of the car starting from A?

A. 55 km/h B. 58 km/h C. 60 km/h D. 72 km/h

Q34. A certain distance is covered by a certain speed. If half of this distance is covered in the double of time that required in first case, then the ratio of the two speeds is:

A. 4:1 B. 1:4 C. 2:1 D. 1:2

Q35. Aarif starts walks from A towards B , a distance of 67 km at the rate of 13 km/h. An hour later Sudeep starts his journey at B towards A and walks at the rate of 5 km/h . Where will Aarif meet Sudeep from B?

A. 12 km B. 15 km C. 18 km D. 21 km

Q36. What is meters/sec for 54 km/hr?

A. 15 m/sec B. 20 m/sec C. 25 m/sec D. 30 m/sec

Q37. What is km/hr for 16 m/sec?

A. 53.6km/hr B. 55.6km/hr C. 57.6km/hr D. 59.6km/hr

Q38. Anita can cover a distance in 1 hr 24min by covering two-third of the distance at 4km/hr and the rest at5 km/hr. Find the total distance.

A. 3 kms B. 4 kms C. 5 kms D. 6 kms

Q39. Hitesh covers a distance via auto driving at 70 km/hr and returns back to the beginning stage riding on a bike at 55km/hr. locate his average speed for the entire trip?

A. 62.6 km/hr B. 61.6 km/hr C. 60.6 km/hr D. 59.6 km/hr

Q40. A man cycles from A to B, a distance of 21 km in 1 hr 40 min. The street from A is level for 13 km and afterward it is tough to B. The man's average rate on level is 15 km/hr. Locate his average tough pace?

A. 10 km/hr B. 11 km/hr C. 12 km/hr D. 13 km/hr

Q41. A police starts chasing a thief standing at a distance of 100 meters. If the speed of the thief be 8km/hr and that of the policeman 10 km/hr, how far the thief would have run just before being caught?

A. 200 m B. 300 m C. 400 m D. 500 m

Q42. I walk a distance and cover back setting aside an total time of 37 minutes. I could walk both routes in 55 minutes. To what extent would it take me to cover both ways?

A. 18 min B. 19 min C. 20 min D. 21 min

Q43. A man finishes 30 km of a voyage at 6km/hr and the staying 40km of the venture in 5 hr.His average speed for the entire voyage is:

A. 70/11 km/hr B. 7 km/hr C. 15/2 km D. 8 km/hr

Q44. A man covers half of his journey at 6km/hr and other half at 3 km/hr. His Average speed is:

A. 3 km/hr B. 4km/hr C. 4.5 km/hr D. 9 km/hr

Q45. The distance between two places Kolkata and Banaras is 778 km. A car covers the travelling from Kolkata to Banaras at a uniform speed of 84 kmph and returns back to Kolkata with a uniform speed of 56 kmph. Find the average speed of car during the whole travelling.

A. 67.2 km/hr B. 65.5 km/hr C. 63.5 km/hr D. 61.2 km/hr

This chapter contains the questions I discussed and created in our classes or obtained from students as their doubts. All the questions noted, typed, redesigned and rectified by group of volunteers consisting of:

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----------ANSWERS AND SOLUTION----------

Q1.B

Q1 Solution:-

Given distance D= 900 meters and Time= 3 minutes = 180 seconds
Speed =Distance / Time=900 / 180= 5 m/s.
But speed is asked in km/h , to convert 5 mtr/sto km/h , multiply it by 18 / 5
Speed in km/h = 5 x18 / 5= 18 km/h

Q2.D

Q2 Solution:-

54 km/h = 54 x5 / 18= 15 m/s.
Distance it can cover in 18 seconds => Distance = Speed x Time
= 15 x 18 = 270 meters

Q3.C

Q3 Solution:-

Distance is 270 km and time is 5 hours.
Speed =Distance / Speed=270 / 5= 54 km/h
But in the given question, speed in m/s is asked.
Converting obtained speed 54 km/h into m/s = 54 x5 / 18= 15 km/h

Q4.C

Q4 Solution:-

Time = 1 hour 40 minutes = 1 and 40 / 60
hours =5 / 3 hours
Distance covered by the car = Speed x Time = 30 X 5 / 3 = 50 km

Q5.C

Q5 Solution:-

Speed of car = 60 km/h.
Boy runs at one fourth the speed of car so Speed of boy = ¼ x 60 km/h = 15 km/h
Time taken by boy to reach his school = 20 minutes = 1 / 3rd hour
Distance between his school and house = Speed x Time=15 x1 / 3= 5 km

Q6.B

Q6 Solution:-

If same distance Is covered with different speed of x and y units respectively, then the average speed of the complete journey =2xy / (x+y)
Here x= 6 and y= 8
Average Speed =2 x 6 x 8/(6+8)= 6.8 km/h approximately

Q7.C

Q7 Solution:-

It covered the total distance in two equal parts with speeds of 50 and 40 km/h.
Average speed of the journey =2xy/(x+y)=2 x 50 x 40/(50+40)=400 / 9
It takes 9 hours to cover the total distance
Distance covered = Average speed x Time=400 / 9x 9 = 400 km

Q8.C

Q8 Solution:-

Time taken to cover 100km =Distance / Speed=100 / 20= 5 hours
Time taken by car to cover next 210 km =Distance / Speed=210 / 70= 3 hours
Total distance covered = 100 km + 210 km = 310 km

Total time taken = 5 hours + 3 hours = 8 hours
So, average speed =Total Distance / Total Time=310 / 8hours = 38.75 km/h

Q9.C
Q9 Solution:-

Speed of car B is 25% faster than Car A => Car B =125 / 100Car A
The ratio of speeds of car A and car B = 100 : 125 =4 :5
The Ratio of times taken by car A and B to cover same distance = 5 : 4
Time take by car A to cover that distance => 5x = 40 x= 8 minutes
Time taken by car B to cover the distance = 4x =4 x 8 =32 minutes

Q10.A
Q10 Solution:-

Let the usual time be t minutes
When time speed decreases to $2/7^{th}$ of her usual speed, time taken will increase to $7/2^{th}$ of her usual time.
Ratio of times taken by her at reduced speed and actual speed = 7 : 2
Difference of times = 7x-2x = 5x = 25 minutes
Time taken at actual speed= 2x = 10 minutes

Q11.B
Q11 Solution:-

$3/7^{th}$ his journey = 210x3/7= 90 km
He travelled 90 km at 30 km/h => Time taken to travel 90 km = 90/30= 3 hours.
Remaining4 / 7th of journey = 210 x4 / 7= 120 km
He covered 120km at 40 km/h=> Time taken to travel 120km =120 / 20=6 hours
Total distance = 210 km Total time= 9 hours
Average Speed =Total Distance / Total Time=210 / 9=23.3 km/h

Q12.C
Q12 Solution:-

Distance travelled by yamaha= 840 km and time= 12 hours
Speed of yamaha=Distance / Time=840 / 12= 70 km/h
Now Speed of car=4 / 7th the speed of car =4 / 7x 70 = 40 km/h
Ratio of speed of car and motorbike= 5:7
Speed of car= 5x=40
Then speed of motorbike=7x=7x8 = 56kmph
Distance covered by bullet in 9 hours= Speed x Time= 56 x 6 = 336

Q13.D
Q13 Solution:-

Distance covered by person on bullet = 72 km and Time taken by him= 9 hours
So speed of motorbike= Distance / Time=72 / 9= 8 km/h
He drives the car with 4 times the speed of the bullet => Speed of the car= 4 x 8 =32 km/h
Distance covered by him by car in 5 hours = Speed X Time = 32 x5 =160km.

Q14.A
Q14 Solution:-

Actual speed = (p-q) km/hr, time taken = r hrs.
Distance = (speed*time)
∴ 1 = (p-q) r ⇒1/r = (p-q)

Q15.C

Q15 Solution:-

Let his office time be 10 a.m. He reaches office at 8 minutes earlier when he travels at 40 km/h => He reaches at 9:52 a.mHe reaches his office 4 minutes late when travels at 30 km/h speed=> He reaches at 10.04 a.m
The time difference is (10.04 – 9.52) = 12 minutes
Let the distance be D and time=Distance/Speed
$T_1 – T_2$ = 12 minutes =12/60hours =1/ 5hours
=> D/30–D / 40=1/5
=> (4D-3D)/ 120=1/5
=> D= 24 km

Q16.B

Q16 Solution:-

Speed of Car A = 58 km/h and
Time taken by Car A = 5 hours
Distance travelled by Car A in 5 hours => Distance= Speed x Time= 58 x 5 =290
Now distance travelled by Car B = 290+60= 350 km
So speed of Car B =Distance Travelled / Time Taken=350 / 5= 70 km/h

Q17.B

Q17 Solution:-

Distance covered by Aarif at a speed of 40 km/h in 5 hours
Distance= Speed x Time = 40 x 5= 200 km
Sudeep covers same distance in 8 hours => Speed of Sudeep =Distance / Time=200 / 8= 25 km/h.
Aarif speed is increased by 10 km/h => New speed of Aarif = 40+10 = 50 km/h
Sudeep speed is increased by 15 km/h =>New speed of Sudeep = 25+15 = 40 km/h.
So, time taken by Aarif to cover 200 km at 50 km/h =200 / 50= 4 hours
Time taken by Sudeep to cover 200 km at 40 km/h =200 / 40= 5 hours
Required time difference = 5 hours – 4 hours = 1 hour

Q18.C

Q18 Solution:-

Average speed of A is 60 km/h
Speed of B is 25% more than the speed of A.
Speed of B =125 / 100x 60= 75 km/h
Distance travelled by B in 6 hours = 75 x 6 = 450 km

Q19.B

Q19 Solution:-

Let speed of yamaha , bullet and car are 5x, 9x and 6x.
Speed of the car =Distance Travelled / Time Taken= 480/16 = 30 km/h
Now speed of bullet is 150% of car =>150 / 100x 30 = 45 km/h
Speed of bullet is 5x=45 =>x= 5 km/h
Speed of yamaha=5x =25kmph.
So, average speed of yamaha and bullet =
Sum of speeds / 2=(25+45) / 2=35 km/h

Q20.B

Q20 Solution:-

Intial speed of motorbike= 75 km/h and time taken to cover the distance=6 hours
So , total distance covered = Speed x Time = 75 x 6 =450 km
To cover the same distance of 450 km in 5 hours, speed must be =>Distance/Time = 450/5= 90 km/h
So, increase in speed = 90-75 = 15 km/h

Q21.A

Q21 Solution:-

Every 2 minutes, the money climbs 3-1 = 2 meters.
In 28 minutes it will climb 28 meters.
Remaining height to climb is = 31-28 = 3 meters
In 29th minute, the monkey will cover the last 3 minutes and reach the top of the pole .

Q22.B

Q22 Solution:-

Time taken in cycling one way and riding back = 8 hours.
Time taken in riding both ways = 2 hours less than W+R = 8-2 = 6 hours.
Time taken to cover one way=6 / 2= 3 hours
Time taken in walking 1 way = (Walk in 1 way + cover in 1 way) – cover in 1 way
= 8 -3 = 5 hours
Time taken in walking two days = 5+5 = 10 hours.

Q23.C

Q23 Solution:-

Two cars are moving in opposite direction, their relative speed is the sum of their speeds.
Relative Speed = 35 km/h + 30 km/h = 65 km/h
Distance between P and Q = 357.5 kilometers
Time =Distance / Speed=357.5 / 65= 5.5 hours
They will meet after 5 hrs 30 min

Q24.C

Q24 Solution:-

Initially the distance between A and B is 200 meters.
As A and B both are moving in same direction, their relative speed is the difference of their speeds.
Relative speed = 12-8= 4 m/s.
Means in every second, A travels 4 meters more than B.
In 15 seconds, A will increase his lead by 15x4 = 60 meters.
So, after 15 more seconds, the distance between A and B will be 200 meters + 60 meters =260 meters

Q25.D

Q25 Solution:-

The distance between two cities = 1000 km
Speed of the Car starts from Bangalore= 60 km/h
Speed of the car starts from Kakinada = 40 km/h
Two are travelling in opposite direction, relative speed = 60+40 = 100 km/h.
Time taken to meet each other =Distance / Speed=1000 / 100= 10 hours
Car started from Bangalore travelled 10 hours.
So, distance from Bangalore= Speed of the car started from Bangalore x Time = 60 x 10 = 600 km

Q26.D

Q26 Solution:-

Given that speed of the Car A= 80 km/h
The ratio of the speeds of A and B = 5:6
Speed of Car A = 5x=60
Now speed of Car B = 6x= 72 km/h.
As both Cars are travelling towards each other, they are moving in opposite direction => Relative speed = 60+72= 132 km/h
Time taken to meet each other = Distance between two places/Relative speed=198 / 132=1.5 hours.

So, two Car s meet other after 1 hour 30 minutes

Q27.B

Q27 Solution:-

Thief stealth the Santro car at 8 a.m and rides at a speed of 40 km/h
Theft was found at 9.30 a.m
In 1 hour 30 minutes, thief travels = 40 x 1 hour 30 minutes = 60 km.
So, thief was 60 km ahead of policeman.
At 9.30 policeman started chasing at a speed of 70 km/h.
As they both are moving in same direction, relative speed = 70-40 = 30 km/h
Time taken by policeman to cover 60 km travelled by thief already =
Distance / Relative Speed=60 / 30= 2 hours.
Starting counting 2 hours from 9.30 a.m , thief will be caught at 11.30 am.

Q28.D

Q28 Solution:-

Distance left = (1/2 *80) km = 40 km
Time left = {(1-3/5)*10} hrs = (2/5*10)= 4hrs.
Speed required = 40/4 km/hr = 10 km/hr

Q29.B

Q29 Solution:-

Speed of the cyclist = 15 km/h
Total distance to be covered =45km
So time taken by him to cover 45 km=Distance / Speed=45 / 15= 3 hours.
Cyclist has taken rest after every 9 km, so in total he took rest 4 times.
So, total time = 3 hours + 4 x 15 minutes = 4 hours

Q30.A

Q30 Solution:-

Time taken by yamaha to cover half the distance = 3 hours
∴ Time taken by Car A to cover complete distance= 2x3= 6 hours
Time taken by Car B to cover half the distance = 2 hours
Time taken by Car B to cover total distance = 2 x 2 = 4 hours.
∴ The ratio of times taken by Car A to Car B for whole journey = 6 hours : 4 hours = 3:2

Q31.B

Q31 Solution:-

If the car were not moving, the person would have heard the two sounds at an interval of 15 minutes.
The distance travelled by car in 13 minutes is equal to the distance travelled by sound in 15-13 = 2 minutes.
Distance travelled by sound in 2 minutes = 80 x 120 sec =9600 meters
So the distance travelled by car in 13 minutes is 9600 meters.
∴ In 1 second , the car travels =9600 / 13 x 60=12.3 meters
So , the speed of the car = 12.3 mps

Q32.B

Q32 Solution:-

Time is 6 minutes =6 / 60hours =1 / 10hours
Distance covered by man in 6 minutes = 2 km/h x6 / 60= 0.2 km
Distance covered by car in 6 minutes = 0.2 km+ 0.8 km = 1 km
Speed of the car =Distance / Time=1 km / 6=10 km/h

Q33.C

Q33 Solution:-

According to the question,
Let speed of the car starts from A is x and speed of the car starts from B is y.
the distance between two places is 180 km
Time taken to cover 180 km distance when they move in opposite direction = 2 hours
So their relative speed = x+y =180 / 2= 90 km/h ----------(i)
Time taken to cover 180km distance when they move in same direction is 6 hours.
Then relative speed = x-y=180 / 6= 30 km/h ----------(ii)
On solving equation (i) and (ii) , we get x=60 km/h.

Q34.A

Q34 Solution:-

Let x kms be covered in y hrs. then, first speed = x/y km/hr
Again, x/2 km is covered in 2y hrs.
∴ new speed = (x/2 * 1/2y) km/hr = (x/4y)km/hr
Ratio of speeds = x/y : x/4y = 1:1/4 = 4:1

Q35.B

Q35 Solution:-

Aarif already gone 13 km in 1 hour when Sudeep starts.
Remaining distance = 67 km – 13 km= 54 km
Now speeds of Aarif and Sudeep are 13 km/h and 5 km/h and they travel in opposite direction
∴ They together cover (13 +5) = 18 km in one hour.
Time taken to cover remaining 54 km = Distance / Speed=54 / 18= 3 hours.
∴ They meet at a distance of (3 x 5) = 15 km from B.

Q36.A

Q36 Solution:-

54 km/hr = (54*5/18) m/sec = 15 m/sec.

Q37.C

Q37 Solution:-

16 m/sec = (16*18/5)km/hr = 288/5km/hr =57.6 km/hr.

Q38.D

Q38 Solution:-

Let the total distance be x km.
Then, 2/3x/4+1/3x/5=7/5
=> x/6+x/15=7/5
=> 5x+2x=42
=> 7x=42
=> x=6.
∴ Total distance = 6 km

Q39.B

Q39 Solution:-

Average speed = 2xy/(x+y) km/hr = (2*70*55)/ (70+55) km/hr
= (2*70*55)/125 km/hr = 308/5 km/hr = 61.6 km/hr

Q40.A

Q40 Solution:-

Let the average speed be x km/hr. at that point,
13/15 + 8/x = 5/3
=> 8/x= (5/3-13/15) = 12/15 = 4/5
=> x = (8*5)/4 = 10
∴ average speed = 10 km/hr

Q41.C

Q41 Solution:-

Relative speed of the policeman = (10-8) km/hr = 2 km/hr
Time taken by policeman to cover 100 m = (100/1000*1/2) hr = 1/20 hr
In 1/20 hr, the thief covers a distance of (8*1/20) km= (2/5 km) = (2/5*1000) m = 400 m

Q42.B

Q42 Solution:-

Let the given distance be x km. At that point,
(Time taken to walk X km)+ (time taken to cover x km) = 37 min.
=> (time taken to walk 2X km) + (time taken to cover 2x km) = 74 min.
=> 55 min + (time taken to cover 2 x km) = 74
=> time taken to cover 2x km = 19 min.

Q43.B

Q43 Solution:-

Total distance = (30+40)km= 70 km
Total time taken = (30/6 +5) hrs =10 hrs
Average speed = 70/10 km/hr = 7 km/hr

Q44.B

Q44 Solution:-

Average speed = 2xy/(x+y) km/hr = 2*6*3/(6+3)km/hr = 4 km/hr

Q45.A

Q45 Solution:-

Average Speed=2xy/(x+y)km/hr
=2×84×56/(84+56)
=(2×84×56/140)
=67.2 km/hr

"Be very strong... be very methodical in your life if you want to be a champion." —*Alberto Juantorena*

TRAINS

Some points to remember:

1. Time taken by A train of length L metres to overtake a pole or a standing man or a signal post is equal to the time taken by the express train to cover L Metres.

2. Time taken by A train of length L metres to overtake a stationary object of length b metres is the time taken by the express train to cover (L + b) metres.

3. If two trains or two bodies are running in the same direction at u m/s and v m/s , where u > v, then their relative speed = (u – v) m/s.

4. Suppose two express trains or two bodies are running in opposite directions at u m/s and v m/s , then their relative speed = (u + v) m/s.

5. If two express trains of length a metres and b metres are running in opposite directions at u m/s and v m/s, then time taken by the express trains to pass each other = (a+b) / (u+ v) sec.

6. If two express trains of length a metres and b metres are running in the same direction at u m/s and v m/s , then the time taken by the faster express train to pass the slower express train = (a+b) / (u + v) sec.

7. If two express train (or bodies) start at the same time from points A and B towards each other and after passing they take a and b sec in reaching B and A respectively, then
(A speed) : (B speed) = (√b : √a).

Example1: An express train moves at $(3/4)^{th}$ its original speed. Due to this, it is 20 min late. Find the original time for the journey.

Method1: Think about 2 diff. situations, 1st with accident and another without accident. As distance in both the cases is constant

So, $V_1/V_2=T_2/T_1$

=> $V_1/[(3/4)*V_1]=(T_1+20)/T_1$

=> $4/3=(T_1+20)/T_1$

=> $T_1=60$

Method 2: Velocity decreases by 25% (3/4 of original speed => decrement by 1/4) so time will increase by 33.3% (4/3 of original time

=> increase by 1/3

now, 33.3%=20 min

=> 100%=60 min

----------EXERCISE----------

Q1. What is 90 km/h as metres per second?

A 15 m /sec B 20 m /sec C 25 m /sec D 30 m /sec

Q2. What is 35m/sec as km/hr?

A 123 km/hr B 124 km/hr C 125 km/hr D 126 km/hr

Q3. A 75m long express train is travelling at 54 km/hr. In what time will it pass an electric pole?

A 25 sec B 20 sec C 15 sec D 5 sec

Q4. A 415 m long express train is travelling at 63 km/hr. In what time will it pass a tunnel 285 m long?

A 40 sec B 50 sec C 60 sec D 70 sec

Q5. An express train overtakes a standing man in 3 seconds and a platform 105 m long in 8 seconds. Find the length of the express train and its speed?

A 59 m, 75.6 km/hr B 61 m, 72.6 km/hr
C 63 m, 75.6 km/hr D 66 m, 79.6 km/hr

Q6. An express train 125m long is travelling at 50 km/ hr. In what time will it overtake a man , travelling at 5 km/hr in the same direction in which the express train is going?

A 22 sec B 20 sec C 15 sec D 10 sec

Q7. An express train 110 m long is travelling at 60 km / hr. In what time will it overtake a man, travelling in the opposite directionto that of the express train at 6 km/hr?

A 9 sec B 8 sec C 7 sec D 6 sec

Q8 . An express train 100m long takes 9 seconds to pass a man walking at 5 km/hr in the opposite directionto that of the express train. Find the speed of the express train.

A 55 km/hr B 45 km/hr C 25 km/hr D 35 km/hr

Q9 . Two express train 128 m and 132m long are travelling towards each other on parallel lines at 42 km/hr and 30 km / hr respectively . In what time will they be clear of each other from the moment they meet?

A 13 sec B 14 sec C 15 sec D 16 sec

Q10. A train with a speed of 60 km/h passes a pole in 30 seconds. The length of train is:

A 500 m B 750 m C 900 m D 1000 m

Q11. The Howrah-Dhanbad-Gaya PASSENGER TRAIN and the Gaya-Dhanbad-Howrah PASSENGER TRAIN start at the same time from Howrah and Meerut and proceed towards each other at 16 km/hr and 21 km/hr respectively. When they meet, it is found that one express train has travelled 60 km more than the other. The distance between two stations is:

A. 445 km B. 444 km C. 440 km D. 450 km

Q12. How much time will An express train 171 m long take to pass a bridge 229 m long , if it is travelling at a speed of 45 km/h?

A 40 sec B 35 sec C 32 sec D 30 sec

Q13. Two express trains 105m and 90m long run at the speeds of 45km/h and 72 km/h respectively in opposite directions. The time they take to pass the each other, is

A 5 sec B 6 sec C 7 sec D 8 sec

Q14. Two express trains are travelling in opposite directions at 36km/h and 45km/h pass each other in 20 sec. if one express train is 200m long, the length of the other express train is

A 144 m B 200 m C 240 m D 250 m

Q15. An express train running at the rate of 36 km per hour passes a standing man in 10 sec. It will pass a platform 55m long, in

A 11/2 sec B 6 sec C 15/2 sec D 31/2 sec

Q16. An express train is travelling at the rate of 40km/h. A man is going in the same direction parallel to the express train at 25km/h. If the express train passes the man in 48 sec. , the length of the express train:

A 50 m B 100 m C 150 m D 200 m

Q17. Two express trains , one from station A to station B and the other from B to A starts at same time. After meeting,the express trains reach their destinations after 9 hours and 16hours respectively. The ratio of their speeds is

A 2:3 B 4:3 C 6:7 D 9:16

Q18. Express train A travelling at 63 km/h takes 27 sec to pass Express train B when travelling in opposite directions whereas it takes 163 seconds to overtake it when travelling in the same direction. If the length of express train B is 500 meters, find the length of Express train A.

A . 180 m B. 240 m C. 310 m D. 420 m

Q19. Two identical express trains A and B travelling in reverse direction at same speed tale 2 min to pass each other completely. The number of bogies of A are increased from 12 to 16. How much more time would they now Require to pass each other?

A. 20 sec B. 30 sec C. 40 sec D. 50 sec

Q20. A train 100 m long is running at the speed of 30 km/h / hr. Find the time taken by it to pass a man standing near the railway line.

A 12 sec B 20 sec C 25 sec D 30 sec

Q21. A man is standing on a railway bridge which is 180 m long. He finds that a train crosses the bridge in 20 seconds but himself in 8 seconds. Find the length of the train and its speed?

A 44 km/h B 48 km/h C 54 km/h D 60 km/h

Q22. A train 150 m long is running with a speed of 68 kmph. In what time will it pass a man who is running at 8 kmph in the same direction in which the train is going?

A 6sec B 9sec C 12sec D 15sec

Q23. A train 220 m long is running with a speed of 59 kmph.. In what will it pass a man who is running at 7 kmph in the direction opposite to that in which the train is going?

A 10 sec B 12 sec C 15 sec D 20 sec

Q24. Two trains 137 metres and 163 metres in length are running towards each other on parallel lines, one at the rate of 42 kmph and another at 48 km/h. In what time will they be clear of each other from the moment they meet?

A 10 sec B 12 sec C 15 sec D 20 sec

Q25. Two trains 100 metres and 120 metres long are running in the same direction with speeds of 72kmph and 54 kmph,In what time will the first train cross the second?

A 30 sec B 36 sec C 40 sec D 44 sec

Q26. A train 100 metres long takes 6 seconds to cross a man walking at 5 kmph in the direction opposite to that of the train. Find the speed of the train.?

A 44 km/h B 48 km/h C 55 km/h D 60 km/h

Q27. A train running at 54 kmph takes 20 seconds to pass a platform. Next it takes.12 sec to pass a man walking at 6 kmph in the same direction in which the train is going . Find the length of the train and the length of the platform.

A 140 m B 145 m C 150 m D 154 m

Q28. A man sitting in a train which is traveling at 50 kmph observes that a goods train, traveling in opposite direction, takes 9 seconds to pass him. If the goods train is 280 m long, find its speed.?

A 44 km/h B 48 km/h C 54 km/h D 62 km/h

Q29. A overtaking express train takes two hours less for a journey of 300 km if its speed is increased by 5 km/hr from its normal speed. The normal speed is:

A. 35 km/hr B. 50 km/hr C. 25 km/hr D. 30 km/hr

Q30. An express train covers a distance in 100 min, if it runs at a speed of 48km/h on an average. The speed at which the express train must run to reduce the time of journey to 40 min will be:

A. 30 km/h B. 50 km/h C. 80 km/h D. 120 km/h

Q31. An express trainstarts from Kolkata at 6:00 am and reaches Patna Jn.. at 10am. The other express trainstarts from Patna Jn.. at 8am and reached Kolkata at 11:30 am, If the distance between Kolkata and Patna Jn. is 200 km, then at what time did the two express trains meet each other?

A. 8:46 am B. 8:30 am C. 8:56 am D. 8:50 am

Q32. Two stations A and B are 110 km apart on a straight line. One express trainstarts from A at 7 am and travel towards B at 20 km/hr speed. Another express trainstarts from B at 8 am and travel towards A at 25 km/hr speed. At what time will they meet?

A. 9 am B. 10 am C. 11 am D. None of these

Q33. An express train 120 m in length overtakes a pole in 12sec and another express train of length 100 m travelling in reverse direction in 10 sec. Find the speed of the second express train in km per hour.

A. 43.2 km/hr B. 43 km/hr C. 44 km/hr D. 43.5 km/hr

Q34. An express train covered a certain distance at a uniform speed. If the express train had been 6 km/hr faster, it would have taken 4 hour less than the scheduled time. And, if the express train were slower by 6 km/hr, the express train would have taken 6 hr more than the scheduled time. The length of the journey is:

A. 700 km B. 740 km C. 720 km D. 760 km

Q35. The average speed of a train is 87 kmph. The train was scheduled to start at 7 a.m from howrah, and it has to reach a patna, 348 km away at 11:45 a.m same day and there was a stop at Asansol in the way . What was duration of stop?

A. 45 mins B. 1 hour C. 1.5 hour D. 2 hour

Q36. An express train covers a distance in 50 min, if it runs at a speed of 48 km/h on an average. The speed at which the express train must run to reduce the time of journey to 40 min will be.

A. 45 km/h B. 60 km/h C. 75 km/h D. None of these

Q37. Two express trains starting at the same time from 2 stations 200 km apart and going in reverse direction pass each other at a distance of 110 km from one of the stations. What is the ratio of their speeds?

A. 11:9 B. 7:3 C. 18:4 D. None of these

Q38. An express train covers the distance betweenstations X and Y, 50 minutes faster than a goods express train. Find this distance if the average speed of the overtaking express train is 60 km/h and that of goods express train is 20 km/h.

A. 20 kms B. 25 kms C. 45 kms D. 40 kms

Q39. A man jogging inside a railway tunnel at a constant speed hears An express train approaching the tunnel from behind at a speed of 30 km/h, when he is one third of the way inside the tunnel. Whether he keeps travelling forward or turns back, he will reach the end of the tunnel at the same time the express train reaches that end. The speed at which the man is travelling is:

A. 6 km/hr B. 8 km/hr C. 12 km/hr D. 10 km/hr

Q40. A good express train and a overtaking express train are travelling on parallel tracks in the same direction. The driver of the goods express train observes that the overtaking express train coming from behind overtakes and passes his express train completely in 60 sec. Whereas a overtaking on the overtaking express train marks that he passes the goods express train in 40 sec. If the speeds of the express trains be in the ratio 1:2. Find the ratio of their lengths.

A. 3:1 B. 2:1 C. 3:2 D. 4:3

Q41. Agniwesh takes 8 hours to travels 600 km , partly by train and partly by car, If he had travelled all the way by train, he would have saved $2/3^{rd}$ of the total time that he travelled in by car and would he have reached 3 hour earlier. What is the distance covered by train ?

A. 140km B. 210km C. 280km D. 420 km

This chapter contains the topics and questions I discussed and created in our classes or obtained from students as their doubts. All the questions noted, typed, redesigned and rectified by group of volunteers consisting of:

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----------ANSWERS----------

Q1.C	**Q2.D**	**Q3.D**	**Q4.A**	**Q5.C**
Q6.D	**Q7.D**	**Q8.D**	**Q9.A**	**Q10.A**
Q11.B	**Q12C**	**Q13.B**	**Q14.D**	**Q15.D**
Q16.D	**Q17.B**	**Q18.C**	**Q19.A**	**Q20.A**
Q21.C	**Q22.B**	**Q23.B**	**Q24.B**	**Q25.D**
Q26.C	**Q27.A**	**Q28.D**	**Q29.C**	**Q30.D**
Q31.C	**Q32.B**	**Q33.A**	**Q34.C**	**Q35.A**
Q36.B	**Q37.A**	**Q38.B**	**Q39.D**	**Q40.B**
Q41.D				

----------ANSWERS WITH SOLUTION----------

Q1.C
Q1 Solution:-
90 km/h = (90 x 5/18) m/sec = 25 m /sec.

Q2.D
Q2 Solution:-
35 m/sec = (35 x 18 / 5) km/hr = 126 km/hr.

Q3.D
Q3 Solution:-
Speed of the express train = (54 x 5 / 18) m/sec = 15 m / sec.
Time taken to pass an electric pole = Time taken to cover 75m
= (75 / 15) sec = 5 sec.

Q4.A
Q4 Solution:-
Speed of the express train= (63x 5 / 18) m/sec = 35/2 m/sec.
Time taken to pass the tunnel = Time taken to cover (415 + 285) m
= (700 x 2/35) sec = 40 sec.

Q5.C
Q5 Solution:-
Let the length of the eTpress train be T metres and its speed be P km/hr i.e. (5P/18) m/sec.
Then, T / (5P / 18) = 3
⇒ 18T = 15P
⇒ 6T = 5P.
Also, (T + 105) / (5P/ 18) = 8
⇒ 18 (T + 105) = 40P
⇒ 9 (T + 105) = 20P
⇒ 20P -9T = 945
⇒ 24T – 9T = 945
⇒ 15T = 945
⇒ T= 63.
∴ 5P = (6 x 63)
⇒ P = (6 x 63) /5 = 378 / 5 = 75.6
So, the length of the express train is 63 m and its speed is 75.6 km/hr.

Q6.D

Q.6 Solution:-

Speed of the express train relative to man = (50 – 5) km/hr
= (45x5/18) m/sec = 25/2 m/ sec.
Distance covered in overtake the man = 125m.
∴ Time taken = 125/(25/2) sec = (125 x 2/25) sec = 10 sec.

Q7.D

Q7 Solution:-

Speed of the express train relative to man = (60 + 6 km/hr = 66 km/hr
= (66 x 15 / 18) m/sec = 55/3 m/sec.
Distance covered in overtake the man = 110m.
Time taken = 110/(55/3) sec = (110 x 3 / 55) sec = 6 sec.

Q8.D

Q8 Solution:-

Let the speed of the express train be x km/hr.
Relative speed = (x + 5) km /hr = 5 (x+ 5) / 18 m/sec.
Distance covered in overtake the man = 100m.
∴ 100/ 5 (x+5) / 18 = 9
⇒ 45 (x+ 5) = 1800
⇒ x + 5 = 40
⇒ x = 35.
Speed of the express train = 35 km/hr.

Q9.A

Q9 Solution:-

Relative speed = (42 + 30) km/hr = 72 km/hr
= (72 x 5 / 18) m/sec = 20 m / sec.
Distance covered in overtake each other = (128 + 132) m = 260m.
∴ Required time = 260 / 20 sec= 13 sec.

Q10.A

Q10 Solution:-

speed = (60x5/18) m/sec = 50/3 m/sec.
Length of the express train = (50/3x 30)m = 500 m

Q11.B

Q11 Solution:-

The two express trains start simultaneously. Let they meet after a time t.
The express train that has covered 60 km more must be the faster of the two.
So:
60=(21−16)×t
⇒ t=12 hours.
Since they are traveling towards each other, total distance is the sum of the distances travelled by the two express trains individually.
Total distance = 16×12+21×12 = 444 Km

Q12C

Q12 Solution:-

Speed = (45x5/18) m/sec = 25/2 m/sec.
Required time =(171+229)/(25/2) sec. = (400x2/25)sec. =32 sec.

Q13.B

Q13 Solution:-

Sum of the lengths of the express train =(105+90)m= 195 m

Relative speed = (72+45) km/h

= 117 km/h

= (117x5/18) m/sec.

=585/18 m/sec.

Required time = (195x18/585) sec.= 6 sec.

Q14.D

Q14 Solution:-

let the length of the other eLpress train be L meters.

Sum of their length =(200+L)m

Relative speed =(36+45) km/h

=81km/h

= (81x5/18) m/sec.

= 45/2 m/sec.

(200+L)/ (45/2) = 20

⇒ 400 +2L = 900

⇒ 2L = 500

⇒ L = 250

∴ length of the other eLpress train is 250m

Q15.D

Q15 Solution:-

speed of the express train = (36x5/18) m/sec. =10 m/sec.

Let the length of the second express train be x meters. Then, x/10 =10 ⇒ x =100m

Time taken by the express train to pass the platform = (100+55)/10 sec.=31/2 sec.

Q16.D

Q16 Solution:-

relative speed = (40-25)km/h =15km/h =(15x5/18) m/sec. =25/6 m/sec.

Length of the express train = (25/6x48)m= 200 m.

Q17.B

Q17 Solution:-

(A's speed) : B's speed) = √b:√a= √16:√9 = 4:3

Q18.C

Q18 Solution:-

Let the length of train A is x mtr.

And given the length of train B is 500 mtr.

Let speed of train B is y km/hr

ATP

500+x = (63+y).(5/18).27 (while travelling in same direction)

55=15y – 2x----------(i)

500+x=(63-y).(5/18).163 (while travelling in opposite direction)

x+45y = 2335----------(ii)

solving the equation (i) and (ii) we get

x = 310

Q19.A

Q19 Solution:-

Total initial bogies is 12+12=24
Additional bogies =16−12=4
24 bogies take 2 minutes.
4 bogies will take:
=(2×60)/(24×4)
= 20 sec.

Q20.A

Q20 Solution:-

Speed of the train = (30 x 5/18) m / sec = (25/3) m/ sec.
Distance moved in passing the standing man = 100 m.
Required time taken = 100/(25/3) = (100 x(3/25)) sec = 12 sec

Q21.C

Q21 Solution:-

Let the length of the train be L metres,
Then, the train covers L metres in 8 seconds and (L + 180) metres in 20 sec
L/8=(L+180)/20 => 20L = 8 (L + 180) <=> L = 120.
Length of the train = 120 m.
Speed of the train = (120/8) m / sec = m / sec = (15 x18/5) kmph = 54 km/h

Q22.B

Q22 Solution:-

Speed of the train relative to man = (68 - 8) kmph
= (60x 5/18) m/sec = (50/3)m/sec
Time taken by the train to cross the man I
= Time taken by It to cover 150 m at 50/3 m / sec = 150 x3/ 50 sec = 9sec

Q23.B

Q23 Solution:-

Speed of the train relative to man = (59 + 7) kmph
= 66 x5/18 m/sec = 55/3 m/sec.
Time taken by the train to cross the man = Time taken by it to cover 220 m
at (55/3) m / sec = (220 x3/55) sec = 12 sec

Q24.B

Q24 Solution:-

Relative speed of the trains = (42 + 48) kmph = 90 kmph
=(90x5/18) m / sec = 25 m /sec.
Time taken by the trains to'pass each other
= Time taken to cover (137 + 163) m at 25 m /sec =(300/25) sec = 12 sec

Q25.D

Q25 Solution:-

Relative speed of the trains = (72 - 54) kmph = 18 km/h
= (18 x 5/18) m/sec = 5 m/sec.
Time taken by the trains to cross each other
= Time taken to cover (100 + 120) m at 5 m /sec = (220/5) sec = 44 sec.

Q26.C

Q26 Solution:-

Let the speed of the train be S kmph.
Speed of the train relative to man = (S + 5) kmph = (S + 5) x5/18 m/sec.
So 100/((S+5)x5/18)=6 <=> 30 (S + 5) = 1800 <=> S = 55
Speed of the train is 55 km/h.

Q27.A

Q27 Solution:-

Let the length of train be T metres and length of platform be P metres.
Speed of the train relative to man = (54 - 6) kmph = 48 kmph
= 48x(5/18) m/sec = 40/3 m/sec.
In passing a man, the train covers its own length with relative speed.
Length of train = (Relative speed x Time) = (40/3)x12 m = 160 m.
Also, speed of the train = 54 x(5/18)m / sec = 15 m / sec.
(T+P)/15 = 20 <=> T + P = 300 <=> P = (300 - 160) m = 140 m.

Q28.D

Q28 Solution:-

Relative speed = 280/9 m / sec = ((280/9)x(18/5)) kmph = 112 kmph.
Speed of goods train = (112 - 50) kmph = 62 kmph.

Q29.C

Q29 Solution:-

Let the normal speed be s km/hr
Then new speed = (s+5) km/hr
300/s−2=300/(s+5)
(300 – 2s)/s = 300/(s+5)
300s + 1500 – $2s^2$ - 10s = 300s
=> s^2 + 5s -1500=0
=> s^2 + 30s – 25s -1500=0
=> (s+30)(s-25) = 0
=> s=25 ignoring negative value of s.
s = 25 km/hr

Q30.D

Q30 Solution:-

Time = 100/60=5/3hr
Speed =48 mph
Distance =S×T
=48×5/3
=80 km
Now, ATP, journey is to be reduced to 40 min.
So, new time,
=40 min=40/60 hr
=2/3 hr=2/3 hr
New speed,
=Distance/New Time
=80/(2/3)
=80×3/2
=120 km/h

Q31.C

Q31 Solution:-

Average speed of express train leaving Kolkata = 200/4=50km/hr
Average speed of express train leaving Patna Jn.. = 200×2/7=400/7
By the time the other express trainstarts from Patna Jn., the first express train had travelled 100km
So, the express trains meet after:
=(200−100)/(50+400/7)=14/15 hr
=14/15×60=56 minutes
So they meet at 8:56 am

Q32.B

Q32 Solution:-

In 1 hour (7 am to 8 am) tarin from station A travels 20 km distance and reaches to C, (say).
A ---------- C ----------B
7 am ---------- 8 am
AC = 20 km, CB = 90 km
Distance travelled in 1 hour = 20 km
Remaining distance =110−20 = 90 km
Time=Distance/Speed
90/(20+25)=2 hours
So, time = 8 am + 2 am = 10 am

Q33.A

Q33 Solution:-

Let the speed of the express train be X km/hr
Then,
120=x×5/18×12
⇒ x=36 km/hr
Let speed of the other express train be Y km/hr
Then, relative speed in reverse direction:
=(y+36)×5/18
So total distance:
(120+100)=(y+36)×5/18×10
y=43.2 km/hr

Q34.C

Q34 Solution:-

Let the length of the journey be d km and the speed of express train be s km/hr.
Then,
d/(S+6)=t−4-----(i)
d/(S−6)=t+6------(ii)
Subtracting the 1 equation from another we get:
d/(S−6)−d/(S+6)=10------(iii)
Now t=d/s
Substitute in equation (i) and solve for d and s
We get s=30 and d = 720 km

Q35.A

Q35 Solution:-

Speed of train = 87 kmph and distance it covers is 348 km.
Time taken to cover the distance=Distance / Speed= 348/87= 4 hours.
But total time taken by train to reach destination is = 11:45 a.m. – 7 a.m. =4 hours 45 minutes.
Time of halt = Total time – take taken without halt
= 4 hours 45 minutes – 4 hours = 45 minutes

Q36.B

Q36 Solution:-

Time = 50/60=5/6 hr
Speed = 48 mph
Distance = S×T=48×5/6=40 km
Time = 40/60 hr
New speed = 40×3/2=60 km/h

Q37.A

Q37 Solution:-

Insame time, they cover 110 km and 90 km respectively.
For the same time speed and distance is inversely proportional.
So ratio of their speed = 110:90 = 11: 9

Q38.B

Q38 Solution:-

Let d be the distance between the stations X and Y.
Time taken by the overtaking express train to cover the distance d=d/60 hour
Time taken by the goods express train to cover the distance d=d/20 hour
Time difference between these two express trains is given by 50 minutes or 50/60 hour
⇒ d/20−d/60=50/60
⇒ d(60−20)20×60=50/60
d = 25 kms

Q39.D

Q39 Solution:-

Let the express train is at distance Y km from the tunnel and the length of the tunnel is X km. Man is at point C which is x/3 km away from B.

A ---------- B ---------- C ----------D
<---- y------><------x/3-------><------2x/3------->

AB=y, BC =x/3 and CD =2x/3
Let M km/h be the speed of man.
Now, express train is at A and man is at C and both will take same time for reaching from B.
y/30=x/3.M
M=10x/y-------(i)
Also, express train and man will take some time for reaching at D.
x+y/30=2xM
⇒ M=20X+y------(ii)
From both the equations we get: x=y
And on putting value in any equation we get: M = 10 km/hr

Q40.B

Q40 Solution:-

Let the speeds of the two express trains be s and 2s m/s respectively.
Also, suppose that the lengths of the two express trains are P and Q metres respectively.
Then,
(P+Q)/(2s−s)=60 ----------(i)
and
P/(2s−s)=40 ----------(ii)
On dividing these two equation we get:
(P+Q)/P=60/40
1+Q/P=3/2
Q/P=1/2
P:Q= 2 : 1

Q41.D

Q41 Solution:-

Difference in time of 1 hour is due to saving in time resulting from that distance being covered by the train instead of car.
2 / 3rd time in car = 3 hour
Total time in car= 3 x3 / 2= 4.5 hours
Time spend in train journey = 8-4.5= 3.5 hours.
If all the distance were covered by train, the time taken is 8-3 = 5 hours.
In 5 hours, the distance covered by train is 600 km.
In 3.5 hours , distance covered by train =600 / 5x 3.5=420 km.
So, the distance covered by car= 600- 420 = 180 km

"Nothing is more beautiful than the smile that has struggled through the tears." —*Demi Lovato*

BOATS AND STREAM

Some points to remember:

In water, the direction along the stream is called Downstream. And the direction against the stream is called Upstream.

A. If the speed of the boat in still water is x km/hr and the speed of the stream is y km/hr, then:

1 Speed downstream = (x + y) km/hr

2. Speed upstream= (x - y) km/hr

B. If the speed downstream is a km/hr and the speed upstream is b km/hr, then:

1. Speed in still water = 1/2 (a + b) km/hr

2. Rate of the stream = 1/2 (a - b) km/hr

C. When the distance covered downstream and upstream are equal, we can write:
(x + y)t1 = (x - y)t2 where t1 and t2 are different time taken.

BOATS AND STREAM

----------EXERCISE----------

Q1 Abhilash can row upstream at 7 km/hr and downstream at 10 km/hr.find man's rate in still water and the rate of current.

A. 8.5 and 1.5 km/hr B. 8 and 2 km/hr
C. 7.5 and 2.5 km/hr D. 7 and 3 km/hr

Q2. Agniwesh can row downstream at 18 km/hr and upstream at 12 km/hr. Find his speed in still water and the rate of the current.

A. 16,3 B. 15,4 C. 15,3 D. 16,4

Q3. Chandan swims downstream 28 km in 4 hrs and upstream 12 km in 3 hrs. Find his speed in still water and also the speed of the current.

A. 5,2 B. 5.5,1.5 C. 5.5,2.5 D. 5,1

Q4. Rahul takes 3 hours 45 minutes to row a boat 15 km downstream of a river and 2hours 30 minutes to cover a distance of 5km upstream. find the speed of theriver current in km/hr.

A. 1.5km/hr B. 1km/hr C. 2.5km/hr D. 2km/hr

Q5. A boat covers a certain distance downstream in 6 hours and takes 8 hours to return upstream to the starting point. If the speed of the stream is 3 km/hr, find the speed of the boat in still water.

A. 19 km/hr B. 20 km/hr C. 21 km/hr D. 22 km/hr

Q6. The speed Hooghly river is 5 km/hr. A boat travels 28 km upstream and then returns downstream to the starting point. If its speed in still water be 9 km/hr, find the total journey time.

A. 5 hr B. 8 hr C. 9 hr D. 10 hr

Q7. Shekhar can row 18 km/hr in still water.it takes him thrice as long to row up as to row down the river.find the rate of stream.

A. 7 km/hr B. 8 km/hr C. 9 km/hr D. 10 km/hr

Q8. Tripti can swim in still water is at 12km/hr. She takes 6 hrs to swim to a certain distance and return to the starting point. The speed of current is 4km/hr. Find the distance between the two points.

A. 85 km B. 24 km C. 32 km D. 36 km

Q9. A boat running downstream covers a distance of 30 kms in 2 hrs. While returning the boat takes 6 hrs. If the speed of the current is half that of the boat, what is the speed of the boat?

A. 15 km/hr B. 54 km/hr C. 10 km/hr D. None of these

Q10. There is a road along with a river. Uttam and Vikrant started from a place A,moved to a goes to some distance at point B and then returned to A again. Uttam moves on a cycle at a speed of 12 km/hr,while Vikrant travels on a boat at a speed of 10 km/hr. If the speed of curent is 4 km/hr, who will return to placeA faster?

A. Uttam B. Vikrant C. Both together D. CBD

Q11. Abhishek can swim 6 km/hr in still water. But he takes double time to return. Find the speed of current.

A. 1.2 km/hr B. 1 km/hr C. 2 km/hr D. 1.5 km/hr

Q12. Rakesh can travel 8km/hr in still water. When water is flowing at 2km/hr it takes him 3hrs 12min to move to and fro. Where far he travelled?

A. 9 km B. 10 km C. 11 km D. 12 km

Q13. Laxman can row 7 ½ km/hr in still water. If a river flowing at 1.5 km/hr an hour,it takes him 50 minutes to row to a place and back, what is the distance of place?

A. 3 km B. 4 km C. 5 km D. 6 km

Q14. A boat goes from A to B 4 hours. And retrurns to A in 5 hours. If the speed of the stream is 2km/hr, Find the distance between two points.

A. 50 km B. 60 km C. 70 km D. 80 km

Q15. If the ratio of speed of a speedboat and river is in the artio of 36:5. If it travels upto a distance in 5 hours 10min. Then in what time will return from same distance.

A. 5 hrs 50 min B. 6 hours C. 6 hours 50 min D. 12 hrs 10 min

Q16. In a waterway, a man takes 3 hours in paddling 3 km upstream or 15km downstream. What is the rate of the current?

A. 2 km/hr B. 4 km/hr C. 6 km/hr D. 9 km/hr.

Q17. In a stream running at 2 km/hr,a motar boat goes 6km upstream and back again to the starting point in 33 minutes.find the speed of the motarboat in still water.

A. 21 km/hr B. 22 km/hr C. 23 km/hr D. None of these

Q18. A fisher man can row at 2km against the stream in 20 min. And he takes 15min while travelling along with stream . What is the rate of the current?

A. 1 km/hr B. 2 km/hr C. 3 km/hr D. None of these

Q19. The current of a stream keeps running at 4km 60 minutes. A boat goes 6 km and back to the beginning stage in 2hour. The rate of the boat in still water is:

A. 6 km/hr B. 7.5 km/hr C. 8 km/hr D. 6.8 km/hr

Q20. Suraj can row 40km upstream and 55km downstream in 13 hours and he can row 30km upstream and 44km downstream in 10 hours.find his speed in still water.

A. 6 km/hr B. 7.5 km/hr C. 8 km/hr D. 6.8 km/hr

Q21. The speed of the boat in still water is 15 km/hr. If it takes twice as long as to go upstream to a point as to return downstream to the starting point. What is the speed of the current?

A. 4 km/hr B. 3 km/hr C. 2 km/hr D. 5 km/hr

Q22. A motorboat whose speed is 15 km/hr in still water goes 30km downstream and comes back in four and a half hours. The speed of the stream is:

A. 4.5 km/hr B. 6 km/hr C. 7 km/hr D. 5 km/hr

Q23. A speedboat can travel 6 km/hr in still water. It requires triple time to travel same distance against the current. Speed of the current is:

A. 16 km/hr B. 18 km/hr C. 24 km/hr D. 28 km/hr.

Q24. A ball is projected vertically up-wards reaches, at the end of 'tt' seconds, an elevation of 's' feet where $s=160t-16t^2$. The highest elevation is

A. 800 B. 600 C. 400 D. 200

Q25. A boat is paddled downstream at 15.5km/hr and upstream at 8.5km/hr. The rate of the stream is:

A. 3.5 km/hr B. 5.75 km/hr C. 6.5 km/hr D. 7 km/hr

Q26. A boat travels 32 km upstream and 60 km downstream in 9 hr. Also it travels 40 km upstream and 84 km downstream in 12 hrs. Find the speed of the boat in still water and rate of the current.

A. 10,2 B. 9,3 C. 8,4 D. 7,5

Q27. Speed of boat in still water is 16 km/hr. If the speed of the stream is 4 km/hr, find its downstream and upstream speeds.

A. 18,14 B. 20,12 C. 22,10 D. 24,8

Q28. A boatman rows to a place 45 km distant and back in 20 hour. He finds that he can row 12 km with the stream in the same time as 4 km against the stream. Find the speed of the stream.

A. 1 km/hr B. 2 km/hr C. 3 km/hr D. 4 km/hr

This chapter contains the questions I discussed and created in our classes or obtained from students as their doubts. All the questions noted, typed, redesigned and rectified by group of volunteers consisting of:

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----------ANSWERS ----------

Q1.A	**Q2.C**	**Q3.B**	**Q4.B**	**Q5.C**	**Q6.C**
Q7.C	**Q8.C**	**Q9.C**	**Q10.D**	**Q11.C**	**Q12.D**
Q13.A	**Q14.D**	**Q15.C**	**Q16.A**	**Q17.B**	**Q18.A**
Q19.C	**Q20.C**	**Q21.B**	**Q22.D**	**Q23.B**	**Q24.C**
Q25.A	**Q26.A**	**Q27. B**	**Q28.C**		

----------ANSWERS AND SOLUTION----------

Q1.A

Q1 Solution:-

Rate in still water=1/2(10+7)km/hr=8.5 km/hr.
Rate of current=1/2(10-7)km/hr=1.5 km/hr.

Q2.C

Q2 Solution:-

As we know Speed of the boat or swimmer in still water
= 1/2 x (Downstream Speed + Upstream Speed)
= 1/2 x (18+12)
= 15 km/hr
Speed of the current = 1/2 x (Downstream Speed - Upstream Speed)
= 1/2 x (18-12)
= 3 km/hr

Q3.B

Q3 Solution:-

Downstream Speed u = 28/4 = 7 km/hr
Upstream Speed v = 12/3 = 4 km/hr
Speed of the boat or swimmer in still water = 1/2x(Downstream Speed + Upstream Speed)
= 1/2x(7+4)
= 5.5 km/hr
Speed of the current = 1/2x(Downstream Speed.Upstream Speed)
= 1/2x(7-4)
= 1.5 km/hr

Q4.B

Q4 Solution:-

rate downstream=(15/3 ¾)km/hr=(15x4/15)km/hr=4km/hr.
Rate upstream=(5/2 ½)km/hr=(5x2/5)km/hr=2km/hr.
Speed of current=1/2(4-2)km/hr=1km/hr

Q5.C

Q5 Solution:-

t1 = 6 hrs
t2 = 8 hrs
y = 3 km/hr
x = ?
We know,
$(x + y)t_1 = (x - y)t_2$
(x + 3)6 = (x - 3)8
x = 21 km/hr

Q6.C

Q6 Solution:-

We know, Downstream speed = x + y = 9 + 5 = 14 km/hr
Upstream Speed = x + y = 9.5 = 4 km/hr
Speed = Distance/Time
∴ Time = Distance/Speed
∴ Total time taken = t1 + t2
= 28/4 + 28/14
= 7 + 2 = 9 hr

Q7.C

Q7 Solution:-

Sol. Let Shekhar's rate upstream be x km/hr.then ,his rate downstream=3x km/hr.
So,2x=18 or x=9.
Rate upstream=9 km/hr,rate downstream=27 km/hr.
So,rate of stream=1/2(27-9)km/hr=9 km/hr.

Q8.C

Q8 Solution:-

Let distance = d
Downstream time = t1; Downstream Speed = 12+4 = 16 km/hr
Upstream Time = t2; Upstream Speed = 12-4 = 8 km/hr
Total time = t1 + t2
ATP
6 = d/16 + d/8
⇨ d = 32 km

Q9.C

Q9 Solution:-

Downstream Speed = 30/2 = 15 km/hr
Upstream Speed = 30/6 = 5 km/hr
Speed of the boat in still water = 1/2x(downstream speed + upstream speed)
= 1/2x(15+5)
= 10 km/hr

Q10.D

Q10 Solution:-

Clearly Uttam travels on road so he moves both ways at a speed of 12 km/hr.
Vikrant moves downstream (10+4)=14 km/hr and upstream (10-4)=6km/hr.
So,average speed of Uttam's boat =2x14x6/(14+6)km/hr
=42/5 km/hr=8.4 km/hr.
since the average speed of the Uttam is greater ,he will return before B.

Q11.C

Q11 Solution:-

Let men's rate upstream be u km/hr`At that point, men's rate downstream = 1/2 (2u+u) km/hr = 3u/2 km/hr`And there 4; 3u/2 =6 <=> u= (2x6)/3 =4.`And there 4: 4 km/hr, rate downstream = (2x4) km/hr = 8 km/hr`Rate of stream = 1/2 (8-4) km/hr = 2 km/hr

Q12.D

Q12 Solution:-

Speed downstream (8+2) km/hr=10km/hr.Speed upstream= (8-2) km/hr=6km/hr.Let the required distance be x km. at that point,x/10+x/6+16/5

=>3x+5x=96
=>8x=96
=>x=12.
Required distance =12 km.

Q13.A

Q13 Solution:-

Speed downstream =(7.5+1.5)km/hr=9 km/hr;
Speed upstream=(7.5-1.5) km/hr=6 km/hr.
Let the required distance be d km.then,
d/9+d/6=50/60.
2d+3d=(5/6*18)
5d=15
d=3.
So,the required distance is 3km.

Q14.D

Q14 Solution:-

Let the distance between the two points be d km. Then,
Speed downstream =d/4 km/hr,
Speed upstream=d/5 km/hr.
Speed of the stream=1/2(d/4-d/5).
∴ 1/2 (d/4- d/5) = 2
=> d/4 -d /5 = 4
=> d = 80.
So, the distance between the two points is 80 km.

Q15.C

Q15 Solution:-

Let the speed of motorboat be 36v km/hr then the speed of river will be 5v km/hr.
Speed downstream = (36v+ 5v) km/hr=41v km/hr,
Speed upstream = (36v-5v) km/hr=31v km/hr.
Distance covers downstream = (41vx31/6) km.
Distance upstream= [(41x31) v/6 x 1/31v] hrs
= 41/6 hrs
= 6 hrs 50 min.

Q16.A

Q16 Solution:-

Speed upstream =3/3 km/hr =1 km/hr.
Speed downstream =15/3 km/hr=5 km/hr.
Speed of current =1/2 (5-1) km/hr =2 km/hr

Q17.B

Q17 Solution:-

.let the speed of the motarboat in still water be x km/hr.then,
6/(x+2) + 6/(x-2)=33/60
Or 6[1/(x+2)+1/(x-2)]=33/60
Or 6[{(x-2)+(x+2)}/{(x+2)(x-2)}=33/60
Or $6.20(2x)/(x^2 – 4) = 11$
Or $240x = 11x^2 - 44$
Or $11x^2-240x-44 = 0$
Or $11x^2-242x+2x-44 = 0$
Or (x-22)(11x+2) = 0
Or x = 22.

Q18.A

Q18 Solution:-

Speed upstream =3/3 km/hr =1 km/hr.
Speed downstream =15/3 km/hr=5 km/hr.
Speed of current =1/2 (5-1) km/hr =2 km/hr

Q19.C

Q19 Solution:-

Let the speed in still water be x km/hr. Then,
Speed downstream = (x+ 4) km/hr,
speed upstream = (x-4) km/hr.
6/(x+4) + 6 /(x-4) = 2
=> 1/(x+4) +1/(x-4)=2/6 =1/3
=>(x+4)+(x-4)/x2-16=1/3
=>x^2-16=6x
=> x^2 -6x-16=0
=> (x-8) (x+2) = 0
=> x = 8.

Q20.C

Q20 Solution:-

let rate upstream=x km/hr and rate downstream=y km/hr.
Then,40/x +55/y =13…(i)
and 30/x +44/y =10
Solving above equations we get-
Substituting x = 5 and y = 11.
Rate in still water =1/2(11+5) km/hr=8 km/hr.
Rate of current=1/2(11-5) km/hr=3 km/hr

Q21.B

Q21 Solution:-

Let speed of the current = S km/hr.
As per question,
Downstream Speed = 2xUpstream speed
15 + S = 2(15.S)
S = 3 km/hr

Q22.D

Q22 Solution:-

Let the speed of the stream be s km/hr.
Then, upward speed = (15−s) km/hr
and downward speed = (15+s) km/hr
Therefore,
30(15+s)+30(15−s)=4.5
On solving this equation we get, s = 5 km/hr

Q23.B

Q23 Solution:-

Let the speed of the speedboat in still water be x km/hr.
Speed downstream = (x +2) km/hr,
speed upstream = (x-2) km/hr.
Then 4 (x+2) = 5 (x-2)
=> x = 18.

So, the speed of the speedboat in still water is 18 km/hr.

Q24.C

Q24 Solution:-

Given that:

$s=160t-16t^2$.

Highest value of S will be reached when dS/dt=0

⇒ $160-32t=0$

⇒ $t=5$ sec

So, $S=(160\times5)-(16\times5\times5)$

$800-400=400$

Q25.A

Q25 Solution:-

Speed downstream =15.5km/hr,

Speed upstream =8.5km/hr.

Speed of the stream=1/2(15.5-8.5) km/hr=3.5 km/hr

Q26.A

Q26 Solution:-

Let, upstream speed = u km/hr

Downstream speed = d km/hr

32/u + 60/d = 9 (Time = Distance/Speed)

Simlarly,

40/u + 84/d = 12

32m + 60n = 9 ...(i) (Assuming 1/u = m and 1/d = n)

40m + 84n = 12 ...(ii)

(Equation(ii) x 4) - (Equation (i)x5), we get,

n = $\frac{1}{12}$. So, m = $\frac{1}{8}$

So, downstream speed = 12 km/hr

Upstream speed = 8 km/hr

So,

Speed of the boat in still water = $\frac{1}{2}[12 + 8] = \frac{1}{2}$ x 20 = 10 km/hr

Speed of the current = $\frac{1}{2}[12 - 8] = \frac{1}{2}$ x 4 = 2 km/hr

Q27. B

Q27 Solution:-

Downstream Speed = x + y = 16 + 4 = 20 km/hr

Upstream Speed = x – y = 16 - 4 = 12 km/hr

Q28.C

Q28 Solution:-

Ratio of time taken for up and down = 3:1

Out of 20 hr he took 15 hr for up and 5 for down.

Speed up = 45/15=3

and down = 45/5=9

So speed of stream

= $\frac{9-3}{2}$ km/hr

= 3 km/hr

PERCENTAGE

1. PERCENTAGE: The word percent can be understood as follows:
Per cent ⇒ for every 100.

So, when percentage is calculated for any value, it means that you calculate the value for every 100 of the reference value. When you se the word "percent" or the symbol %, remember it means 1/100.

Example: 20 percent=20%=20×(1/100)=1/5

2. WHY PERCENTAGE?

Percentage is a concept evolved so that there can be a uniform platform for comparison of various things. (Since each value is taken to a common platform of 100)

Example: To compare three different students depending on the marks they scored we cannot directly compare their marks until we know the maximum marks for which they took the test. But by calculating percentages they can directly be compared with one another.

3. CONCEPT OF PERCENTAGE:

By a certain percent, we mean that many hundredths. So x percent means x hundredths, written as x%.
To express x% as a fraction: We have , x%=x/100.
So ,20%=20/100=1/5;
48%=48/100=12/25 etc.
To express a/b as a percent : We have, a/b=(a/b)×100%
So , 14=[1/4×100]=25%;
0.6=6/10=3/5=[3/5×100]%=60%..

4. COMMODITY PRICE INCREASE/DECREASE:

If the price of a commodity increases by R%, then the reduction in consumption so as not to increase the expenditure is:

$$=\frac{R}{R+100}\times 100\%$$

If the price of the commodity decreases by R%, then to maintain the same expenditure by increasing the consumption is:

$$=\frac{R}{100-R}\times 100\%$$

5. RESULTS ON POPULATION:

Let the population of the town be P now and Suppose it increases at the rate of R% per annum, then:
1. Population after n years $=P[1+(R/100)]^n$
2. Population n years ago $=P[1+(R/100)]^n$

6. RESULTS ON DEPRECIATION:

Let the present value of a machine be P. Suppose it depreciates at the rate R% per annum. Then:
1. Value of the machine after n years $=P[1-(R/100)]^n$
2. Value of the machine n years ago $=P[1-(R/100)]^n$
3. If A is R% more than B, then B is less than A by

=[(R/(100+R))×100]%
If A is R% less than B , then B is more than A by
=[(R/(100−R))×100]%

7. PERCENTAGES - FRACTIONS CONVERSIONS:

For faster calculations we can convert the percentages or decimal equivalents into their respective fraction notations. The following is a table showing the conversions of percentages and decimals into fractions:

Percentage	Decimal	Fraction
10%	0.1	1/10
12.5%	0.125	1/8
16.66%	0.1666	1/6
20%	0.2	1/5
25%	0.25	1/4
30%	0.3	3/10
33.33%	0.3333	1/3
40%	0.4	2/5
50%	0.5	1/2
60%	0.6	3/5
62.5%	0.625	5/8
66.66%	0.6666	2/3
70%	0.7	7/10
75%	0.75	3/4
80%	0.8	4/5
83.33%	0.8333	5/6
90%	0.9	9/10
100%	1.0	1

8. CONVERTING DECIMALS:

We can go for converting decimals more than 1 from the knowledge of the above cited conversions as follows:
We know that 12.5%=0.125=1/8
Then, 1.125=[8(1)+1]/8=9/8 (i.e., the denominator will be addded to numerator once, denominator remaining the same.
Also, 2.125=[8(2)+1]/8=17/8 (here the denominator is added to numerator twice)
3.125=[8(3)+1]/8=25/8 and so on.
So we can derive the fractions for decimals more than 1 by using those less than 1.
We will se how use of fractions will reduce the time for calculations:

Example:

What is 62.5% of 320?
Value = (5/8)×320 =200. [since 62.5%=5/8]

9. IMPORTANT POINTS TO NOTE:

When any value increases by
10%, it becomes 1.1 times of itself. (since 100+10 = 110% = 1.1)
20%, it becomes 1.2 times of itself.
36%, it becomes 1.36 times of itself.

4%, it becomes 1.04 times of itself.
So we can se the effects on the values due to various percentage increases.
When any value decreases by
10%, it becomes 0.9 times of itself. (Since 100-10 = 90% = 0.9)
20%, it becomes 0.8 times of itself
36%, it becomes 0.64 times of itself
4%, it becomes 0.96 times of itself.
So we can se the effects on a value due to various percentage decreases.
Note:

1. When a value is multiplied by a decimal more than 1 it will be increased and when multiplied by less than 1 it will be decreased.

2. The percentage increase or decrease depends on the decimal multiplied.

Example:
When the actual value is x, find the value when it is 30% decreased.
30% decrease => 0.7 x.

Example:
A value after an increase of 20% became 600. What is the value?
1.2x=600 (since 20% increase)
=> x=500.

Example:
If 600 is decrease by 20%, what is the new value?
new value =0.8×600=480. (Since 20% decrease)
So depending on the decimal we can decide the % change and vice versa.

Example:
When a value is increased by 20%, by what percent should it be reduced to get the actual value?
(It is equivalent to 1.2 reduced to 1 and we can use % decrease formula)
% decrease=(1.2−1)×100=16.66%
When a value is subjected multiple changes, the overall effect of all the changes can be obtained by multiplying all the individual factors of the changes.

Example:
The population of a town increased by 10%, 20% and then decreased by 30%. The new population is what % of the original?
The overall effect =1.1×1.2×0.7 (Since 10%, 20% increase and 30% decrease)
=0.924=92.4%.

Example:
Two sucessive discounts of 10% and 20% are equal to a single discount of:
Discount is same as decrease of price.
So, decrease =0.9×0.8=0.72⇒28% decrease (Since only 72% is remaining)

PERCENTAGE

----------EXERCISE----------

Q1. x% of x is the same as 10% of y. Then y is:

A x/10 B x/100 C $x^2/10$ D $x^2/100$

Q2. Agniwesh scored 110 runs which included 3 boundaries and 8 sixes. What percent of his total score were made by running betwen the wickets?

A. 45% B. $45\frac{5}{11}\%$ C. $55\frac{5}{11}\%$ D. 55%

Q3. If y equals 10% of x and z equals 20% of y, then which one of the following equals 30% of z?

A. 0.0006% of x B. 0.006% of x C. 0.06% of x D. 0.6% of x

Q4. 8 is 4% of A, and 4 is 8% of b. c equals b/a. What is the value of c?

A. 1/32 B. 1/4 C. 1 D. 4

Q5. Annu and Chandana took an examination. Annu secured 9 marks more than Chandana and his marks was 56% of the sum of their marks.The marks obtained by them are:

A. 39, 30 B. 41, 32 C. 42, 33 D. 43, 34

Q6. If A=x % of y and B=y % of x, then which of the following is true?

A. A < B. B. A >B. C. A=B D. None.

Q7. Two numbers A and B are such that the sum of 5% of A and 4% of B is two-third of the sum of 6% of A and 8% of B. Find the ratio of A:B.

A. 1:2 B. 2:3 C. 3:4 D. 4:3

Q8. In an election betwen two candidates, one got 55% of the total valid votes, 20% of the votes were invalid. If the total number of votes was 7500, the number of valid votes that the other candidate got, was:

A. 2700 B. 2900 C. 3000 D. 3100

Q9. If 50% of x equals the sum of y and 20, then what is the value of x–2y?

A. 20 B. 40 C. 60 D. 80

Q10. Rahul gave 40% of the money he had to his wife. he also gave 20% of the remaining amount to his 3 sons. half of the amount now left was spent on miscellaneous items and the remaining amount of Rs.12000 was deposited in the bank. how much money did Rahul have initially?

A. 1,00,000 B. 1,10,000 C. 1,20,000 D. 1,30,000

Q11. Arjun earns 10 percent more than Karan and Karan earns 20 percent more than Nehal. if Nehal earns rs 17,500 less than Arjun, what is the earnings of Nehal?

A. Rs. 39,800.0 B. Rs. 48,600.0, C. Rs. 54,687.5, D. Rs. 65,275.0

Q12. In an election contested by two parties, Party A secured 12% of the total votes more than Party B .If Party B got 132,000 votes, by how many votes did it lose the election?

A. 12840 B. 15840 C. 16,000 D. 28,000

Q13. A shopkeeper sells 60 percent of apple he had and throws away 15 percent of the remaining. Next day he sells 50 percent of the remaining and throws away the rest. What percent of his apples does the shopkeeper throw?

A. 17 B. 23 C. 27 D. None of these

Q14. Difference of two numbers is 1660. If 7.5% of the number is 12.5% of the other number, find the number ?

A. 4050 B. 4150 C. 4250 D. 4350

Q15. If Abhishek has x% more money than Udit and it also x% of sum of their amount taking together. Then what is the approximate value of x?

A . 56% B. 59% C. 62% D. 64%

Q16. If 40% of a number is equal to two-third of another number, what is the ratio of first number to the second number?

A. 2:3 B. 3:2 C. 4:3 D. 5:3

Q17. If the price of petrol increases by 25, by how much must a user cut down his consumption so that his expenditure on petrol remains constant?

A. 15% B. 16.67% C. 20% D. 25%

Q18. A student multiplied a number by 3/5 instead of 5/3. What is the percentage error in the calculation?

A. 34% B. 44% C. 54% D. 64%

Q19. If the numerator of a fraction be increased by 15% and its denominator be diminished by 8% , the value of the fraction is 15/16. Find the original fraction.

A. 1/2 B. 2/3 C. 3/4 D. 4/5

Q20. In the new budget , the price of kerosene oil rose by 25%. By how much percent must a person reduce his consumption so that his expenditure on it does not increase ?

A. 5% B. 20% C. 50% D. 75%

Q21. if (x+y)/(x−y)=4/3, then what percentage to the nearest integer of x+3y is x−3y ?

A. 30% B. 35% C. 40% D. 45%

Q22. Savitri appeared in an exam that had 75 problems with.10 arithmetic, 30 algebra and 35 geometry problems. She answered 70% of the arithmetic ,40% of the algebra, and 60% of the geometry problems correctly. She had to do 60% of the problems correctly. How many more questions she would have to answer correctly to pass.

A. 5 B. 25 C. 50 D. 75

Q23. Kanchan purchased a bag for Rs.360 and sold it to Khushboo for Rs. 360, allowing her a credit of 9 years.If the interest be 7.5% then the Kanchan has gain %?

A. 143 B. 223 C. 243 D. 273

Q24. In an election between two candidates, 75% of the voters cast thier thier votes, out of which 2% of the votes were declared invalid. A candidate got 9261 votes which were 75% of the total valid votes. Find the total number of votes enrolled in that election.

A. 16800 B. 17800 C. 18800 D. 19800

Q25. if 50% of (x-y) = 30% of (x+y) then what percent of x is y?

A. 5 % B. 25 % C. 50 % D. 75 %

Q26. B as a percentage of A is equal to A as a percentage of (A+B). Find B as a percentage of A.

A. 61% B. 61.8% C. 63% D. 63.8%

Q27. If the price of petrol increases by 25 but Bikash planned to spend only 15% more on petrol, by what amount should he reduce the consuption of petrol?

A. 4% B. 8% C. 12% D. 16%

Q28. Population of a country was 1 million at the beginning of Year 2015. The numbers grow by x during the year. A tornedo hits this country in the next year and many of population die. The population decreases by y during 2016 and at the beginning of 2017 the country is now left with 1 million of population. Which of the following is true?

A. x=y B. x<y C. x>y D. CBD

Q29. Khushbu got 20% marks and failed by 10 marks but Nikky got 42% marks and also 12% more than the passing marks. Find the pass marks of examination.

A. 20 B. 25 C. 30 D. 40

Q30. Savitri got 30% of the maximum marks in an examination and failed by 10 marks. Tripti took the same examination and got 40% of the total marks and got 15 marks more than the passing marks. What was the maximum marks in the examination?

A. 100 B. 150 C. 250 D. 300

Q31. When the price fo a product was decreased by 10% , the number sold increased by 30%. What was the effect on the total revenue ?

A. 15% B. 17% C. 25% D. 27%

Q32. When 75% of a two-digit number is added to it, the digits of the number are reversed. Find the ratio of the unit's digit to the ten's digit in the original number.

A. 1:4 B. 1:3 C. 1:2 D. 1:1

Q33. 10% of the inhabitants of village having died of cholera.,a panic set in , during which 25% of the remaining inhabitants left the village. The population is then reduced to 4050. Find the number of original inhabitants.

A. 3000 B. 4000 C. 5000 D. 6000

Q34. The ratio of the number of men and women in a college is 7:8. If the percentage increase in the number of men and womenbe 20% and 10% respectively, what will be the new ratio?

A. 8:9 B. 17:18 C. 21:22 D. CBD

Q35. Seats for Hindi, Bengali and Sanskrit in a school are in the ratio 5:7:8. There is a proposal to increase these seats by 40%, 50% and 75% respectively. What will be the ratio of increased seats?

A. 2:3:4 B. 6:7:8 C. 6:8:9 D. None

Q36. A new group of employees wants to organise a party worth Rs 4,200 to their office. If the manager, offer to pay 50% more than the employees. Owner of company contributes 3 times the manager's contribution, then how much should the manager donate?

A. Rs 900 B. Rs 1000 C. Rs 1100 D. Rs 1,200

Q37. Two numbers are respectively 20% and 50% more than a third number. The ratio of the two numbers is:

A. 1:2 B. 2:3 C. 3:4 D. 4:5

Q38. Paulson spends 75% of his income. His income is increased by 20% and he increased his expenditure by 10%.Find the percentage increase in his savings .

A. 5% B. 25% C. 50% D. 75%

Q39. Raman`s salary was decreased by 50% and subsequently increased by 50%.How much percent does he lose?

A. 5% B. 25 % C. 50 % D. 75%

Q40. The salary of a person was reduced by 10% .By what percent should his reduced salary be raised so as to bring it at par with his original salary ?

A. 5/9% B. 25/9% C. 50/9% D. 100/9%

Q41. In a research Bipoti found the lenth of rods the ratio of 4:7:9. But later it increased by 30%, 20% and 40%. What will be their new ratio?

A. 26:42:63 B. 36:42:63 C. 46:42:63 D. 56:42:63

Q42. The total cost of constructing a road includes 3 items: cost of material, work and transportation. In a year, the total cost of these things were in the proportion 4:3:2.Next year, the total cost of material rose by 10%,cost of work increased by 8% however the overheads lessened by 5%.Find the increase for every penny in the auto's cost.

A. 44/9 % B. 54/9 % C. 64/9 % D. 74/9 %

Q43. If 15% of A =20% of B , then A:B =?

A. 3:4 B. 4:3 C. 17:16 D. 16:17

Q44. How many kg of pure salt must be added to 30kg of 2% solution of salt and water to increase it to 10% solution ?

A. 5/3 B. 8/3 C. 10/3 D. 7/5

Q45. Due to reduction of 25/4% in the price of sugar , a man is able to buy 1kg more for Rs.120. Find the original and reduced rate of sugar.

A. 5 B. 6.25 C. 7.50 D. 9.75

Q46. In an examination , 35% of total students failed in Hindi , 45% failed in English and 20% in both . Find the percentage of those who passed in both subjects

A. 100 B. 200 C. 300 D. 400

Q47. The population of a town is 176400. It increases annually at the rate of 5% p.a. What will be its population after 2 years?

A 194481 B 294481 C 394481 D 494481

Q48. 45% of 750 - 25% of 480 = ?

A 219 B 217.50 C 325 D 135

Q49. If a number p is 10% less than another number q and q is 10% more than 125, then p is equal to?

A 123 B 123.75 C 132.50 D 132.25

Q50. The population of a town increased from 175000 to 262500 in a decade. The average percent increase of population per year is:

A 20% B 12% C 5% D 7%

This chapter contains the questions I discussed and created in our classes or obtained from students as their doubts. All the questions noted, typed, redesigned and rectified by group of volunteers consisting of:

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----------ANSWERS----------

Q1.C	**Q2.B**	**Q3.D**	**Q4.B**	**Q5.C**	**Q6.C**
Q7.D	**Q8.A**	**Q9.B**	**Q10.A**	**Q11.C**	**Q12.B**
Q13.B	**Q14.B**	**Q15.C**	**Q16.D**	**Q17.C**	**Q18.D**
Q19.C	**Q20.B**	**Q21.C**	**Q22.A**	**Q23.C**	**Q24.A**
Q25.B	**Q26. B**	**Q27.B**	**Q28.C**	**Q29.C**	**Q30.C**
Q31.B	**Q32.C**	**Q33.D**	**Q34.C**	**Q35.A**	**Q36.A**
Q37.D	**Q38.C**	**Q39.B**	**Q40.D**	**Q41.A**	**Q42.A**
Q43.B	**Q44.B**	**Q45.C**	**Q46.D**	**Q47.A**	**Q48.B**
Q49.B	**Q50.C**				

----------ANSWERS WITH SOLUTION----------

Q1.C

Q1 Solution:-

x% of x = x/100 * x = 10% of y = y/10

=> $y = (x^2/100) * 10 = x^2/10$

Q2.B

Q2 Solution:-

Number of runs made by running,
=110−(3×4+8×6)
=110−(60)
=50.
Required percentage,
=(50/110)×100%
$=45\frac{5}{11}\%$

Q3.D

Q3 Solution:-

y =10% of x=(10/100)×x=0.1x
z =20% of y=(20/100)×y
=0.2y=0.2×0.1x
Now, 30% of z=(30/100)×z
=0.3c=(0.3)(0.2)(0.1x)
=0.006x=0.6%x

Q4.B

Q4 Solution:-

4% of A is 4a/100.
Since this equals 8, we have 4a/100=8.
Solving for A yields a=8×(100/4)=200.
Also, 8% of b equals 8b/100 and this equals 4.
So, we have (8/100)×b=4.
Solving for b yields b=50.
Now, c=b/a=50/200
=1/4.

Q5.C

Q5 Solution:-

Let their marks be (x+9) and x.

ATP

$x+9=(56/100)\times(x+9+x)$

$\Rightarrow 25(x+9)=14(2x+9)$

$\Rightarrow 25x+25\times9=28x+14\times9$

$\Rightarrow 9\times(25-14)=28x-25x$

$\Rightarrow 9\times11=3x$

$\Rightarrow 3x=99$

$\Rightarrow x=33$

So, their marks are 42 and 33.

Q6.C

Q6 Solution:-

x% of y=(x/100)×y=(xy/100)

y% of x=(y/100)×x=(xy/100)

⇒ A = B

Q7.D

Q7 Solution:-

5% of A+4% of B=2/3(6% of A+8% of B)

Or, 5% of A+4% of B=2/3(6% of A+8% of B)

$\Rightarrow (5/100)\times A+(4/100)\times B=2/3(6/100\times A+8/100\times B)$

$\Rightarrow (1/20)\times A+(1/25)\times B=(1/25)\times A+(4/75)\times B$

$\Rightarrow (1/20-1/25)\times A=(4/75-1/25)\times B$

$\Rightarrow (1/100)\times A=(1/75)\times B$

$\Rightarrow AB=100/75=4/3$

So required ratio = 4:3

So B is 3/x100% of A=75%

Q8.A

Q8 Solution:-

Number of valid votes = 80% of 7500 = 6000.

Valid votes polled by other candidate = 45% of 6000=(45/100)×6000 = 2700.

Q9.B

Q9 Solution:-

50% of x equals the sum of y and 20. Expressing this as an equation yields:

(50/100)×x=y+20

x/2=y+20

x=2y+40

x–2y= 40

Q10.A

Q10 Solution:-

Let the initial amount with Rahul be Rs.x then,

Money given to wife= Rs.(40/100)x=Rs.2x/5.Balance=Rs(x-(2x/5)=Rs.3x/5.

Money given to 3 sons= Rs(3X((20/200) X (3x/5)) = Rs.9x/5.

Balance = Rs.((3x/5) – (9x/25))=Rs.6x/25.
Amount deposited in bank= Rs(1/2 X 6x/25)=Rs.3x/25.
So 3x/25=12000
=> x= ((12000 x 35)/3)=100000
So Mr.Rahul initially had Rs.1,00,000 with him.

Q11.C
Q11 Solution:-
Let Nehal earns Rs. x.
Satish earns =x+20
Arjun earns =1.2x+10
Earning difference of Arjun and Nehal =17,500
1.32x−x=17,500
0.32x=17,5000
⇒ x=175000/0.32
⇒ x=Rs. 54,687.5
So, Nehal's earnings x=Rs. 54,687.5
Arjun's earnings =1.32×x=1.32×Rs. 54,687.5=Rs. 72,187.5
Karans' earnings=1.2×x=1.2×Rs. 54,687.5=Rs. 65,625.0

Q12.B
Q12 Solution:-
Let the percentage of the total votes secured by Party A be x%
Then the percentage of total votes secured by Party B=(x–12)%
As there are only two parties contesting in the election, the sum total of the votes secured by the two parties should total up to 100%
i.e.,x+x–12=100
2x–12=100
Or, 2x=112
Or, x=56
If Party A got 56% of the votes, then Party B got (56–12)=44% of the total votes.
44% of the total votes =132,000
i.e., (44/100)×T=132,000
⇒ T=(132,000/44×100)=300,000 votes.
The margin by which Party B lost the election = 12% of the total votes
= 12% of 300,000 = 15840

Q13.B
Q13 Solution:-
Let the number of apples be 100.
On the first day he sells 60% apple s i.e.,60 Remaining apples =40.
He throws 15% of the remaining i.e., 15% of 40 = 6.Now he has 40−6=34 apple s
The next day he throws 50% of the remaining 34 apple s i.e., 17.
So total apples that he throws is = 6+17 = 23 apples.

Q14.B
Q14 Solution:-
Let the numbers be P and Q. Then , 7.5 % of P =12.5% of Q

P = 125xQ/75 = 5xQ/3.
Now, P-Q =1660
5xQ/3 –Q =1660
2xQ/3= 1660
Q =[(1660x3)/2] =2490.
One number = 2490, Second number =5xQ/3 =4150.

Q15.C
Q15 Solution:-

Let Abhishek has amount of A and Udit has amount of B.
So ATP
If we take B=100 then A=100+x
So A=x%of(A+B)
=> 100+x=x(100+100+x)/100
=> 100+x=(200x+x^2)/100 (cancelling k from both side)
=> 10000+100x=200x+x^2
=> x^2+100x-10000=0
=> x^2+2.50x+2500=12500
=> $(x+50)^2$ = 1250
=> x+50=112 (approx)
=> x=62

Q16.D
Q16 Solution:-

Let the numbers be A and B
So ATP
40% of A = 2/3 of B
Then 40A/100=2B/3
Solving we get
=> A:B=5:3

Q17.C
Q17 Solution:-

Let the price of petrol be Rs.100x per litre and his consuption is 100y.
So total expenditure on it is 100x.100y
Now, the price of petrol increases by 25%. So, the new price of petrol = Rs.125x.
To maintain the total expenditure, he has to spend only Rs.100x.100y on petrol.
Let k litres of petrol he will uses now.
So,
125x.k=100x.100y
⇒ k=100.100y/125
=k=80y litres
He has cut down his petrol consumption by 100y – 80y = 20y litres
=(20y/100y)×100
=20%.

Q18.D

Q18 Solution:-

Let the number be x.
Then, error
=5x/3−3x/5
=16x/5
Error %
=(16x/15)/(5x/3)×100
=64%

Q19.C

Q19 Solution:-

Let the original fraction be x/y.
Then (115%of x)/(92% of y)=15/16 => (115x/92y)=15/16
⇨ [(15/16)*(92/115)]=3/4

Q20.B

Q20 Solution:-

Reduction in consumption = [((R/(100+R))*100]%
⇨ [(25/125)*100]%=20%.
⇨

Q21.C

Q21 Solution:-

Dividing both the numerator and the denominator of the given equation :
(x+y)/(x−y)=4/3
3x + 3y = 4x−4y
Solving we get x=7y
=> Now, the percentage of x+3y to the expression x−3y is
(x−3y)/(x+3y)×100
=(7y-3y)/(7y+3y)x100
=(4y/10y)x100
=40%

Q22.A

Q22.Solution:-

Number of questions attempted correctly=(70% of 10 + 40% of 30 + 60% 0f 35)
=7 + 12+21= 45
questions to be answered correctly for 60% grade=60% of 75 = 45
So required number of questions= (45-40) = 5.

Q23.C

Q23 Solution:-

Interest rate =15/2=7.5%.
CP=Rs. 360.
SP=360+intrest on 360 for 9 years
Interest = [360×(15/2)×9]/100
=Rs. 243.
Gain = Interest =Rs. 243.

Q24.A

Q24 Solution:-

Let the number of votes enrolled be x. Then ,
Number of votes cast =75% of x. Valid votes = 98% of (75% of x).
75% of (98% of (75%of x)) =9261.
[(75/100)*(98/100)*(75/100)*x] =9261.
X = [(9261*100*100*100)/(75*98*75)] =16800.

Q25.B

Q25 Solution:-

50% of (x-y)=30% of(x+y)
⇨ (50/100)(x-y)=(30/100)(x+y)
⇨ 5(x-y)=3(x+y)
⇨ 2x=8y
⇨ x=4y
So required percentage =((y/x) X 100)% = ((y/4y) X 100) =25%

Q26. B

Q26 Solution:-

From the question stem, we know
B/A= A/(A+B) = x(Let)
=> B=Ax and A/(A+B) = x
=> x=A/(A+Ax) [putting B = Ax]
=> x=1/(1+x)
⇒ x(1+x)=1
=> $x+x^2=1$
=> $x^2+x-1=0$
⇒ $x=(-1+\sqrt{5})/2$
Or, $x=(-1-\sqrt{5})/2$
So, $x=(-1+\sqrt{5})/2$ [ignoring negative value of x]
=>x = (-1+ 2.236)/2
=>x = 1.236/2
=0.618=62% (approx)

Q27.B

Q27 Solution:-

Let the price of petrol be Rs.100x per litre and his consuption is 100y.
So total expenditure on it is 100x - 100y
Now, the price of petrol increases by 25%. So, the new price of petrol = Rs.125x.
To maintain the total expenditure, he has to spend only Rs.100x - 100y on petrol.
Since Bikash wants to increase the expenditure on petrol by 15%.
i.e., he has to spend (100x - 100y)+15% of (100x - 100y) (=115.100xy)
Let k litres of petrol he will uses now.
Then, 125x×k=115.100xy
⇒ k=(115.100xy)/125x
=(115.100y)/125
=92y

As the new quantity that he can buy is 0.92y, he gets 0.08y lesser than what he used to get earlier.
Or a reduction of 8%.

Q28.C
Q28 Solution:-

Let us assume the value of x to be 10%.
So, the population in the beginning of year 2016 (end of 2015) will be 1 million + 10% of 1 million = 1.1 million
In 2016, the numbers decrease by y% and at the end of the year the population = 1 million.
i.e., 0.1 million of population have died in 2016.
In terms of the percentage of the population alive at the beginning of 2016,
it will be (0.1/1.1)×100%=9.09%.
From the above illustration it is clear that x>y

Q29.C
Q29 Solution:-

As given Nikky got 42% and 12% more than pass marks So pass marks = 42%−12%=30%
ATP:
If x is maximum marks then
30%of x–20% of x=10 (marks) [as khushboo got 20% marks and failed by 10 marks]
i.e., 10% of x=10
So, x = 100 marks.
So pass marks is 30% 0f x = 30

Q30.C
Q30 Solution:-

Let x be the maximum marks in the examination.
So, Savitri got 30%of x
=30/100×x
=0.3x
And Tripti got 40% of x
=40/100×x
=0.4x
Tripti got 0.4x−0.3x=0.1x more than Savitri. ----------(1)
Tripti has got 15 + 10 = 25 marks more than Savitri.------ (2) [As Tripti got 15 marks more than the passing mark and Savitri got 10 marks less than the passing mark]

Equating (1) and (2), we get
0.1x=25
⇒ x=250
x is the maximum mark and is equal to 250 marks.

Q31.B
Q31 Solution:-

Let the price of the product be Rs.100 and let original sale be 100 pieces.
Then , Total Revenue = Rs.(100*100)=Rs.10000.
New revenue = Rs.(90*130)=Rs.11700.
Increase in revenue = ((1700/10000)*100)%=17%.

Q32.C
Q32 Solution:-

Let the number be xy i.e. 10x+y
If 75% of it is added to it (10x+y)(1+75/100)=(7/4)(10x+y)
ATP
(7/4)(10x+y) = 10y + x
7(10x+y) =4(10y+x)
70x+7y =40y+4x
66x =33y
x/y =1/2

Q33.D
Q33 Solution:-

Let the total number of orginal inhabitants be x.
((75/100))*(90/100)*x)=4050
⇨ (27/40)*x=4050
⇨ x=((4050*40)/27)=6000.

Q34.C
Q34 Solution:-

Let initially the number of men and women in the college be 700x and 800x respectively.
Their increased number is (120% of 7x) and (110% of 8x).
⇒ (120/100.700x) and (110/100.800x)
840x : 880x
So new ratio is = 21:22

Q35.A
Q35 Solution:-

Let initially the number of seats for Hindi, Bengali and Sanskrit be 500x, 700x and 800x respectively.
Number of increased seats are (140% of 500x), (150% of 700x) and (175% of 800x).
Then the required ratio will be as
(140/100.500x):(150/100.700x):(175/100.800x)
=700x:1050x:1400x
=2:3:4

Q36.A
Q36 Solution:-

Let employee contribute 100x
Then manager contributes 150x [50% more than employees]
Then Ownerr contributes 450x [3 times more than manager]
So ATP
The ratio of the share employees : manager: owner of company=100:150:450

So the proportion to manager's share = 150/700
So, the managers would donate (150/700)×4200=Rs 900

Q37.D
Q37 Solution:-
Let the third number be is 100x.
Then, first number = 120% of100x = 120x
Second number = 150% of 100x = 150x
So the ratio of first these two numbers = 120x:150x=4:5

Q38.C
Q38 Solution:-
Let the original income=Rs.100 . Then , expenditure=Rs.75 and savings =Rs.25
New income =Rs.120 , New expenditure =
Rs.((110/100)*75)=Rs.165/2
New savings = Rs.(120-(165/2)) = Rs.75/2
Increase in savings = Rs.((75/2)-25)=Rs.25/2
Increase %= ((25/2)*(1/25)*100)% = 50%.

Q39.B
Q39 Solution:-
Let the original salary = Rs.100
New final salary=150% of (50% of Rs.100)=
Rs.((150/100)*(50/100)*100)=Rs.75.
Decrease = 25%

Q40.D
Q40 Solution:-
Let the original salary be Rs.100 . New salary = Rs.90.
Increase on 90=10 , Increase on 100=((10/90)*100)%
= (100/9)%

Q41.A
Q41 Solution:-
Let the lenth of rods be 400x,700x and 900x individually.
Presently they are 130% of 400x, 120 % of 700x and 140 % of 900x.
So new ratio = (130.4x): (120.7x) (140.9x)
=520x:840x:126x
=26:42:63.

Q42.A
Q42 Solution:-
Let the total cost of material, work and transportation be Rs. 400k, 300k and 200k respectively.
At that point total cost =900k rs .
New cost= (110% of 400k) + (108% of 300k) +(90% of 200k)=440k+324k+180k = 944k
So total Increase =944k-900k = 44k
So, Increase%= $\frac{44k}{900k}$x100 % = 44/9 %

Q43.B

Q43 Solution:-

15/100 a = 20/100 b

=> 15 A = 20 B

=> A/B = 20/15 = 4/3

So A:B =4 :3

Q44.B

Q44 Solution:-

Amount of salt in 30kg solution = [(20/100)*30]kg=0.6kg

Let x kg of pure salt be added

Then , (0.6+x)/(30+x)=10/100=>60+100x=300+10x

=> 90x=240

=> x=8/3.

Q45.C

Q45 Solution:-

Let the original rate be Rs.x per kg.

Reduced rate = Rs.[(100-(25/4))*(1/100)*x}]=Rs.15x/16per kg

120/(15x/16)-(120/x)=1 => (128/x)-(120/x)=1

=> x=8.

So, the original rate = Rs.8 per kg

Reduce rate = Rs.[(15/16)*8]per kg = Rs.7.50 per kg

Q46.D

Q46 Solution:-

Let A and B be the sets of students who failed in Hindi and English respectively .

Then , n(A) = 35 , n(B)=45 , n(A B)=20.

So , n(AUB)=n(A)+n(B)- n(A∩B)=35+45-20=60.

Percentage failed in Hindi and English or both=60%

So , percentage passed = (100-60)%=40%

So , total number of students = 400.

Q47.A

Q47 Solution:-

Population after 2 years = {176400 * (1+5/100)2 }

176400* 21/20*21/20=194481.

Q48.B

Q48 Solution:-

= (45⁄100 x 750) - (25⁄100) x 480)

= 337.50 - 120

= 217.50

Q49.B

Q49 Solution:-

q = 125 + 10% of 125 = 137.50

p = 137.50 - 10% of 137.50 = 123.75

Q50.C

Q50 Solution:-

Increase in 10 years = (262500 - 175000) = 87500

Increase % = (87500/175000) = 50%

So, average = (50/10)% = 5%

"Strength and growth come only through continuous effort and struggle." —*Napoleon Hill*

SIMPLE INTEREST

Interest: The money paid by the borrower to the lender for the use of money is called Interest.

Principal: The sum lent is called principal.

Simple Interest(I): (PxRxT)/100

Where P = Principal R= Rate of interest per annum
T= Time period in years

Amount= Principal + Simple Interest

Amount(A)= P(100+RT)/100

P=(100xI)/(RxT)

R=(100xI)/(PxT)

T=(100xI)/(PxR)

In case if money is lent to someone for earning interest: The day on which money is deposited is not counted while the day on which money is withdrawn is counted .

SIMPLE INTEREST

----------ExERCISE----------

Q1. What is the Simple Interest on Rs 8000 for 5 years at 10% per annum rate of interest?

A. 1000 B. 2000 C. 3000 D. 4000

Q2. A sum of money Rs 32000 is lent in two parts, one at the rate of 10% and another at 12% . If the annual interest received is Rs 3600. What is the amount lent at 12%?

A. 20000 B. 38000 C. 44000 D. 60000

Q3. In how many years a sum of Rs. 450 gives Rs. 81 as interest at 4.5% of Simple Interest ?

A 4 B 4.5 C 5 D 6

Q4. The difference between the interests received from two scheme on Rs 5000 for two years is Rs 25. The difference between their rates is:

A 0.20% B 0.25% C 0.5% D 1%

Q5. What will be the interest on Rs 2400 for 8 years 4 months at 6% per annum rate of interest ?

A. 1200 B. 1800 C. 2400 D. 3000

Q6. Bikash lent Rs 3600 to Karan for 3 years and Rs 6600 to Manish for 2 years and overall he received Rs 1200 as Simple Interest . What is the rate of interest per annum ?

A. 1 B. 2 C. 4 D. 5

Q7. A certain sum of money amounts to Rs. 1008 in 2 years and to Rs. 1164 in $1\frac{1}{2}$% years. What is the sum and the rate of interest?

A Rs. 800 B Rs. 850 C Rs. 900 D Rs. 1000

Q8. A certain sum of money amounts to Rs. 1008 in 2 years and to Rs.1164 in 3 ½ years. What is the sum and rate of interests.

A. 10% B. 11% C. 12% D. 13%

Q9. A sum of Rs. 12,500 amounts to Rs. 15,500 in 4 years at the rate of Simple Interest . What is the rate of interest?

A 5 B 6 C 7 D 8

Q10. A sum of Rs. 1550 is lent out into two parts, one at 8% and another one at 6%. If the total annual income is Rs. 106, What is the money lent at 6%.

A. 800 B. 900 C. 1000 D. 1500

Q11. Abhilash borrowed some money at certain rate of SI for 3 years. If the rate had been 2% higher, He would have to pay Rs. 360 more. What was the amount.

A. 4000 B. 4800 C. 6000 D. 7500

Q12. The Simple Interest on a sum of money is $1/25^{th}$ of the principal. If the rate of interest is 16%. What is the number of months?

A. 1 B. 2 C. 3 D. 4

Q13. What is the Simple Interest on Rs 8000 from 7^{th} August 2016 to 31^{st} December 2016 at 5% per annum rate of interest?

A. 160 B. 180 C. 240 D. 300

Q14. Ruby took a loan of Rs. 1200 on Simple Interest for as many years as the rate of interest. If she paid Rs. 432 as interest at the end of loan period, what was the rate of interest?

A 4 B 5 C 6 D 7

Q15. Rs. 800 amounts to Rs. 920 in 3 years. If interest rate is increased by 8%, the what will be amount?

A. 752 B. 886 C. 992 D. 1012

Q16. The Simple Interest on a sum of money is 4 /25th of the principal and the rate of interest is equal to the number of years . What is the rate of interest?

A. 1 B. 2 C. 3 D. 4

Q17. At what rate percent per annum will a sum of money double in 16 years?

A $3\frac{1}{3}\%$ B $6\frac{2}{3}\%$ C 6.25% D 12.5%

Q18. What would be the Simple Interest obtained on an amount of Rs 6535 at the rate of 10% after 6 years?

A Rs 3600 B Rs 3921 C Rs 3950 D Rs 4250

Q19. A sum of money at Simple Interest amounts to RS. 815 in 3 years and to 854 in 4 years. The sum is?

A 615 B 650 C 698 D 750

Q20. At what rate percent per annum will a sum of money double in 16 years.

A. 6 % B. 6 ¼% C. 6.5% D. 7 ¼%

Q21. Rs.1000 contributed at 5% per annum Simple Interest. If the interest is added to the principal at regular intervals, the sum will be gets to be Rs 2000 after.

A 3 years B 4 years C 4.5 years D $6\frac{2}{3}$ years

Q22. A man took a loan from a bank at the rate of 12% per annum Simple Interest . After 3 years he had to pay Rs. 5400 interest only for the period. The principal amount borrowed by him was?

A 14500 B 15000 C 15500 D 16500

Q23. What is the Simple Interest on Rs 2400 for 9 months at 4 paisa per rupee per month?

A. 612 B. 718 C. 864 D. 930

Q24. What is the present worth of Rs. 132 due in 2 years at 5% Simple Interest per annum ?

A 120 B 150 C 155 D 650

Q25. In how many years, Rs. 150 will produce the Simple Interest at 8%per annum as Rs. 800 produce in 3 years at $4\frac{1}{2}$ years?

A 7 B 8 C 9 D 10

Q26. what will be the ratio of Simple Interest earned by certain amount at the same rate of interest for 6 years and that for 9 years?

A 2:3 B 3:4 C 4:3 D none

Q27. A sum was put at a Simple Interest at a certain rate of 4 years. Had it been put a 4% higher rate, it would have fetched Rs 720 more. What is the principal?

A. 2000 B. 3000 C. 4000 D. 6000

Q28. The difference between the Simple Interest received from two different sources on Rs. 1500 for 3 years is Rs. 13.50. Then difference between their rate of interest is?

A 3% B 0.3% C 5% D 7%

Q29. The Simple Interest on a certain sum of money for $2\frac{1}{2}$ years at 12% per annum is Rs. 40 less than the Simple Interest on the same sum for $3\frac{1}{2}$ years at 10% per annum . What is the sum?

A 400 B 800 C 1600 D 500

Q30. The Simple Interest on a sum of money is 4/9 of the principal .What is the rate percent and time, if both are numerically equal.

A. 6 year 1 months B. 6 year 5 months C. 6 year 7 months D. 6 year 8 months

Q31. A sum amounts to Rs 2240 in 2 years and Rs 2600 in 5 years.Find the sum

A Rs 1800 B Rs 2000 C Rs 2200 D 2500

Q32. What annual installment will discharge a debt of Rs. 1092 due in 3 years at 12% Simple Interest ?

A. 325 B. 375 C. 425 D. 500

Q33. Find the amount which yields Simple Interest of Rs. 4016.25 at the rate of 9 p.c.per annum in 5 years.

A 8150 B 8500 C 8925 D 9250

Q34. What is the Simple Interest on Rs. 68,000 at $16\frac{2}{3}$% per annum for 9 months.

A. 1000 B. 1800 C. 4000 D. 8500

Q35. A sum at Simple Interest s at 13½ % per annum amounts to Rs.2502.50 after 4 years What is the sum?

A. 1000 B. 1625 C. 2000 D. 2500

Q36. In how many years will a sum of money becomes 4 times at 5% per annum Simple Interest ?

A. 42 B. 48 C. 60 D. 80

Q37. At what rate of interest per annum , will Rs 5500 be obtained as Simple Interest on Rs 25000 for 2 years 9 months?

A. 8% B. 9% C. 12% D. 15%

Q38. Rs. 800 becomes Rs. 956 in 3 years at a certain rate of Simple Interest . If the rate of interest is increased by 4%, What amount will Rs. 800 become in 3 years?

A 1000 B 1025 C 1050 D 1250

Q39. A sum of money becomes 4 times in 9 years at Simple Interest . In how many years will it become 8 times of itself at the same rate?

A. 12 B. 18 C. 21 D. 30

Q40. Manu borrows Rs. 5000 for 2 years at 4% per annum Simple Interest . he immediately lends it to another person at $6\frac{1}{4}$% per annum for 2 years find his gain in the transaction per year?

A 112.50 B 122.50 C 145 D 190

Q41. A sum was put at Simple Interest at a certain rate for 3 years. Had it been put at 2% higher rate, it would have fetched Rs. 360 more. What is the sum?

A 4000 B 5000 C 6000 D 7000

Q42. A certain amount earns Simple Interest of Rs. 1750 after 7 years. Had the interest been 2 % more, how much more interest would it have earned?

A 120 B 240 C 360 D Data is inadequate

Q43. A certain total of cash gets to be three times of itself in20 years at basic interest. In how long does it turns out to be twofold of itself at the same rate?

A 8 years B 10 years C 12 years D 14 years

Q44. Rahul too loan 40% of the whole at 15% per annum., half of rest at 10% per annum also, the remaining at 18% per annum Simple Interest . What is the effective rate of interest?

A 11.33% B 12.24% C 13.25% D 14.40%

Q45. What is the Simple Interest on Rs. 3000 at 6.25% per annum for the period from 4th Feb., 2005 to 18th April, 2005.

A. 27.00 B. 37.50 C. 40.00 D. 45.00

Q46. A certain sum of money amounts to Rs 2400 in 3 years and Rs 2720 in 5 years. What is the principal?

A. 1200 B. 1600 C. 1920 D. 2400

Q47. A man borrowed Rs 10000 from a lender at 9% per annum rate of interest .What is the amount to be paid by the man after 2 years 6 months?

A. 12250 B. 15500 C. 20500 D. 25000

Q48. A sum invested at 5% Simple Interest per annum amounts to Rs. 504 in 4 years. The same amount at 10% Simple Interest per annum in 21⁄2 years will amount to?

A 520 B 525 C 550 D 600

Q49. Agniwesh invested certain sum of money at 7% per annum for 4 years. However he would get Rs 1040 more Simple Interest , if he had invested the same sum of money at 6% for 9 years. What is the sum ?

A. 1200 B. 1800 C. 4000 D. 4300

Q50. Divide Rs. 2379 into 3 parts so that their amounts after 2,3 and 4 years respectively may be equal, the rate of interest being 5% per annum at Simple Interest . The first part is?

A 759 B 792 C 818 D 828

This chapter contains the topics and questions I discussed and created in our classes or obtained from students as their doubts. All the questions noted, typed, redesigned and rectified by group of volunteers consisting of:

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----------ANSWERS ----------

Q1.D	**Q2.A**	**Q3.A**	**Q4.B**	**Q5.A**
Q6.D	**Q7.A**	**Q8.D**	**Q9.B**	**Q10.B**
Q11.C	**Q12.C**	**Q13.A**	**Q14.C**	**Q15.C**
Q16.D	**Q17.C**	**Q18.B**	**Q19.C**	**Q20.B**
Q21.D	**Q22.B**	**Q23.C**	**Q24.A**	**Q25.C**
Q26.A	**Q27.D**	**Q28.B**	**Q29.B**	**Q30.D**
Q31.B	**Q32.A**	**Q33.C**	**Q34.D**	**Q35.B**
Q36.C	**Q37.A**	**Q38.B**	**Q39.C**	**Q40.A**
Q41.C	**Q42.D**	**Q43.B**	**Q44.D**	**Q45.B**
Q46.C	**Q47.A**	**Q48.B**	**Q49.C**	**Q50.D**

----------ANSWERS WITH SOLUTION----------

Q1.D

Q1 Solution:-

Simple Interest =PTR /100

= 8000x5x10/100= Rs 4000

Q2.A

Q2. Solution:-

Let P be the money lent at 10% .

Then (32000- P) is lent at 12%

Simple Interest on both amounts is equal to Rs 3600

Px1x10/100+ (32000-P)x1x12/100= 3600

10P/100 + 32000x 12/100 – 12P/100= 3600

2P/100 = 3840-3600

2P= 240 x100

=> P =Rs 12000

Money lent at 12%= (32000-12000)= 20000.

Q3.A

Q3 Solution:-

Time = (100x 81/450 x 4.5)

= 4 years

Q4.B

Q4 Solution:-

Let the rates be r_1% per annum and r_2 % per annum Then,ATP:

$(5000xr_1/100x2)- (5000xr_2/100x2) =25$

=> $100(r_1-r_2) = 25$

=> $r_1-r_2 =0.25$

So, the difference in rates = 0.25% per annum.

Q5.A

Q5 Solution:-

Time period is 8 years 4 months = 8+4/12 years =25/3years

We know:

Simple Interest =PTR /100= 2400x25/3x6/100=Rs 1200

Q6.D

Q6 Solution:-

SI on 3600 for 3 years +Simple Interest on Rs 6600 for 2 years = 1200
3600 x 3 xR /100+ 6600 x 2xR /100= 1200
108R +132R = 1200
240R= 1200
R= 5%
The rate of interest per annum is 5%

Q7.A
Q7 Solution:-
Simple Interest for 11⁄2years = Rs. (1164-1008)=156
Simple Interest for 2 years = Rs. (156 x 2⁄3 x 2) = Rs. 208
Principal = Rs. (1008 - 208) = Rs. 800

Q8.D
Q8 Solution:-
Simple Interest for 3 ½ years = Rs. 1164
Simple Interest for 1 ½ years = Rs. 1008
Simple Interest for 1 ½ years = Rs. (1164-1008) = Rs.156.
Simple Interest for 2 years = Rs. (156x(2/3)x2)=Rs.208
Principal = Rs. (1008 - 208) = Rs. 800.
Now, P = 800, T = 2 and Simple Interest = 208.
Rate =(100x 208)/(800x2)% = 13%

Q9.B
Q9 Solution:-
Simple Interest = Rs. (15500 - 12500) = Rs. 3000
Rate = (100x 3000⁄12500 x 4)
= 6%

Q10.B
Q10 Solution:-
Let the sum lent at 8% be Rs. P and that at 6% be Rs. (1550 - P).
=> [(Px8x1)/100 + (1550-P)x6x1]/100=106
=> 8P + 9300 –6P=10600
=> 2P = 1300
=> P = 650.
=> Money lent at 8% = Rs. 650. Money lent at 6% = Rs. (1550 - 650) = Rs. 900.

Q11.C
Q11 Solution:-
Let sum = P and rate = R.
Then, [(Px(R+2)x3)/100] – [(PxRx3)/100] = 360.
=> 3PR + 6P - 3PR = 36000 => 6P=36000 => P=6000
So, sum = Rs. 6000.

Q12.C
Q12 Solution:-
Simple Interest is $1/25^{th}$ of the principal
=> SI =1 /25P
=> 1/25P= Px16/100xT
=> T= ¼ years
So, the time period is 1 /4th year = 3 months

Q13.A
Q13 Solution:-

Number of days from August 6 th to December 30 = 146 days (we don't count the given day)
Simple Interest =PTR /100= 8000 x(146/365)x5/100= Rs 160

Q14.C
Q14 Solution:-
Let Rate = R% and time also R years. Then,
We have
SI=PTR/100
Putting T =R we get:
(1200xRxR)/100 = 432
⇨ $12R^2 = 432 \Rightarrow R = 6$

Q15.C
Q15 Solution:-
Simple Interest = Rs. (920 - 800) = Rs. 120; p = Rs. 800, T = 3 year.
R = ((100x 120)/(800x3)) % = 5%.
New rate = (5 + 3)% = 8%.
New Simple Interest = Rs. (800x8x3)/100 = Rs. 192.
New amount = Rs.(800+192) = Rs. 992.

Q16.D
Q16 Solution:-
Simple Interest is 4 /25th of the principal
=> SI =4/25P.
Rate of interest per annum is equal to number of years
=> R =T
SI =PTR /100x4/25
P = PxRxR /100x4/25
=> R^2 =400/25
=> R=20/5=4%

Q17.C
Q17 Solution:-
Let Principal = P, Then,
Simple Interest = P and T = 16 years
Rate = (100xP/Px16)%
= 25/4%

Q18.B
Q18 Solution:-
Simple Interest = PTR/100
= 6535 x 6 x 10/100
= Rs 3921

Q19.C
Q19 Solution:-
Simple Interest for 1 year = Rs. (854 - 815) = 39
Simple Interest for 3 years = Rs. (39 x 3) = 117
So, Principal = 815 - 117 = 698

Q20.B
Q20 Solution:-

Let principal = P. Then, Simple Interest = P and T = 16 year.
=> Rate = (100x P)/(Px16)% = 6 ¼ % per annum.

Q21.D
Q21 Solution:-
Simple Interest for the 10 years = Rs. (1000x 5/100x10) = Rs. 500
Principle after 10 years becomes = Rs. (1000+500) = Rs. 1500
Simple Interest on it = Rs. (2000- 1500) = 500
Time = (100x500/5x1500) years = 20/3 years

Q22.B
Q22 Solution:-
Principal = Rs. (100x 5400/12x3) = Rs. 15000

Q23.C
Q23 Solution:-
P = Rs 2400 Time Period T = 9 months =9 /12years = ¾ year
Rate of interest =4 paisa per Rupee per month= 4% per month= 48% per annum
Simple Interest =PTR/100= 2400x¾x48/100= Rs 864

Q24.A
Q24 Solution:-
Let the present worth be Rs. P then,
Simple Interest = Rs. (132 - P)
So, (P x5x2/100) = 132 - P
10P = 13200 - 100P
110P = 13200
P = 120

Q25.C
Q25 Solution:-
P = Rs. 800 R = 4 1/2 = (9/2 T = 3 years
Simple Interest = Rs. (800 x 9 x /2 3/100) = 108
Now, P = Rs 150, Simple Interest = Rs. 108, R = 8%
Time = (100x 108/150 x 8) = 9 years

Q26.A
Q26 Solution:-
Let the principal be P and rate of interest be R%
So, Required Ratio =(PxRx6/100/PxRx9/100)
6PR/9PR
=2:3

Q27.D
Q27 Solution:-
Let rate of interest be R and principal be P.
SI at R rate of interest=>Simple Interest = P x 4 x(R+4) /25
If the rate of interest is 4% more, then SI= P x 4 x(R+4) /25
The difference between these two Simple Interest s is Rs 720
P x 4 x(R+4) /25 - P x 4 x(R+4) /25= 720P x 4 x4 /25= 960
So, P= Rs 6000

Q28.B
Q28 Solution:-

(1500 x R_1 x 3⁄100) - (1500 x R2x 3⁄100) = 13.50
= 4500 (R_1 - R2) = 1350
= R_1 - R_2 = 1350⁄4500 = 0.3%

Q29.B
Q29 Solution:-
Let the sum be P then,
(Px10x7⁄100x2) - (Px12x5⁄100x2)=40
=> 7P⁄20 - 3P⁄10 = 40
P = 40x20
The sum is Rs. 800

Q30.D
Q30 Solution:-
Let sum = Rs. P. Then, Simple Interest = Rs. 4P/9
Let rate = R% and time = R years.
Then, (PxRxR)/100=4P/9 or R^2 =400/9
=> R = 20/3 = 6 2/3.
=> Rate = 20/3 % and Time = 20/3 years = 6 years 8 months.

Q31.B
Q31 Solution:-
Simple Interest for 3 year = (2600-2240) = Rs. 360
Simple Interest for 1 year = 360/3 = Rs. 120.
Simple Interest for 2 year =120x2= Rs. 240 .
Sum = Rs. (2240-240) = Rs. 2000.

Q32.A
Q32 Solution:-
Let each Installment be Rs. I
Then, [I+ {(Ix12x1)/100}] + [I+ {(Ix12x2)/100}] + I = 1092
=> [((28I/25) + (31I/25) + I] = 1092
=> (28I+31I+25I)=(1092x25)
=> I= (1092x25)/84 = Rs.325.
=> Each installment = Rs. 325.

Q33.C
Q33 Solution:-
We have P=(100xI)/(RxT)
Principal = (100x 4016.25)⁄(9 x 5)=(401625⁄45)= 8925

Q34.D
Q34 Solution:-
P = Rs.68000,R = 50/3% per annum and T = 9/12 years = 3/4years.
=> Simple Interest = (PxRxT)/100
= Rs.(68,000x(50/3)x(3/4)x(1/100))
= Rs.8500

Q35.B
Q35 Solution:-
Let sum be Rs. P then , Simple Interest = Rs.(Px(27/2) x4x(1/100)) = Rs.27P/50
=> amount = (Rs. P+(27P/50)) = Rs.77P/50

=> 77P/50 = 2502.50
=> P = 2502.50 x 50 = 1625
So , sum = Rs.1625.

Q36.C
Q36 Solution:-
Sum of money becomes 4 times=> Amount= 4P
Amount= P+Simple Interest
⇨ Simple Interest = 4P-P
SI = P TR /100
=> 3P= P x T x5 /100
T= 60 years

Q37.A
Q37 Solution:-
Given P= Rs 25000 and
Time period = 2 years 9 months= 29 /12=11 /4years
Simple Interest =PTR /1005500 = 25000 x11 /4xR /100 R = 8 %

Q38.B
Q38 Solution:-
Simple Interest = (956 - 800) = 156
Rate = (100x156)/(800x3)
New Rate = (13/2 + 4) = 21/2
New Simple Interest = Rs. (800 x 21 x/2 3/100) =252
So, New Amount = Rs. (800 + 252) = 1025

Q39.C
Q39 Solution:-
A sum of money (principal) P becomes 4 times
=> Amount= 4P
Simple Interest obtained is 3P
To get Simple Interest 3P, it takes 9 years.
To get Simple Interest P, it takes 9/3= 3 years
Now it has to become 8 times
=> The Simple Interest to be obtained is 7P
To get Simple Interest P, it takes 3 years
So to get 7P as Simple Interest , it takes 7x3 = 21 years

Q40.A
Q40 Solution:-
Gain in 2 years = Rs. [(5000x25x/42/100) - (500x4x2/100)]
= Rs. (625 - 400)= Rs. 225
Gain in 1 year = Rs. (225/2)= Rs. 112.50

Q41.C
Q41 Solution:-
Let the sum be = P and rate = R. Then,
(Px(R+2)x3/100) - (PxRx3/100) = 360
3PR + 6P - 3PR =36000
6P = 36000
P=6000

Q42.D

Q42 Solution:-

We need to know the Simple Interest , principal and time to What is the rate. Since the principal is not given, so the data is inadequate.

Q43.B

Q43 Solution:-

Let the sum be Rs. P. Then, Simple Interest in 20 years = Rs. (3P-P) = Rs.2P
Rate = (100xSimple Interest /RxT) = (100x2P/Px20) % Per annum = 10% P.a.
Now, sum = Rs. P, Rate = 10% P.a., Simple Interest = Rs. P.
∴ Time = (100xSimple Interest /PxR) = (100xP/Px10) years = 10 years.

Q44.D

Q44 Solution:-

Let the whole sum be Rs 100.
Sum at 15% per annum =Rs 40, Rest=Rs 60.
Sum at 10% per annum =Rs 30, sum at 18% per annum =Rs 30.
Simple Interest on Rs 100 for 1 years = (40x15/100x1) + (30x10/100x1) + (30x18/100x1)= Rs (6+3+ 5.4) =Rs 14.4.
Required rate = 14.40%per annum.

Q45.B

Q45 Solution:-

Time = (24+31+18)days = 73 days = 73/365 years = 1/5 years.
P = Rs.3000 and R = 6¼ %per annum = 25/4%per annum
=> Simple Interest = Rs.(3,000x(25/4)x(1/5)x(1/100))= Rs.37.50.

Q46.C

Q46. Solution:-

We know that Amount= Principal + Simple Interest
Principal +Simple Interest for 5 years= Rs 2720 ----------(i)
Prinipical +Simple Interest for 3 years= Rs 2400 ----------(ii)
(i)-(ii) gives theSimple Interest for 2 years = 320
Simple Interest for one year = Rs320 /2= 160
Given P+SI for 3 years= 2400
P + 3 x 160 = 2400
=> P=2400-480=Rs 1920

Q47.A

Q47 Solution:-

Principal = Rs 10000 Rate of interest R = 9%
T= 2 years 6 months= 2 ½ years=5 /2years
Simple Interest =PTR /100= 10000 x5 /2x9 /100= Rs 2250
Amount= Prinipal + Simple Interest = Rs 10000+ Rs 2250 = Rs 12250

Q48.B

Q48 Solution:-

Let the sum be Rs. z. Then,
Simple Interest = Rs. (504 - z)
So, (z x 5 x 4⁄100) = 504 - z
20z = 50400 - 100z
120z = 50400
z = 420

Now P = 420, R = 10%, T = 5⁄2
Simple Interest = (420 x 10 x 5⁄100x 2) = 105
Amount = Rs (420 + 105) = 525

Q49.C
Q49 Solution:-

The difference between the Simple Interest obtained in two cases is Rs 1040.
Let Principal be P .
P x 9x6 /100 - P x 4 x 7 /100 = 1040
54P/100 - 26P/100 = 1040
26P/100 = Rs 1040
P=Rs 4000

Q50.D
Q50 Solution:-

Let the parts be a,b and [2379 - (a + b)]
a + (a x 25⁄100) = b + (b x 35⁄100) = c + (c x 45⁄100)
= 11a⁄10 = 23b⁄20 = 6c⁄5 = k
a = 10k⁄11
b = 20k⁄23
c = 5k⁄6
But, a + b + c = 2379
10k⁄11 + 20k⁄23 + 5k⁄6 = 2379
1380k + 1320k + 1265k = 2379 x 11 x 23 x 6
k = 2379 x 11 x 23 x 6⁄3965= 3 x 11 x 23 x 6⁄5
a = 828

"He who believes is strong; he who doubts is weak. Strong convictions precede great actions." —*Louisa May Alcott*

COMPOUND INTEREST

If the interest at the end of a year or fixed period is added to the sum lent, and the amount so obtained becomes the principal for the next period, then sum of the money is said to be lent at compound interest.

WORKING FORMULAE: If P is the principal, T is the number of years and R is rate of interest per annum.

Then Amount= $P[1+R/100]^T$

Note 1 : When the interest is compounded half yearly
Amount= $P[1 +(R/2)/100]^{2T} = P[1+R/200]^{2T}$

Note 2: When the interest is compounded quarterly
Amount= $P[1 +R/4/100]^{4T} = P[1+R/400]^{4T}$
Compound interest is obtained when principal is subtracted from Amount.

COMPOUND INTEREST

----------EXERCISE----------

Q1. A sum of money amounts to Rs 2400 in 2 years and Rs 2640 in 3 years at CI. Find the rate of percent per annum?

A. 10% B. 11% C. 12.5% D. 14%

Q2. Find compound interest on Rs. 7500 at 4% per annum for 2 years, compounded annually.

A. 612 B. 621 C. 634 D. 643

Q3. The compound interest on a certain sum of money for 2 years at 10% pa. Is Rs 2520. Find the simple interest on the same sum of money at the same rate for 2 years?

A. Rs 2000 B. Rs 2200 C. Rs 2400 D. Rs 2540

Q4. Find compound interest on Rs. 8000 at 15% per annum for 2 years 4 months, compounded annually.

A. 1201 B. 2102 C. 3109 D. 4304

Q5. The value of a land increases by 15% annually. If its present value is 1058000. What was its value 2 years ago?

A. Rs 400000 B. Rs 500000 C. Rs 800000 D. Rs 1000000

Q6. Find the compound interest on Rs. 10,000 in 2 years at 4% per annum, the interest being compounded half-yearly.

A. 628.5 B. 762.1 C. 824.32 D. 964.5

Q7. The difference between Compound Interest and Simple Interest on Rs 4000 for 2 years is Rs 10. What is the rate of interest per annum?

A. 2% B. 3% C. 4% D. 5%

Q8. Find the compound interest on Rs. 16,000 at 20% per annum for 9 months, compounded quarterly.

A. 1247 B. 2522 C. 3486 D. 4335

Q9. Find the compound interest on Rs 32000 at 10% p.a for one and half years, the interest being compounded half yearly?

A. Rs 5044 B. Rs 6000 C. Rs 6822 D. Rs 7000

Q10. If the simple interest on a sum of money at 5% per annum for 3 years is Rs.1200, find the compound interest on the same sum for the same period at the same rate.

A. 1261 B. 2145 C. 3409 D. 9261

Q11. What sum will amount to Rs 30000 in 3 years at 25% p.a compound interest?

A. Rs15000 B. Rs 15360 C. Rs 20000 D. Rs 24000

Q12. In what time will Rs. 1000 become Rs. 1331 at 10% per annum compounded annually?

A. 1 B. 2 C. 3 D. 4

Q13. Find the Compound interest on Rs 5000 in 2 years, the rate of interest being 5% for the first year and 10% for the second year ?

A. Rs 775 B. Rs 875 C. Rs 1050 D. Rs 1250

Q14. If Rs. 600 amounts to Rs. 683.20 in two years compounded annually, find the rate of interest per annum.

A. 2 B. 5 C. 8 D. 11

Q15. Find the compound interest on Rs 80000 for 3 years at 5% per annum rate of interest?

A. Rs 12000 B. Rs 12610 C. Rs 14800 D. Rs 15300

Q16. If the compound interest on a certain sum at 16 (2/3)% to 3 years is Rs.1270, find the simple interest on the same sum at the same rate and for the same period.
A. 1080 B. 2010 C. 3040 D. 4030

Q17. At what rate percent per annum compound interest will Rs 12500 amount to Rs 13520 in 2 years?
A. 13% B. 10% C. 8% D. 4%

Q18. The difference between the compound interest and simple interest on a certain sum at 10% per annum for 2 years is Rs. 631. Find the sum.
A. 12500 B. 21500 C. 53400 D. 63100

Q19. At what rate percent compound interest, will Rs 20000 amount to Rs 22050 in 2 years?
A. 12% B. 8% C. 5% D. 2%

Q20. Divide Rs. 1301 between A and B, so that the amount of A after 7 years is equal to the amount of B after 9 years, the interest being compounded at 4% per annum.
A. 125 B. 218 C. 345 D. 625

Q21. Find the compound interest on Rs 24000 at 10% per annum for 2 years 6 months
A. Rs 6492 B. Rs 6200 C. Rs 6000 D. Rs 5825

Q22. A certain sum amounts to Rs.7350 in 2 years and to Rs.8575 in 3 years.find the sum and rate percent.
A. 1250 B. 2100 C. 5400 D. 6430

Q23. What is the difference between Compound interest and simple interest on Rs 12800 for 2 years at 10% p.a rate of interest?
A. Rs 120 B. Rs 128 C. Rs 150 D. Rs 172

Q24. A sum of money amounts to Rs.6690 after 3 years and to Rs.10,035 after 6 years on compound interest. find the sum.
A. Rs.3660 B. Rs.4460 C. Rs.4860 D. Rs.5460

Q25. The difference between Compound Interest and Simple Interest on a certain sum of money for 3 years at 10% p.a rate of interest is Rs 1550. Find the principal?
A. Rs 50000 B. Rs 48000 C. Rs 45000 D. Rs 42000

Q26. A sum of money doubles itself at compound interest in 15 years. In how many years will it become eight times?
A. 12 B. 21 C. 34 D. 45

Q27. At Compound interest, a sum of money becomes 2 times itself in 4 years, In how many years will it become 8 times?
A. 10 years B. 12 years C. 14 years D. 15 years

Q28. The Simple Interest on a certain sum of money for 3 years at 8% per annum is Rs 1200. What is the compound interest on the same sum of money at the same rate of interest for 2 years?
A. Rs 640 B. Rs 760 C. Rs 800 D. Rs 832

COMPOUND INTEREST

This chapter contains the questions I discussed and created in our classes or obtained from students as their doubts. All the questions noted, typed, redesigned and rectified by group of volunteers consisting of:

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----------ANSWERS ----------

Q1.A	**Q2.A**	**Q3.C**	**Q4.C**	**Q5.C**	**Q6.C**
Q7.D	**Q8.B**	**Q9.A**	**Q10.A**	**Q11.B**	**Q12.C**
Q13.A	**Q14.C**	**Q15.B**	**Q16.A**	**Q17.D**	**Q18.D**
Q19.C	**Q20.D**	**Q21.A**	**Q22.C**	**Q23.B**	**Q24.B**
Q25.A	**Q26.D**	**Q27.B**	**Q28.D**		

----------ANSWERS AND SOLUTION----------

Q1.A

Q1.Solution:-

A1 = Rs 2400 and A2= 2640

P + Compound Interest for 3 years – PI + Compound Interest for 2 years = Rs 2640 – 2400 = Rs 240

This Rs 240 is the simple interest obtained on Rs 2400 in the 3 rd year.

240 = 2400 x 1 x R/100

R= 10%

Q2.A

Q2 Solution:-

Amount = Rs [7500x(1+(4/100)2] = Rs (7500 x (26/25) x (26/25)) = Rs. 8112.

So, C.I. = Rs. (8112 - 7500) = Rs. 612.

Q3.C

Q3.Solution:-

Given CI= Rs 2520 and Rate of intest R = 10% and T= 2 years

Let Principal P be Rs 100

=> Amount at compound interest

=> $A = 100x(110/100)^2$

=> A= Rs 121

So Compound Interest for 2 years is Rs 21

If CI is Rs 21 then P is Rs 100

So, CI is Rs 1 then P 2520

So, CI is Rs 2520 then P =2520/21x 100 = Rs 12000

Now Simple Interest on Rs 12000 for 2 years at 10% rate of interest per annum

=> SI =PTR/100

=> 12000 x2 x10/100= Rs 2400

Q4.C

Q4 Solution:-

Time = 2 years 4 months = 2(4/12) years = 2(1/3) years.
Amount = Rs. [8000 X (1+(15/100))2 X (1+((1/3)x15)/100)]
=Rs. [8000 x (23/20) x (23/20) x (21/20)]
= Rs. 11109. .
:. C.I. = Rs. (11109 - 8000) = Rs. 3109.

Q5.C

Solution:-

Its present value is Rs 1058000 means that is the amount.
$A= P [1+R/100]^T$
=> Rs 1058000 = $P [1+15/100]^2$ = Rs 800000

Q6.C

Q Solution:-

Principal = Rs. 10000; Rate = 2% per half-year; Time = 2 years = 4 half-years.
Amount =Rs [10000 x (1+(2/100))4]
= Rs(10000 x (51/50) x (51/50) x (51/50) x (51/50))
= Rs. 10824.32.
:. C.I. = Rs. (10824.32 - 10000) = Rs. 824.32.

Q7.D

Q7.Solution:-

The difference between Compound Interest and Simple Interest for 2 years at R% p.a is:
$D =PR^2/100^2$
$R^2 =Dx100^2/P$
$R^2 =10x100x100/4000$
R= 5%

Q8.B

Q8 Solution:-

Principal = Rs. 16000; Time = 9 months =3 quarters;
Rate = 20% per annum = 5% per quarter.
Amount = Rs. [16000 x (1+(5/100))3] = Rs. 18522.
CJ. = Rs. (18522 - 16000) = Rs. 2522.

Q9.A

Q9 Solution:-

Given Principal P= Rs 32000
Rate of Interest =10% and Time period= one and half years = 1 and 1/2years =3/2years
$Amount= P[1 +R/2/100]^{2T}$
=> $A = 32000 [1 +10/200]^{2 \times 3/2}$ = 37044
Compound Interest = Rs 37044 – Rs 32000 = 5044

Q10.A

Q10 Solution:-

Clearly, Rate = 5% p.a., Time = 3 years, S.I.= Rs. 1200. . .
So principal=RS [100x1200]/3x5=RS 8000
Amount = Rs. 8000 x $[1 +5/100]^3$ = Rs. 9261.
C.I. = Rs. (9261 - 8000) = Rs. 1261.

Q11.B

Q11 Solution:-

Given Amount= Rs 30000 Time period T= 3 years and Rate of interest= 25%
We have to find the princpali P
$A = P[1+R/100]^T$
=> $30000 = P[1 + 25/100]^3$
=> $30000 = P\,[5/4]^3$
=> $P = 30000x4/5x4/5x4/5$
= Rs 15,360
On a sum of Rs 15,360, the amount we get in 3 years 25% rate of compound interest is Rs 30000

Q12.C

Q12 Solution:-

Principal = Rs. 1000; Amount = Rs. 1331;
Rate = 10% p.a. Let the time be n years. Then,
[1000 (1+ (10/100))n] = 1331
or (11/10)n = (1331/1000) = (11/10)3
n = 3 years.

Q13.A

Q13 Solution:-

Given Principal = Rs 5000 T= 2 years and Rate of interest for 1 st year is 5% and 2 nd year is 10% =>
R_1= 5% and R_2= 10%
$A = [1+R_1/100][1+R_2/100]$
A = 5000 x [1+5/100][1+10/100]
=> A=5000x21/10x11/10
=> A= Rs 5775
So, compound interest= A – P = 5775 – 5000 = Rs 775

Q14.C

Q14 Solution:-

Principal = Rs. 500; Amount = Rs. 583.20; Time = 2 years.
Let the rate be R% per annum.. 'Then,
[500 (1+(R/100)2] = 583.20 or $[1+(R/100)]^2 = 5832/5000 = 11664/10000$
$[1+(R/100)]^2 = (108/100)^2$ or 1 + (R/100) = 108/100 or R = 8
So, rate = 8% p.a.

Q15.B

Q15 Solution:-

Here the given principal is Rs 80000. Time period is 3 years and rate of interest is 5%.
$A = P\,[1+R/100]^T$ => $A = 80000[1+R/100]^3$
$A = 80000\,x[1 + 5/100]^3$
A= Rs 92610
Compound Interest = Amount – Principal = 92610 – 80000 = Rs 12610

Q16.A

Q Solution:-

Let the sum be Rs. P. Then,
C.I. = [P x (1 + ((50/(3x100))3 - P] = ((343P/216) - P) = 127P/216
127P /216 = 1270 or P = (1270 x 216)/127 = 2160.
So, the sum is Rs. 2160
S.I. = Rs (2160 x (50/3) x 3 x (1 /100)) = Rs. 1080.

Q17.D

Q17 Solution:-

Amount A= Rs 13520 Principal = Rs 12500 Rate of Interest= R and Time period T = 2 years

$A = P[1+R/100]^T$

=> $13520 = 12500[1+R/100]^2$

=> $13520/12500=[1+R/100]^2$

=> $676/625=[1+R/100]^2$

=> $(26/25)^2 =[1+R/100]^2$

=> $[1+R/100] =26/25$

=> $R/100=1/25$

So, rate of interest is 4%.

Q18.D

Q Solution:-

Let the sum be Rs. P. Then,

C.I. = P (1 + (10 /100))2 - P = 21P/100 ,

S.I. = ((P x 10 x 2)/100) = P/5

(C.I) - (S.I) = ((21P/100) - (P/5)) = P/100

So, the sum is Rs.63,100.

Q19.C

Q19 Solution:-

Given the Amount is Rs 22050 And Principal = Rs 20000

Time period T= 2 years

$A = P[1+R/100]^T = 22050 = 20000[1 +R/100]^2$

$22050=20000[1 + R/100]^2$

$441=400[1 + R/100]^2$

$21^2=20^2[1 + R/100]^2$

$21=20(1 + R/100)$

$21 = 10(1 +R/100)$

R= 5%

Q20.D

Q20 Solution:-

Let the two parts be Rs. P and Rs. (1301 - P).

P(1+4/100)7 =(1301-P)(1+4/100)9

P/(1301-P)=(1+4/100)2=(26/25x26/25)

625P=676(1301-P)

1301P=676x1301

P=676.

So,the parts are Rs.676 and Rs.(1301-676)i.e Rs.676 and Rs.625.

Q21.A

Q21 Solution:-

Principal = Rs 24000 Rate of interest = 10% p.a

Time Period = 2 ½ years

For 2 years , the rate of interest is 10% and for next 6 months rate of interest will be 10/2%= 5%

Amount => $A = Rs\ 24000(1 +10/100)^2(1 +5/100)$

A= 24000 x110/100x110/100x105/100

A = 24000 x11/10x11/10x21/10

=30492

Compound interest = Amount – Principal

= Rs 30492 – Rs 24000

= Rs 6492

Q22.C

Q22 Solution:-

S.I on Rs.7350 for 1 year=rs.(8575-7350) = Rs.1225.
Rate=(100x1225/7350x1)%=50/3%
Let the sum be Rs.P.then,
$P(1+50/3x100)^2=7350$
Px7/6x7/6=7350
P=(7350x36/49)=5400.
Sum=Rs.5400.

Q23.B

Q23 Solution :

Simple Interest =PTR/100= 12800 X 2 X10/100= Rs 2560
To find compound interest, first we find Amount
Amount= $P[1 +R/100]^T$
= > $12800 \times [1 +10/100]^2$
=> 12800x11/10x11/10=15488
Compound interest = A – P
=> Rs 15488 – 12800 = Rs 2688
The difference between Compound Interest and Simple Interest = Rs 2688 – Rsd 2560 = Rs 128

Q24.B

Q24 Solution:-

Let the sum be Rs.P.then
$P(1+R/100)^3=6690$ ----------(i) and
$P(1+R/100)^6=10035$ ----------(ii)
On dividing,we get $(1+R/100)^3=10035/6690=3/2$.
Substituting this value in (i),we get:
Px3/2=6690 or P=(6690x2/3)=4460
So,the sum is Rs.4460.

Q25.A

Q25 Solution:-

When the difference between the simple interest and compound interest on P for 3 years at R% rate of interest, then $P =100^3 D/R^2(300+R)$
P=100 x 100 x 100 x 1550/10 2 x (300+10)
P=100 x 100 x 100 x 1550/100 x 310
= Rs 50000

Q26.D

Q26 Solution:-

$P(1+R/100)^{15}=2P$
$(1+R/100)^{15}=2P/P=2$
=> $(1+R/100)^{15}=2$ ----------(i)
Let amount becomes eight times in n years, So , ATP:
$P(1+R/100)^n=8P$
$(1+R/100)^n=8=2^3=[(1+R/100)^{15}]^3$ [Substituting value from equation]
$(1+R/100)^n=(1+R/100)^{45}$
n=45.
So,the required time=45 years.

Q27.B

Q27 Solution:-

At compound interest, a principal is always multiplied.A sum of money becomes 2 times in 4 years.
Means in every 4 years, the principal becomes 2 times.
To become 8 times => 2 3 times (for each 2 times, it takes 4 years) , it takes 3 x 4 = 12 years

Q28.D

Q28 Solution :

Given SI= Rs 1200 T= 3 Years R= 8% T= 3 years
SI =PTR/100
=> 1200 = P x 3 x8/100
=> P = Rs 5000
To find CI, first we find Amount => $A = P[1+R/100]^T$
= Rs 5832
So, Compound Interest = A –P= Rs 5832 – Rs 5000 = Rs 832

PROFIT AND LOSS

Basic formulae:

1. Cost Price, (c.p.) = The price, at which an article is purchased, is called its cost price.
2. Selling price (s.p) = The price, at which an article is sold, is called its selling price.
3. Profit or Gain = (S.P) - (C.P)
4. Loss = (C.P) - (S.P)
5. Gain or Loss is always reckoned on C.P.
6. Gain% = (Gain*100) / C.P
7. Loss% = (Loss*100) / C.P
8. S.P = (100+ Gain %) /100 * (C.P)
9. S.P = (100 - Loss %) / 100 * (C.P)
10. C.P = 100 / (100 + Gain %)* (S.P)
11. C.P = 100 / (100 - Loss %)* (S.P)

Important cases:

1. If an article is sold at a profit of say, 20%, thenS.P.= 120% of C.P..
2. If an article is sold at a loss of say, 20%, thenS.P.= 80% of C.P..
3. When a person sells two similar items, one at a gain of say x% and the other at a loss of say x%. then the seller always incurs a loss given by:
   Loss% = $(x/10)^2$
4. If a seller sells his goods at cost price but uses false weights, then
   Gain% = [Error/(True value - Error) * 100]%

----------**EXERCISE**----------

Q1 . Dipa bought 6 oranges for Rs 10 and sold them at 4 for Rs 6. Find his loss or gain percent.

A. 8% gain B. 10% gain C. 8% loss D. 10% loss

Q2. By selling 33 meter of cloth, one gains the selling price of 11 meters. Find the gain percent.

A. 50% B. 45% C. 40% D. 60%

Q3. If the cost price is 96% ofS.P.then what is the profit%?

A. 1.16% B. 2.16% C. 3.16% D. 4.16%

Q4. The C.P. of 25 articles is equal toS.P.of 20 articles. Find the loss or gain percent.

A. 35% B. 30% C. 25% D. None of these

Q5. When a producer allows 36% commission on retail price of his product, he earns a profit of 8.8%. what would be his profit % if the commission is reduced by 24%?

A. 19.6% B. 29.6% C. 49.6% D. None

Q6. Mita bought cookies at 3 for a rupee. How many for a rupee should she sell to make a profit of 50%.

A. 1 B. 2 C. 1.5 D. None of these

Q7. Meghana buys a calculator for Rs 600 and sells it to Vikash at 10% profit. Vikash sells it to Chandana for 5 % profit. Chandana after using it for certain time, sells it to Dinesh at a loss of 20%. For how much Chandana sell the calculator to Dinesh.

A. Rs 570.50 B. Rs 564.40 C. Rs 554.40 D. None of these

Q8. An article is sold by X to Y at a loss of 20%, Y to Z at a gain of 15%, Z to W at a loss of 5% and W to V at a profit of 10%. If v had to pay Rs 500, how much X paid for it?

A. Rs 520.07 B. Rs 515.07 C. Rs 510.07 D. Rs 505.07

Q9. Mukesh when could not find buyers for his vegetable at Rs 10/kg, reduced the rate to Rs 8.10 per kg but uses a faulty weight of 900 gm in place of 1 kg weight. Find the percent change in the actual price or loss.

A. 8% B. 8.10% C. 9% D. 10%

Q10. Murari marks theS.P.of an article at a profit of 20%. Considering the demand of the article, he further increases the price by 10%. Find the final profit %.

A. 31% B. 32% C. 33% D. 34%

Q11. Pratap sold an item for Rs 4600 and thus makes a 15% profit. Find the profit or loss % if it was sold for Rs 3600.

A. 10% gain B. 11% loss C. 10% loss D. 11% gain

Q12. Priya sells a watch at 5% loss. If she had bought it at 20% more and sold it for Rs 102 more, she would have incurred a loss of 40%. Find the cost price of the watch.

A. Rs.500 B. Rs.550 C. Rs.600 D. Rs.650

Q13. When Priyanka sold an article for Rs 540, she made a loss of 10%. At what price should she sell it, so that she incurs a loss of only 5%.

A. Rs 520 B. Rs 535 C. Rs 555 D. Rs 570

Q14. Puja sells chocolates at a profit of 20% for Rs 60. What will be the percentage loss or gain if she reduces the price to Rs 55 due to less demand.

A. Loss8% B. Gain10%C. Loss12% D. Gain15%

Q15. Rahul buys rice for Rs 1600. He had to sell 1/4th at a loss of 20%. If he is to make an overall gain of 10%, what percentage of profit he needs to make out of the remaining stock of rice?

A. 20% B. 21% C. 25% D. 28%

Q16. A 10% hike in the price of wheat forces Rajkumar to purchase 2 kg less for Rs 110. Find the original price of the wheat.

A. Rs 5/kg B. Rs 7/kg C. Rs 8/kg D. Rs 10/kg

Q17. The C.P. of 21 articles is equal toS.P.of 18 articles.find profit or loss %

A. 12.45% B. 16.66% C. 18% D. 23%

Q18. Rajat sells bananas at a profit of 20%. If he increases the selling price of each banana by 25 paisa, he earns a profit of 45%. Find the initial selling price of each banana and also its cost price.

A. SP = Re1.20, C.P. = Rs 1 B. SP = Re1.50, C.P. = Rs 1

C. SP = Re1.20, C.P. = Rs 1.10 D. None of the above.

Q19. Raju sold two plots for Rs 72 lakh each. On first plot he earns a profit of 16% and on the other plot he loses 16%. How much does he loss or gain in the whole transaction?

A. 2.5% loss B. 3% gain C. 2.56% loss D. 3.56% loss

Q20. Rakesh marks all his goods at 50% above the cost price and thinking that he will still make 25% profit, offers a discount of 25% on the marked price. What is his actual profit on the sales?

A. 12.5% B. 15% C. 17.5% D. 20%

Q21. Priyanka sold an article for Rs. 48, and loses 20%. On what price should she sell it to make a profit of 20%?

A. 72 B. 80 C. 88 D. 96

Q22. Tripti sold an article at 5 % profit instead of selling at a loss of 5%, So she got 5 Rs more. What was the cost price of the article?

A. Rs 25 B. Rs 50 C. Rs 75 D. Rs 100

Q23. Rohit sees that if he doubles the selling price of an article, then he gets triple profit as of orignal profit. Then initial profit percent is:

A. 50% B. 100% C. 150% D. 200%

Q24. A machine was sold at an addition of 10%. Had it been sold at Rs. 80 less, The seller would have lost 10%. What is the expense cost of the machine?

A. 350 B. 400 C. 450 D. 520

Q25. At what percentage above the cost price must an article be marked so as to gain 33% after allowing a discount of 5%?

A. 25% above C.P. B. 35% above C.P. C. 40% above C.P. D. 45% above C.P.

Q26. If books bought at prices ranging from Rs.150 to Rs.250 are sold at prices ranging from Rs.225 to Rs.325, what is the greatest possible profit that might be made in selling 6 books?

A. 650 B. 750 C. 900 D. 1050

Q27. Toffees are bought at the rate of 5 for a rupee. To gain 25% they must be sold at?

A. 4 Toffees for Rs. 2 B. 3 Toffees for Re. 1

C. 4 Toffees for Re. 1 D. 4 Toffees for Rs. 1.5

Q28. If A surpasses B by 40 % and B is less than C by 20 %, then A:C =?

A. 3:1 B. 3:2 C. 26:25 D. 28:25

Q29. The marked price of a shirt and trousers are in the proportion 1:2. The shopkeeper gives 40% discount on the shirt. If the total discount received on both is 30%, then discount received on on trousers is:

A. 15% B. 20% C. 25% D. 30%

Q30. On a payment of Rs. 10000 three progressive rebates of 10%, 10% and 30% and three progressive rebates of 40%, 5% and 5% was available. By picking the better one, he can save:

A. Rs. 200 B. Rs. 255 C. Rs. 400 D. Rs. 433

Q31. Anumita purchases some items at the rate of Rs.100 per item. She decided to sell the first item for Rs. 2, second one for Rs. 4, third for Rs. 6…and so on. She wants to make an overall profit of at least 40%, what is the minimum number of items she should sell?

A. 117 B. 118 C. 119 D. 120

Q32. Traders A and B buy two goods for Rs. 1000 and Rs. 2000 respectively. Trader A marks his goods up by x%, while trader B marks his goods up by 2x% and both offers a discount of x%. If both make the same profit/loss, find x.

A. 25% B. 37.5% C. 51% D. 66.67%

Q33. Anish marks all his goods at 50% above the cost price and thinking that he will still make 25% profit,offers a discount of 25% on the marked price.what is the actual profit or loss?

A. Profit 12.5% B. Loss 15% C. Profit 17.5% D. None

Q34. A retailer buys 40 pens at the market price of 36 pens from a wholesaler ,if he sells these pens giving a discount of 1% ,what is the profit % ?

A. 10 B. 21 C. 34 D. 43

Q35. Avinash gets profit of selling price of 11 dolls by selling 33 peice of dolls. Find the profit percent.
A. 12% B. 25% C. 36% D. 50%

Q36. Nikky bought an article for Rs.1750 and sold it for Rs.1680. Find her gain or loss percent.
A. 3% B. 4% C. 5% D. 6%

Q37. Find the profit or loss as percent while a motorcycle is bought for Rs.25000 and it was sold for Rs.28000.
A. 3% B. 6% C. 9% D. 12%

Q38. Jyoti purchases a mobile for Rs.400 and sold it for Rs.380. Calculate her gain or loss percent.
A. 3% B. 4% C. 5% D. 6%

Q39. Ruby bought an article for Rs.120 is sold for Rs.150. Find the gain or loss percent.
A. 20% B. 23% C. 25% D. 28%

Q40. Shekhar bought a bicycle for Rs.600 and sold it for Rs.550. Find profit or loss percent.
A. 3% B. $8\frac{1}{3}\%$ C. 12% D. 13%

Q41. A shopkeeper bought chocolates at 6 for Rs.10 and sold them at Rs.4 for Rs.6 .Find his profit or loss percent .
A. 10 B. 12 C. 14 D. 15

Q42. Ruby bought a laptop for Rs.8,000 and spent Rs.500 on its spares. Later she sold it for Rs.9,500. Find her gain or loss percent.
A. Gain 100/17% B. Gain 200/17% C. Loss 100/17% D. Loss 200/17%

Q43. A man brought some chocolates at 3 for a rupee. How many for a rupee should he sell to make a profit 50%?
A. 1 B. 2 C. 3 D. 4

Q44. A person incures loss for by selling a watch for rs1140.at what price should the watch be sold to earn a 5% profit ?
A. 1260 B. 2150 C. 3460 D. 4345

Q45. At what % above C.P must an article be marked so as to profit 33% after allowing a customer a discount of 5%?
A. 20% above C.P. B. 40% above C.P. C. 20% below C.P. D. 40% below C.P.

Q46. A man bought a horse and a car riage for Rs 3000.he sold the horse at a profit of 20% and the carriage at a loss of 10%,thereby profiting 2% on the whole.find the cost of the horse.
A. 1200 B. 1400 C. 1500 D. 2000

Q47. Find the single discount equivalent to a series discount of 20% ,10% and 5%
A. Rs48.40 B. Rs56.40 C. Rs68.40 D. Rs76.40

Q48. After getting 2 successive discounts, a shirt with a list price of Rs 150 is available at Rs 105. If the second discount is 12.55,find the first discount.
A. 12% B. 20% C. 24% D. 33.33%

Q49. A dishonest shopkeeper sells his goods at cost price but uses a weight of 960 gms for a kg weight . Find his profit percent.

A. 12% B. 21% C. 34% D. 41%

Q50. A book was sold for rs 27.50 with a profit of 10%. if it were sold for rs25.75, then what would be % of profit or loss?

A. 1% B. 2% C. 3% D. 4%

----------ANSWERS----------

Q1. D	Q2.A	Q3.D	Q4.C	Q5C.	Q6.B
Q7.C	Q8. A	Q9.D	Q10.B	Q11.C	Q12.C
Q13.D	Q14.B	Q15.A	Q16.A	Q17.B	Q18.A
Q19.C	Q20.A	Q21.A	Q22.B	Q23.B	Q24.B
Q25.C	Q26.D	Q27.C	Q28.D	Q29.C	Q30.B
Q31.C	Q32.D	Q33.A	Q34A.	Q35.D	Q36.B
Q37.D	Q38.C	Q39.C	Q40.B	Q41.A	Q42.B
Q43.B	Q44.A	Q45B.	Q46.A	Q47.C	Q48.B
Q49.D	Q50.C				

----------ANSWERS WITH SOLUTION----------

Q1. D

Q1 Solution:-

Suppose, number of oranges bought = LCM of 6 and 4 = 12

∴ C.P. = Rs (10/6 * 12) = Rs 20 andS.P.= Rs (6/4 * 12) = Rs 18

∴ Loss% = (2/20 * 100)% = 10%

Q2.A

Q2 Solution:-

(SP of 33m) - (C.P. of 33m) = Gain =S.P.of 11m

∴ S.P.of 22m = C.P. of 33m

Let C.P. of each meter be Rs 1. Then, C.P. of 22m = Rs 22.

SoS.P.of 22m = Rs 33.

∴ %Gain = 11/22 * 100

= 50%

Q3.D

Q3. Solution:-

S.P. = Rs100

then C.P.=Rs 96:profit =Rs 4.

Profit={(4/96)*100}%=4.16%

Q4.C

Q4 Solution:-

Let the C.P. of each article = Rs 1.

Then C.P. of 20 articles = Rs 20.

SP of 20 articles = C.P. of 25 articles = Rs 25.

∴ Gain% = (5/20)*100% = 25%

Q5C.

Q5 Solution:-

Let the retail price =Rs 100.then, commission=Rs 36

S.P=Rs(100-36)=Rs 64

But, profit=8.8%

C.P=Rs(100/108.8*64)=Rs 1000/17

New commission =Rs12. New S.P=Rs(100-12)Rs 88

Profit=Rs(88-1000/17)=Rs 496/17

Profit%=(496/17*17/1000*100)%=49.6%

Q6.B

Q6 Solution:-

C.P. of 3 cookies = Rs 1
SP of 3 cookies = 150% of Rs 1 = 3/2
For Rs 3/2, the man sells 3 cookies.
So for Rs 1, number of cookies sold = 3*2/3 = 2

Q7.C

Q 7 Solution:-

SP for Chandana = 600 * (110/100) * (105/100) * (80/100)
= 600 * 924/1000
= Rs 554.40

Q8. A

Q8 Solution:-

C.P. for X = 500 * (100/80) * (100/115) * (100/95) * (100/110)
= 500 * 10000/9614
= Rs 520.07

Q9.D

Q9 Solution:-

After the price was reduced, 900 gm now costs Rs 8.10.
So 1000gm will cost (1000/900)*8.10 = Rs 9
% change in actual price or loss = [(10.9)/10]*100%
= 10%

Q10.B

Q10 Solution:-

Let the C.P. = Rs 100
∴ S.P.= 100 * (120/100) * (110/100)
= Rs 132
Final profit = (132.100)*100%
= 32%

Q11.C

Q11 Solution:-

C.P. = 4600 * (100/115)
=Rs 4000
Loss% = [(4000.3600)/4000]*100%
= 10%

Q12.C

Q12 Solution:-

Assume C.P. = 100x
Selling price at the first case = 95x
Cost price at the second case = 120x
Selling price at the second case = 95x + 102
Loss = 120x - (95x + 102) = 25x - 102
As per question,
(25x – 102)/120x = 40/100
25x-102 = 48
25x = 150
Or, x = Rs 6
So initial C.P.= Rs. 600

Q13.D

Q13 Solution:-

C.P. = 540*(100/90)= Rs 600
New S.P.= 600*(95/100)= Rs 570

Q14.B

Q14 Solution:-

C.P. = 60*(100/120)
= Rs 50
NewS.P.= Rs 55
Gain% = (5/50)*100
=10%

Q15.A

Q15 Solution:-

C.P. of 1/4th of the stock = 1600/4 = Rs 400
SP of 1/4th of the stock = 400*(80/100)
=Rs 320
In order to make a profit of 10% on total C.P., theS.P.should be:
SP = 1600*(110/100)
= Rs 1760
∴ TheS.P.for the remaining 3/4th of the stock
should be Rs 1760 - Rs 320 = Rs 1440.
Cost Price of the 3/4th of stock
= Rs 1600 - Rs 400 = Rs 1200.
∴ %Gain = {(1440 - 1200)/1200*}100
= (240/1200)*100
= 20%

Q16.A

Q16 Solution:-

10% of Rs 110 = Rs 11
Cost of 2 kg of wheat at new price = Rs 11
So, cost of 1 kg of wheat at new price = Rs 5.50 = Rs 11/2
Original Price = (11/2)*(100/110)
= Rs 5 per kg

Q17.B

Q17. Solution:-

Let C.P. of each article be Rs 1
So, C.P. of 18 articles =Rs18 ,
AndS.P.of 18 articles =Rs 21.
Profit%=[(3/18)*100]%=50/3%

Q18.A

Q18 Solution:-

Let C.P. = x paisa.
Initial S.P.= x*(120/100) paisa
As per question,
120x/100 + 25 = (145/100)x
Or, 145x/100 - 120x/100 = 25
Or, 25x/100 = 25
Or, x = 100 paisa
C.P. = 100 paisa or Rs 1.
Initial S.P.= 120 paisa or Rs 1.20.

Q19.C

Q19 Solution:-

Applying direct formula, %loss = $(16/10)^2$%
= 64/25%
= 2.56%

Q20.A

Q20 Solution:-

Let C.P. = Rs 100.
The, marked price, MP = Rs 150
SP = 75% of Rs 150 = Rs 112.50
∴ Gain% = 12.50%

Q21.A

Q21 Solution:-

Let the C.P be Rs. x. Then,
80% of x = 48 ⇒ 80/100 *x =48
⇒ x= (48*100/80) = 60
C.P = Rs. 60 and gain =20%
∴ S.P= Rs. (120/100*60) = Rs. 72

Q22.B

Q22 Solution:-

Let the C.P be Rs. x. Then,
∴ (105/100)x - (95/100)x = 5
⇒ 105x - 95x= 500 ⇒10x=500
X= 50
∴ C.P. =Rs. 50

Q23.B

Q23 Solution:-

Let C.P is Rs. x and S.P be Rs. y.
Then, profit = Rs. (y - x)
When selling price is doubled S.P = Rs. 2y and profit = Rs. (2y - x)
ATP
2y – x = 3(y – x) [As new profit is thrice of old profit]
⇒ y= 2x
So original profit is y – x = 2x – x = x
⇒ Profit%= (x/x*100) % = 100%

Q24.B

Q24 Solution:-

Let the C.P be Rs. x. Then , S.P = (110/100*x) =11x/10
New S.P = (90/100*x) = Rs. 9x/10
11x/10 - 9x/10 =80 ⇒ (11x - 9x) =800
2x= 800 ⇒ x=400
∴ C. P= 400

Q25.C

Q25 Solution:-

Let C.P. = Rs 100
Then,S.P.= Rs 133
Let marked price, MP = Rs x
As per question,
95% of x = 133
Or, (95/100)*x = 133
Or, x = (133*100) /95
Or, x = Rs 140
∴ Marked price = 40% above cost price.

Q26.D

Q26 Solution:-

Let us consider all the six books are bought at least cost
150 x 6 = 900
Selling at the highest price
325 x 6 = 1950
∴ Profit = selling price ? cost price
=1950 - 900 = 1050

Q27.C

Q27 Solution:-

Let 5 toffees cost price is Re.1
i.e. 1 toffee cost price is 1/5
i.e., 1/5 + 1/5 x 25% = X
1/5+1/5 x 25/100=X
=> X=1/4
=> 4 Toffees for Re. 1

Q28.D

Q28 Solution:-

B= 80% of C= 80/100*C= 4c/5 and
A= 140% of B=(140b/100) =7B/5
A= 7B/5= 7/5*4C/5 =28C/25
=> A/C =28/25
∴ A: C = 28:25

Q29.C

Q29 Solution:-

Let The M.P Of shirt be Rs. x and that of trousers be rs. 2x.
Let y% be the discount on trousers. Then,
60/100*x+ (100 - y)/100*2x= 70/100*(x+2x)
⇒ 3/5+(100 - y)/50 = 21/10 ⇒ (100 - y)/50 = (21/10.3/5)= 15/10=3/2

⇒ (100 - y)= (3/5*50)= 75 ⇒ y=25
∴ discount on trousers = 25%

Q30.B
Q30 Solution:-

1st payment= 90% 0f 90% of 70% of rs. 10000
= rs. (90/100*90/100* 70/100*10000) =5670
2nd. Payment = 60% of 95% of 95% of 10000.
= (60/100*95/100*95/100*10000)= 5415
By choosing the better one he can save rs . (5670 - 5415) = 255

Q31.C
Q31 Solution:

Let she purchases n items, So cost of all items together is 100n
If she wants to sell it at 20% gain then total selling price is 120n
Now selling price is 2 + 4 + 6 + ...upto n terms > 120n
=> (n/2)[2.2 + (n-1).2] > 120n
=> 2 + n – 1 >/= 120
=> n >/= 119

Q32.D
Q32 Solution:

For trader A
Marked price=1000(1+x/100)=1000+10x
Selling Price=(1000+10x)(1-x/100)=(10000-x^2)/10
Profit/Loss= - x^2/10 ----------(i)
For traders B using same method as above we get
Profit/loss = (200x-4x^2)/10 ----------(ii)
ATP
(i) = (ii)
Equating and solving we get x = 66.67

Q33.A
Q33 Solution:-

Let C.P =Rs 100.then ,marked price =Rs100
S.P=75% of Rs 150=Rs112.50
So,profit%=12.50%

Q34.A.
Q34 Solution:-

let the market price of each pen be Rs 1
then,C.P of 40 pens = Rs 36 S.P of 40 pens =99% of Rs 40=Rs 39.60
profit %=((3.60*100)/36) %=10%

Q35.D
Q35 Solution:-

(SP of 33m)-(C.P. of 33m)=Profit=SP of 11m
SP of 22m = C.P. of 33m
Let C.P. of each dolls be Re.1 ,
Then, C.P. of 22 peice= Rs.22,
SP of 22peice=Rs.33.
Profit%=[(11/22)*100]%=50%

Q36.B

Q36 Solution:-

Cost price of the article = Rs.1750
Selling price of the article = Rs.1680
Since, C.P. > S.P. there is a loss
Loss = cost price - selling price
= Rs.1750 - Rs.1680
= Rs.70
Loss% = (loss/cost price) × 100%
= (70/1750) × 100%
= 4%
Therefore, the loss percent is 4%.

Q37.D

Q37 Solution:-

Given, cost price of motorcycle = Rs.25000 and selling price of it = Rs.28000
Therefore, profit = Rs.28000 - Rs.25000 = Rs.3000
Profit percent = (profit/cost price) × 100%
= (3000/25000) × 100%
= 12%
Therefore, the profit percent is 12%.

Q38.C

Q38 Solution:-

Given, cost price of an mobile = Rs.400 and selling price of it = Rs.380
Therefore, loss = Rs.400 – Rs.380 = Rs.20
Loss percent = (loss/cost price) × 100%
= (20/400) × 100%
= 5%
Therefore, the loss percent is 5%

Q39.C

Q39 Solution:

Given, cost price = Rs.120 and selling price = Rs.150
Therefore, gain = Rs.150 - Rs.120 = Rs.30
gain% = (gain/cost price) × 100%
= (30/120) × 100%
= 25%
Therefore, the gain percent is 25%

Q40.B

Q40 Solution:-

Given, cost price = Rs.600 and selling price = Rs.550
Therefore, loss = C.P. - S.P.
= Rs.600. - Rs.550
= Rs.50
loss percent = (loss/cost price) × 100%
= (50/600) × 100%
= 25/3%
= $8\frac{1}{3}$%

Therefore, the loss percent = $8\frac{1}{3}$%

Q41.A
Q41 Solution:-

Suppose , number of chocolates bought = 12 [LCM of 6 and 4]
C.P.=Rs.[(10/6)*12]=Rs.20
S.P. = Rs[(6/4)*12]=Rs.18
Loss%=[(2/20)*100]%=10%

Q42.B
Q42 Solution:-

Cost price includes the overhead expenses also.
Therefore, C.P. = Rs.8,000 + Rs.500 = Rs.8,500
and S.P. = Rs.9,500
Since, S.P. > C.P., there is a profit
Profit = S.P. - C.P.
= Rs.9,500 - Rs.8500
= Rs.1,000
Profit percent = profit/(C.P.) × 100
= 1000/8500 × 100
= 200/17
Therefore, Ruby's gain percent is 200/17%.

Q43.B
Q43 Solution:-

C.P of 3 chocolate=Re 1;
S.P of 3 chocolate =150% of Re.1=3/2.
For Rs.3/2, chocolate sold =3,
for Re.1, chocolate sold = [3*(2/3)] = 2.

Q44.A
Q44 Solution:-

let the newS.P.be rsx.then
(100-loss%) : (1st sp)=(100+gain%) (2nd sp)
{(100-5)/1400}={(100+5)/x}=> x={(105*1140)/95} =1260.

Q45B.
Q45 Solution:-

Let C.P be Rs 100.then S.P be Rs 133
Let the market price be Rs x
Then 90% of x=133=>95x/100=133=>x=(133*100/95)=140
Market price = 40% above C.P

Q46.A
Q46 Solution:-

Let the C.p of the horse be Rs.x, then C.P of the carriage =Rs(3000-x)
20% of x-10% of(3000-x)=2% of 3000
=> x/5-(3000-x)/10=60=.2x-3000+x=600=.3x+3600
=> x=1200
=> So,C.P of the horse =Rs 1200

Q47.C

Q47 Solution:-

let the marked price be Rs 100
then ,net S.P=95% of 90% of 80% of Rs 100
=Rs(95/100*90/100*80/100*100)=Rs68.40

Q48.B

Q48 Solution:-

Let the first discount be x%
Then,87.5% of (100-x)% of 150= 105
=> 87.5/100*(100-x)/100*450=150
=> 100-x=(105*100*100)/(150*87.5)=80
=> x=(100-80)=20
=> first discount = 20%

Q49.D

Q49 Solution:-

Profit% =[Error *100]% = [(40/960)*100] % = 41 %

Q50.C

Q50 Solution:-

S.P. = Rs 27.50: profit =10%.
Solution:- C.P.=rs {(100/110)*27.50}=rs 25.
WhenS.P.=Rs25.75 ,profit =Rs(25.75-25)=Rs 0.75
Profit%={(0.75/25)*100}%=75/25%=3%

"I like criticism. It makes you strong." —*LeBron James*

WORK AND TIME

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Concept #1.- Work done

If a person 'A' can do a work in 'n' days, then A's 1 day's work will be = 1/n

Example. If a person 'A' can do a work in 4 days, then A's 1 day's work = ¼

So, No. of days = total work / work done in 1 day

$$\text{Complete Time} = \frac{1}{1\ Day's\ Work}$$

Concept #2. – Part of Work Done :

If A's 1 day's Work = 1/n, then after X days, A's work = x (1/n)

Ex – If A's 1 day's work = 1/6, then after 3 days, A's work = 3(1/6)

$$\text{Part of work done} = No.\ of\ \text{days}\ worked\ x\ 1\ day's\ work = \frac{No.\ of\ days\ worked}{\text{Complete}\ time}$$

Concept #3. – Combined 1 Days Work :

When more than one person are working on the same job, then their combined 1 day's work = sum of 1 day's work for each person.

Example.- If A can do a job in 'n' days and B can do it in 'm' days and both A and B together can do it in 'T' days, then

A's 1 day's work = 1/n, B's 1 days work = 1/m

(A+B)'s combined 1 day's work = 1/T (concept -2) = A's 1 day's work + B's 1 day's work

$$\frac{1}{T} = \frac{1}{M} + \frac{1}{N}$$

$$T = \frac{MXN}{M+N}$$

Similarly, if A,B and C are working on a work, then (A+B+C)'s 1 day work = A's 1 day's work + B's 1 day's work + C's 1 day's work.

⇒B's 1 day's work = (A+B+C)'s 1 day's work – A's 1 day's work – C's 1 day's work.

Concept #4. – Comparison of Two Worker's Rate:
If a person A is 'n' time as good workman as another person B, then Complete time by A/ = 1/n

And after any time, A's work /B's work = n

Concept #6. – Chain Rule:

$$\frac{Man1 * Day1 * Workrate1}{amount\ of\ work\ done1} = \frac{Man2 * Day2 * Workrate2}{amount\ of\ work\ done2}$$

So from the chain rule we can make the following relationship:

1. Relationship between Men and Work.

More men ==========⇒ can do ==========⇒ More work

Less men ==========⇒ can do ==========⇒ Less work

2. Relationship between Work and Time

More work ==========⇒ takes ==========⇒ More Time

Less work ==========⇒ takes ==========⇒ Less Time

3. Relationship between Men and Time

More men ==========⇒ can do in ========⇒ Less Time

Less men ==========⇒ can do in ========⇒ More Time

Additional Concepts:

1. If A is twice as good as worker B, then A's 1 day's work / B's 1 day's work = 2/1, A's time/B's time = ½
2. If x men can do a job in t1 days and y man in t2 days, then (p men + q women) can do the work in 1/(p/xt1 + q/yt2) days.

$$Time = \frac{1}{\frac{p}{x*t1} + \frac{q}{y*t2}}\ days$$

2. x men or y women can do a work in t days, then (p men + q women) can do the same work in t/(p/x + q/y) days.

$$Time = \frac{t}{\frac{p}{x}+\frac{q}{y}} \text{ days}$$

2. If a person A can do a work in 'n' days and A+B together can do it in 'T' days, then B alone can finished the work = T * n / n-T days.

$$Time = \frac{T * n}{n-T} \text{ days}$$

----------**EXERCISE**----------

Q1. Laxman and Rajkumar can do a work in 12 days. Rajkumar and Suman can do it in 15 days while Suman and Laxman can do it in 20 days. In how many days will they complete it together?

A. 10 days. B. 12 days. C. 15 days. D. 20 days.

Q2. Two printer A and B can together print 3,00,000 pages in 10 hour, if B alone can print the same number of pages in 15 hour, then how much pages can A print alone in 10 hour?

A. 2,00,000 B. 1,00,000 C. 75,000 D. 50,000

Q3. Abhishek can do 1/3rd of a work in 5 days and Binod can do 2/5th of the work in 10 days. In In how many days many days both Abhishek and Binod working together can complete the work?

A. $7\frac{3}{4}$ days B. $8\frac{4}{5}$ days C. $9\frac{3}{8}$ days D. 10 days

Q4. Mohan can do a work in 14 days and Rajat can alone do in 21 days. They start together but 3 days before the finishing of the work, Mohan leaves. Then total number of days to finished the work?

A. $6\frac{1}{5}$ days B. $8\frac{1}{5}$ days C. $10\frac{1}{5}$ days D. $12\frac{1}{5}$ days

Q5. Manu can do a work in 30 days and Nehal can do it in 40 days, If they work together and get total labour cost as Rs. 7000, what is the share of Nehal?

A. 2000 B. 3000 C. 4000 D. 6500

Q6. Agniwesh can do a work in 8 days. Bikash can do the same work in 10 days. In how many days both can do it working together?

A. $4\frac{4}{9}$ days B. $5\frac{4}{9}$ days C. $6\frac{4}{9}$ days D. $7\frac{4}{9}$ days days

Q7. Rakesh and Suraj together can do a work in 12 days. Same work Rakesh alone can do in 30 days. In how many days can Suraj alone do it?

A. 18 days B. 19 days C. 20 days D. 21 days

Q8. Jeet can do a work in 25 days which Sukant can complete in 20 days. Both together worked for 5 days then Jeet leaves. How many days will Sukant take to complete the remaining work?

A. 7 days B. 8 days C. 9 days D. 11 days

Q9. Abhilash can do 1/4th of a work in 10 days, Raju can do 40% of the work in 40 days and Udit can do 1/3rd of the work in 13 days. Who will finish the work first?

A. Abhilash B. Raju C. Udit D. All together

Q10. If 20 man or 24 women or 40 boy can do a job in 12 days working for 8 hours a day, how many man working with 6 women and 2 boy take to do a job four times as big working for 5 hours a day for 12 days?

A. 120 man B. 122 men C. 128 men D. 134 men

Q11. A can do a work in 10 days and B alone can do it in 15 days. They worked together for 5 days and then C finishes remaining work C in 2 days. If they together get Rs. 4500. Find share of C.

A. Rs 450 B. Rs 600 C. Rs 750 D. Rs 900

Q12. Ranjan and Sukant together can complete a work in 8 days. Ranjan can do same work alone in 12 days. In how many days Sukant can complete the work aone?

A. 16 days B. 20 days C. 24 days D. 30 days

Q13. 3 man or 5 women can do a work in 12 days. In how many days will 6 man and 5 women can complete the work?

A. 4 days B. 10 days C. 15 days D. 20 days

Q14. 10 women can finish a work in 8 days and 10 boys take 12 days to finish the work. In how many days will 6 women and 3 boys together take to finish the work?

A. 7 B. 10 C. 9 D. 12

Q15. Avinash and Bikram took a contract do a work for Rs 4500. Avinash alone can do it in 8 days and Bikram alone in 12 days. With the help of Chandan, they completed the work in 4 days. Then share of Chandan:

A. 575 B. 750 C. 900 D. 1250

Q16. A group of persons can finish a work in 60 days. If there were 8 person more, the work could be done in 10 days less. What was the number of persons man initially?

A. 30 B. 40 C. 32 D. 36

Q17. 9 boys can finish a work in 360 days. 18 man can finish the same work in 72 days and 12 women can finish it in 162 days. In In how many days can 4 men, 12 women and 10 boys together finish the bit of work?

A. 68 days B. 81 days C. 96 days D. 124 days

----------ANSWERS AND SOLUTION----------

Q1.A

Q1 Solution:-

(Laxman and Rajkumar)'s 1 day work = 1/12,
(Rajkumar and Sauman)'s 1 day work = 1/15,
(Suman and Laxman)'s 1 day work = 1/20
2(Laxman and Rajkumar and Suman)'s 1 day work = (1/12+ 1/15+ 1/20)= 12/60 = 1/5
∴ (Laxman and Rajkumar and Suman) `s 1 day work = (1/2 *1/5) = 1/10
∴ working together they can complete the work in 10 days.

Q2.B

Q2 Solution:-

Machines A and B together will produce 30,000 m of cloth in 1 hour.
Machine B alone can produce 20,000 m cloth in 1 hour.
So, Machine A can produce 10,000 m cloth in 1 hour.
So, in 10 hour Machine A can produce 1,00,000 m of cloth.

Q3.C

Q3 Solution:-

1/3 work is done by Abhishek in 5 days.
Whole work will be done by Abhishek in 15 days.
2/5 work is done by Binod in 10 days.
Whole work will be done by Binod in (10*5/2) days i.e 25 days
(Abhishek+Binod) 's 1 days work = (1/15+1/25) = 8/75
∴ Abhishek and Binod can do the work in 75/8 = $9\frac{3}{8}$ days

Q4.C

Q4 Solution:-

Rajat's 3 days work = (3*1/21)= 1/7 ; Remaining work = (1-1/7) = 6/7
(Mohan and Rajat)'s 1 day's work = (1/14+ 1/21) = 5/42
5/42 work is finished by (Mohan and Rajat) in 1 day.
6/7 work is finished by (Mohan and Rajat) in (42/5 * 6/7) days = 36/5 days
Total no. of days = (3+36/5) = 51/5 days=$10\frac{1}{5}$ days.

Q5.B

Q5 Solution:-

Manu's 1 days work = 1/30,
Nehal's 1 day work = 1/40,
Ratio of their shares = 1/30:1/40 = 4:3
Nehal's share = (7000*3/7) = Rs. 3000

Q6.A

Q6 Solution:-

Agniwesh's 1 day wor 1/8, Bikash`s 1 day work = 1/10
∴ (Agniwesh and Bikash) 1 day work = (1/8+1/10) = 9/40
Both together can do it in 40/9 days = $4\frac{4}{9}$ days

Q7.C

Q7 Solution:-

(Rakesh and Suraj)'s 1 day work = 1/12, Rakesh's 1 day work =1/30

∴ Suraj's 1 day work = (1/12-1/30) = 3/60 = 1/20
So , Suraj alone can do it in 20 days.

Q8.D
Q8 Solution:-
(Jeet and Sukant)'s 5 days work = 5(1/25+1/20) = (5*9/100) = 9/20
Remaining work = (1-9/20) = 11/20
1/20 work is finished by Sukant in 1 day
11/20 work is finished by Sukant in (1*20*11/20) = 11 days

Q9.C
Q9 Solution:-
1/4th of the work is done by Abhilash in 10 days.
Whole work will be done by Abhilash in (10*4/1) = 40 days
40/100 of the work is done by Raju in 40 days.
Whole work will be done by Raju in (40*5/2) = 100 days
1/3 of the work is done by Udit in 13 days.
Whole work will be done by Udit in (13*3/1) = 39 days
So we see that Udit will complete the work first.

Q10.B
Q10 Solution:-
Amount of work done by 20 man = 24 women = 40 boy or 1 man = 1.2 woman = 2 men.
The man hours required to complete the new job = 4 times the man hours required to complete the old job. (As the new job is 4 times as big as the old job)
Let n be the number of man required.
$n\times5\times12=20\times8\times12\times4$
or n=128
i.e. 128 man working on the job will be able to complete the given job.
However, the problem states that 6 women and 2 man are working on the job.
6 women =6/1.2 = 5 man and 2 man = 1 man.
∴ The equivalent of 5+1=6 man are already working.
Thus, final number of man working,
$=128-6=122$ men

Q11.C
Q11 Solution:-
(A+B)'s 5 days work = 5(1/10+ 1/15)= (5* 1/6)= 5/6
Remaining work = (1-5/6) = 1/6
C's 2 days work = 1/6
(A's 5 day work): (B's 5 day work): (C's 2 days work)
= 5/10: 5/15: 1/6
= 15: 10:5 = 3:2:1
A's offer = (4500*3/6) = Rs. 2250
B's offer = (4500*2/6) = Rs. 1500
C's share= (4500*1/6) = Rs. 750

Q12.C
Q12 Solution:-
(Ranjan +Sukant)'s 1 day work = 1/8
Ranjan 1 day work = 1/12

Sukant 1 day work = (1/8-1/12) =1/24
∴ Sukant alone can finish the work in 24 days.

Q13.A
Q13 Solution:-
3 man =5 women ⇒(6 man +5 women)=15 women
Now, 5 women can do it in 12 days.
1 woman can do it in (12*5) days.
15 women can do it in 12*5/15days=4days.

Q14.B
Q14 Solution:-
10 women 1 days work =1/8 ⇒1 women 1 day work = 1/80
10 boys 1 day work = 1/12 ⇒1 boys 1 day work = 1/120
(6 women + 3 boys) 1 day work = (6/80 +3/120) = (3/40+ 1/40) = 4/40 = 1/10
So, they can finish the work in 10 days.

Q15.B
Q15 Solution:-
Avinash's 1 day work = 1/8 ,Bikram's 1 day work = 1/12
(Avinash+Bikram+Chandan) 's 1 days work = 1/4
Chandan 's 1 day work = ¼ - (1/8+ 1/12) = (1/4 -5/24) = 1/24
Avinash: Bikram: Chandan = 1/8: 1/12: 1/24 = 3:2:1
Chandan's share = (4500x1/6) = Rs. 750

Q16.B
Q16 Solution:-
Let there be x man initially.
X man finish the work in 60 days and (x+8) finish it in 50 days.
X man finish the job in 60 days.
⇒ 1 man can finish it in 50 (x+8) days.
∴ 60 x = 50(x+80)
⇒ 10 x= 400
⇒ x = 40
So, there were 40 person initially.

Q17.B
Q17 Solution:-
9 boys 1 day work = 1/360 ⇒1 child 1 day work = 1/3240
18 man 1 day work = 1/72 ⇒1 man 1 day work = 1/1296
12 women 1 day work = 1/162 ⇒1 women 1 day work = 1/1944
(4men +12 women +10 boys) 1 day work = (4/1296+ 12/1944+10/3240)
= (1/324+1/162+1/324) = 4/324 = 1/81
So they can finish the work in 81 days.

"Difficulties are meant to rouse, not discourage. The human spirit is to grow strong by conflict." —*William Ellery Channing*

PIPES AND CISTERNS

Concept 1.

If an inlet pipe can fill a cistern in 'x' hours, then

$$\text{Filling work done in 1 hour} = \frac{1}{x} = \text{Part of cistern filled in 1 hour}$$

Concept 2.

If an outlet pipe can empty a cistern in 'y' hours, then

$$\text{Empty work done in 1 hour} = \frac{1}{y} = \text{Part of cistern emptied in 1 hour}$$

Concept 3.

Net work done in 1 hours = (filling work in 1 hour) – (Empty work in 1 hour)

$$W = \frac{1}{x} - \frac{1}{y} = \text{Part of cistern filled or emptied}$$

If W is ve, then cistern is emptied.

Concept 4.

$$\text{Total filling or emptying time of cistern} = T = \frac{1}{W} = \frac{x * y}{y - x}$$

Concept 5.

If more than one inlet pipe or more than one out let pipes are fitted, then

$$\text{Net work done in 1 hour} = \left(\frac{1}{x1} + \frac{1}{x2} + ..\right) - \left(\frac{1}{y1} + \frac{1}{y2} + ..\right)$$

$$\text{Filling or empty time} = T = \frac{1}{\text{net work done in 1 hour}}$$

Time taken to fill or Empty = 1/part filled or emptied in 1 hour

Concept 6.

If one inlet pipe can fill in t1 hours and one outlet pipe can empties it in t2 hours, then part of cistern filled or emptied in 1 hours = (1/t1 – 1/t2)

Note : Chain rule will work here same as Time and Work problem.

Problem on Leakage:
Two fill pipes can respectively fill a cistern, say, in 'x' hours and 'y' hours respectively, but due to leakit takes 'P' hours extra to fill the cistern. Now both pipes are closed and the fill cistern can be emptied through the leak in 'T' hours,

$$\textbf{Empty time by leak} = T = \frac{\left(\frac{1}{x}+\frac{1}{y}\right)+\frac{1}{p}}{\left(\frac{1}{x}+\frac{1}{y}\right)^2}$$

If there is only one fill pipe, then above relation can be reduces to
Empty time by leak, T

$$\textbf{Empty time by leak} = T = \frac{x(x+p)}{p}$$

----------EXERCISE----------

Q1. Two pipes A and B can fill a tank in 24 hours and 30 hours respectively. If both the tap are opened then how much time will be needed fill it completely?

A 12 hours 10 min B 13hours20 min C 12 hours 20 min D 11 hours 20 min

Q2. A tap can fill a tank in 15 hours. But due to leakage in the bottom; it is filled in 20 hours. If the tank is full, what amount of time is required to empty it completely.

A 40 hours B 50 hours C 60 hours D 70 hours

Q3. Taps A and B can fill a tank in 6 hours and 9 hours respectively and tap C can fill it in 12 hours. If all of the taps are opened together. What amount of time is required to fill it,

A 39/7 hours B 36/7 hours C 38/7 hours D 34/7 hours

Q4. If two pipes function together, tbe tank will be filled in 12 hours. One pipe fills the tank 10 hours faster than tbe otber. How many hours does it take the second pipe to fill the tank?

A 10 hours B 20 hours C 30 hours D 40 hours

Q5. Tap A and B together can fill a tank in T hours. If A fills alone it take T+5 hourss. If B fills alone and fills the same tank, it will take T+45 hours. What is T?

A 25 Hours B 60 Hours C 15 Hours D None of these

Q6. Two pipes A,B can fill a tank in 24 min. and 32 min. respectively. If both the pipes are opened together, after how much time B should be closed so that the tank is full in 18 min.?

A 8 min B 12 min C 15 min D 14 min

Q7. In 1 minute 3/7 of a container is filled. Container can be filled completely in:

A 2 min B 4/3 min C 7/3 min D None

Q8. A taps can fill a tank in x hours and another tap can exhaust it in y (y>x) hours. If both the Taps are opened, In what time will the tank be filled?

A (x-y) hours B (y-x) hours C xy/(x-y) hours D xy/(y-x) hours

Q9. A tank has an outlet tap that can empty it in 40 minutes. An inlet tap with double radius that of outlet is also opened then the full tank will be emptied in:

A 8 min B 40/3 min C 30 min D 38 min

Q10. Two pipes can fill a tank in 10 hours and 12 hours respectively while a third, pipe empties the full tank in 20 hours. If all the three pipes are opened together, in how much time will the tank be filled?

A 5 hours 30 min B 6 hours 30 min C 7 hours 30 min D 8 hours 30 min

Q11. Pipes A and B can fill a tank in 12 min and 16 min respectively. Both are kept open for 'N' min and then B is closed and A fills the rest of the tank in 5 min. The time 'N' after which B was closed is:

A 3 min B 2 min C 5 min D 4 min

Q12. A tap can fill a tank in 6 hours. After a large portion of the tank is filled, three more taps of same capacity are opened. In what time will the tank be filled completely?

A 3hours 15 min. B 3 hours 45 min. C 4 hours D 4 hours 15 min

Q13. If two taps are opened at the same time, the tank will be filled completely in 12 hours. If one tap fills the tank 10 hours faster than the other. How long does the faster tap take to fill the tank?

A 25 hours B 28 hours C 30 hours D 35 hours

Q14. Two pipes A and B can ill a tank in 36 hours and 45 hours respectively. If both the pipes are opened together, how much time will be taken to fill the tank?

A 10 hours B 15 hours C 18 hours D 20 hours

Q15. A pump can fill a tank in 2 hours. Because of a leakage in the tank, it takes 7/3 hours to fill the tank. The leak can empty the full tank in:

A 8 hours B 7 hours C 7/3 hours D 14 hours

Q16. Taps A and B can fill a bucket in 12 min and 15 min respectively. If both the taps are opened and tap A is closed after 3 mins, how much further time would it take for tap B to fill the bucket?

A 8 min 5 sec B 8 min 15 sec C 7 min 45 sec D 7 min 15 sec

Q17. Two pipes can fill a cistern in 10 hour and 12 hour respectively, while the third can empty it in 20 hour. If all pipes are opened together, then the cistern will be filled in

A 7.5 hr B 8 hr C 8.5 hr D 10 hr

Q18. An electric pump can fill a tank in 3 hours. Because of a leakage in the tank it took $3\frac{1}{2}$ hours to fill the tank. If the tank is full, how much time will the leak take to empty it ?

A 10 hours B 21 hours C 30 hours D 40 hours

Q19. Two pipes A and B can fill a tank in 36 bours and 45 bours respectively. If both the pipes are opened together, bow much time will be taken to fill the tank?

A 20 hours B 22 hours C 24 hours D 28 hours

Q20. Two Pipes A and B can fill a tank in 24 minutes and 32 minutes respectively. If both the taps are opened together, after what amount of time should B be closed so that the tank be full in 18 minute?

A 10 min B 8 min C 12 min D 15 min

Q21. Two Pipes A and B can fill a tank in 1 hour and 75 minutes respectively. There is an outlet pipe C If all the three e taps are opened together, the tank is full in 50 minutes. What amount of the reality of the situation will become obvious eventually taken by C to fill the full tank?

A 20 minutes B 50 minutes C 100 min D 80 min

Q22 Two taps can fill a tank in 14 hours and 16 hours respectively. The taps are opened but it is found that because of leakage in the base it took 32 minutes more to fill the tank. Once the tank is full, in what time, leakage will empty the full tank?

A 5 hr B 8 hr C 9 hr D 10 hr

Q23. A cistern has two taps which fill it in 12 minutes and 15minutes respectively. There is also a waste pipe in the cistern. When all the 3 are opened ,the empty cistern is full in 20 minutes. How long will the waste pipe take to empty the full cistern?

A 9 min B 10 min C 15 min D 14 min

Q24. A tank has two taps A and B. A and B can fill the tank completely in 45 minutes and in 60 minutes respectively. If both the taps are opened alternatively for 1 minute, then in what time the empty tank will be filled completely?

A 2 hours 55 min 15sec B 3 hours 40 min 15sec

C 5 hours 53 min 15 sec D 5 hours.58 min 15 sec

Q25. Two taps can fill a tank in 12 min and 18 min respectively. Both the taps are kept open for 2 min and then the tap that fills the tank in 12 min is turned oF. In how many more minutes will the tank be filled?

A. 9 B. 12 C. 13 D. 10

Q26. Two pipes A and B can fill a tank in 36 min. and 45 min. respectively. A water pipe C can empty the tank in 30 min. First A and B are opened. after 7 min, C is also opened. In how much time, the tank is full?

A 39 min B 42 min C 45 min D 54 min

Q27. Two pipes can fill a cistern in 14 hours and 16 hours respectively. The pipes are opened together and it is found that due to leakage in the bottom it took 32 minutes more to fill the cistern.When the cistern is full, in what time will the leak empty it?

A 110 hours B 112 hours C 115 hours D 140 hours

Q28. Two pipes can fill a tank in 20 and 24 minutes respectively and a waste pipe can empty 3 litres per minute. All the three pipes working together can fill the tank in 15 minutes. The capacity of the tank in litres is

A 100 B 110 C 120 D 140

Q29. Due to hole at the botom of the tank, a tap takes 2 more minutes to completely fill the tank. Due to leakage of water through this hole, a bucket filled completely with water gets emptied in 4 minutes. In how much time can the tap fill the tank, if there was no hole at the bottom at the tank?

A. 1 min B. 2 min C. 4 min D. 6 min

This chapter contains the topics and questions I discussed and created in our classes or obtained from students as their doubts. All the questions noted, typed, redesigned and rectified by group of volunteers consisting of:

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----------ANSWERS----------

Q1.B	**Q2.C**	**Q3.B**	**Q4.C**	**Q5.C**
Q6.A	**Q7.B**	**Q8.D**	**Q9.B**	**Q10.C**
Q11.D	**Q12.B**	**Q13.C**	**Q14.D**	**Q15.D**
Q16.B	**Q17.A**	**Q18.B**	**Q19.A**	**Q20.B**
Q21.C	**Q22.B**	**Q23.B**	**Q24.D**	**Q25.C**
Q26.A	**Q27.B**	**Q28.C**	**Q29.B**	

----------ANSWERS WITH SOLUTION----------

Q1.B

Q1 Solution:-

Part filled by A in 1 hour = $\frac{1}{24}$, part filled by B in 1 hour = $\frac{1}{30}$

Part filled by (A+B) in 1 hour = $(\frac{1}{24}+\frac{1}{30}) = \frac{9}{120} = \frac{3}{40}$

Time taken by both to fill the tank = $\frac{40}{3}$hours = 13 hours 20 min.

Q2.C

Q2 Solution:-

Work done by the break in 1 hour = (1/15-1/20) = 1/60
Time taken by the break to empty it = 60 hours

Q3.B

Q3 Solution:-

Net part filled in 1 hour = (1/6+1/9+1/12) = 7/36
So, the tank will be full in 36/7 hours.

Q4.C

Q4 Solution:-

let the tank be filled by first pipe in t hours.
Then ,second pipe fill it in (t+10)hours.

So $\frac{1}{t}+\frac{1}{t+10}=\frac{1}{12}$

=> $\frac{t+10+t}{t(t+10)} = \frac{1}{12}$

=> $t^2-14t-120=0$
=> $(t-20)(t+6)=0$
=> $t=20$ [neglecting the negative value of t]
So, the second pipe will take (20+10)= 30 hours.

Q5.C

Q5 Solution:-

When Tap A and Tap B filling together, they take T time
So in one hour they fill 1/T parts
Tap A fills in T + 5 hour to fill means in one hour it fills 1/(T+5) parts
Similarly Tap B fills in T + 45 hour to fill means in one hour it fills 1/(T+45) parts
So we get
1/(T+5)+1/(T+45)= 1/T days.
Solving we get T=15

Q6.A

Q6 Solution:-

let B be closed after t min. then ,
Part filled by (A+B) in t min. +part filled by A in (18-t)min.=1
So tx[(1/24)+(1/32)]+(18-t)x(1/24)=1
=> (7t/96) + ((18-t)/24)=1.
=> 7t +4x(18-t)=96.
So, be must be closed after 8 min.

Q7.B

Q7 Solution:-

Part filled in 1 min. = 3/7.
So, remaining part = (1- 3/7)= 4/7
Let the required time be t min.
3/7: 4/7:: 1: t ⇒ 3t/7 = (4/7x1) ⇒ t= 4/3 min.

Q8.D

Q8 Solution:-

Work done by filling pipe in 1 hr = 1/x
Work done by emptying pipe in 1 hr = 1/y
Net filling work done by both in 1 hr = (1/x- 1/y) = (y-x)/xy
∴ The tank will be filled in xy/(y-x) hours.

Q9.B

Q9 Solution:-

A pipe with double diameter will take half time.
So, the second pipe can empty the full tank in 20 min.
Part emptied by both in 1 min. (1/40+ 1/20) = 3/40
Time taken to empty the full tank = 40/3 min.

Q10.C

Q10 Solution:-

Net part filled in 1 hour =(1/10)+(1/12)-(1/20)=(8/60)=(2/15).
The tank will be full in 15/2 hours = 7 hours 30 min.

Q11.D

Q11 Solution:-

ATP:
n(1/12+1/16)=7n/48
⇒ Left capacity = 1−7n/48
This is filled by A in 5 min and fills 1/12 in 1 min
⇒ (48−7n)/48=5/12
n= 4 min

Q12.B

Q12 Solution:-

Time taken by the tap to make the tank half full= 3 hours.
Remaining part = 1/2
Part filled by 4 taps in 1 hour= (4x1/6) = 2/3
2/3 part is filled in 1 hour.
1/2 part is filled in (3/2x1/2) hr = 3/4 hr = 45 min.
Required time = 3hours 45 min.

Q13.C

Q13 Solution:-

Suppose that one pipe takes t hours to fill the tank.
Then ATP the other pipes takes (t-10) hours.

∴ $1/t + 1/(t-10) = 1/12$

⇒ $12(t-10+t) = t(t-10)$

⇒ $t^2-34t+120=0$

⇒ $(t-30)(t-4)=0$

⇒ $t= 30$ or $t= 4$

So, the faster tap takes 30 hours to fill the tank.

Q14.D

Q14 Solution:-

We have: $T = xy/(x+y)$
$= (36x45)/(36+45)$
$= 1620/80 = 20$ hours

So, Part filled by A in 1 hour = 1/36
Part filled by B in 1 hour = 1/45
Part filled by (A+B) in 1 hour = (1/36 + 1/45) = 1/20

∴ Both the pipes can fill the tank in 20 hours.

Q15.D

Q15 Solution:-

Part of the tank filled by the pump in 1 hour = 1/2
Part of the tank filled by the pump in 1 hour because of the leak = 3/7

∴ Part of the tank emptied by the leak in 1 hour = 1/2 - 3/7 = 1/14

∴ Leak will empty the tank in 14 hours.

Q16.B

Q16 Solution:-

Part of bucket filled by tap A and B together in 1 min = 1/12 + 1/15= 3/20

∴ Part of bucket filled by A and B in 3 min = 3x3/20= 9/20
Remaining part = 1 - 9/20= 11/20
Tap B can fill 11/20 part in 15x11/20 = 33/4 min
= 8 min 15 sec

Q17.A

Q17 Solution:-

Work done by all the tanks working together in 1 hour.
1/10+1/12−1/20=2/15
So, tank will be filled in 15/2=7.5 hour

Q18.B

Q18 Solution:-

Work done by the leak in 1 hour=(1/3)-(1/(7/2))=(1/3)-(2/7)=(1/21).
The leak will empty .the tank in 21 hours.

Q19.A

Q19 Solution:-

Part filled by A in 1 hour = (1/36);
Part filled by B in 1 hour = (1/45);
Part filled by (A + B) In 1 hour =(1/36)+(1/45)=(9/180)=(1/20)
So, both the pipes together will fill the tank in 20 hours.

Q20.B

Q20 Solution:-

Let B be closed after t minutes. At that point, (part filled by (A+B) in t min.) + [part filled by A in (18-t) min] = 1

∴ t (1/24+ 1/32) + (18-t)x1/24 = 1

=> 7t/96 + (18-t)/24 =1

=> 7t+4(18-t) = 96

=> 3t= 24

=> t = 8

So, B should be closed after 8 min.

Q21.C

Q21 Solution:-

Work done by C in 1 min. = (1/60 +1/75-1/50) = 3/300 = 1/100

So, C can empty the full tank in 100 minutes.

Q22.B

Q22 Solution:-

Work done by the two taps in 1 hour= (1/14+ 1/16) = 15/112

Time taken by these taps to fill the tank = 112/15 hours = 7 hours 28 min.

Because of leakage, time taken = 7 hours. 28 min. + 32 min. = 8 hours.

∴ Work done by (two taps + spill) in 1 hour = 1/8

Work done by the break in 1 hour = (15/112-1/8) = 1/112

Break will empty the full tank in 8 hours.

Q23.B

Q23 Solution:-

Workdone by the waste pipe in 1min

=(1/20)-(1/12)+(1/15) = -1/10 [negative sign means emptying]

So the waste pipe will empty the full cistern in 10min

Q24.D

Q24 Solution:-

Work done by A in 1st minutes and B 2nd minute= (1/45- 1/60)= 1/180

Part filled in 2 min = 1/180

Part filled in 358 min = (1/360x358) = 358/360 = 179/180

Remaining part = (1-179/180) = 1/180

1/45 part is filled by A in (45x1/180) min= 1/4 min.

Total time taken to fill it = 358 1/4 min = 5 hours.58 min 15 sec

Q25.C

Q25 Solution:-

In 2 minutes, the taps fill 2(1/12+1/16) or 5/18 of the tank.

So, (13/18)th of the tank is to be filled by the second tap at the rate of 118118 of the tank per minute.

This will take another 13 minutes.

Q26.A

Q26 Solution:-

Part filled in 7 min. = 7x((1/36)+(1/45))=(7/20).

Remaining part=(1-(7/20))=(13/20).

Net part filled in 1min. when A,B and C are opened=(1/36)+(1/45)-(1/30)=(1/60).

Now,(1/60) part is filled in one minute.

(13/20) part is filled in [60x(13/20)]=39 minutes.

Q27.B

Q27 Solution:-

Work done by the two pipes in 1 hour =(1/14)+(1/16)=(15/112).
Time taken by these pipes to fill the tank = (112/15) hours = 7 hours 28 min.
Due to leakage, time taken = 7 hours 28 min + 32 min = 8 hours
Work done by (two pipes + leak) in 1 hour = (1/8).
Work done by the leak m 1 hour =(15/112)-(1/8)=(15-14)/112=1/112.
Leak will empty the full cistern in 112 hours.

Q28.C

Q28 Solution:-

Work done by the waste pipe in 1 minute
=1/15−[1/20+1/24]=−1/40
volume of 1/40 part = 3 litres.
So, Volume of whole =(3×40) litres = 120 litres.

Q29.B

Q29 Solution:-

Let the tap completely fill the tank (with no hole in it) in T min
⇒ 1/t−1/4=1/(t+2)
⇒ t = 2 minutes.

Sometimes you don't realize your own strength until you come face to face with your greatest weakness." —*Susan Gale*

CHAIN RULE

1.Direct Proportion: Two quantities are said to be directly proportional, if on the increase (or decrease) of the one, the other increases (or decreases) to the same extent.

For example: Cost is directly proportional to the number of articles.
(More Articles, More Cost)

2.Indirect Proportion: Two quantities are said to be indirectly proportional, if on the increase of the one, the orther decreases to the same extent and vice-versa.

For example: The time taken by a car is covering a certain distance is inversely proportional to the speed of the car. (More speed, Less is the time taken to cover a distance.)

Note: In solving problems by chain rule, we compare every item with the term to be found out.
Chain Rule Formula and Terms

Example:1 In a dairy farm, 40 cows eat 40 bags of husk in 40 days. In how many days one cow will eat one bag of husk?

Solution:- 40 cows eat 40 bags of husk in 40 days
1 cow 1 bag of husk in 40 days

Example:2 36 men can complete a piece of work in 18 days. In how many days will 27 men complete the same work?

Solution:- Given that;
Persons and no of days are indirect proportional to each other
Which means if persons increased then the number of days will reduce to do a job and vice versa
36 men in 18 days
27 men in ? days
36(9 x4)=18(6x3)
27(9x3)=24(6x4)
27 men can finish it in 24 days

Example:3 3 pumps, working 8 hours a day, can empty a tank in 2 days. How many hours a day must 4 pumps work to empty the tank in 1 day?

Solution:- Given that;
Number of pipes and Number of days are indirect proportional to each other
Which means if no of pipes are increased to fill/empty a tank then the number of days required to fill/empty the tank will reduce
3 pumps working 2 days (8 hour a day)
So 3 pumps working 16 hour to empty
Our question is
4 pumps working 1 day (? hour a day)
3(1x3)=16(4x4)
4(1x4)=12(4x3)
4 pumps can empty the tank in 1 day by working(12 hour a day)

Example:4 39 persons can repair a road in 12 days, working 5 hours a day. In how many days will 30 persons, working 6 hours a day, complete the work?

Solution:- Persons and no of days are indirect proportional to each other

Which means if persons increased then the number of days will reduce to do a job and vice versa
39 persons 12 days(5 hour a day)
So, 39 persons are working 60 hours each
Our question is 30 person ? days (6 hour a day)
39(13x3)=60(10x6)
30(10x3)=78(13x6)
So 30 persons are working 78 hours each
30 person can finish that work in 13 days (78/6=13, 6 hours a day)

Example:5 If a quarter kg of potato costs 60 paise, how many paise will 200 gm cost?

Solution:- Given that
Kilogram and cost are direct proportional to each other
This means if the number of kgs of purchase is increased and then cost for that purchase also will increase
Quarter kg =250 gm
250 g = 60 paise
200 g=? paise
250(5x50)= 60(5x12)
200(4x50)=48(4x12)
200 g potato is 48 paisa

Example:6 4 persons can do 4 works in 4 days. In how many such works can be done by 8 men in 8 days?

Solution:- Given that;
4 men 4 works in 4 days
8 men ? works in 8 days
1 men 1 work in 4 days
1 man 2 works in 8 days
8 man (8x2) 16 works in 8 days

CHAIN RULE

----------EXERCISE----------

Q1. If cost of 15 chocolates is Rs 35, find cost of 39 chocolates?

A. Rs 71 B. Rs 81 C. Rs 91 D. Rs 101

Q2. If 36 men can do a work in 25 days, in how many days will 15 men can do it?

A. 30 B. 40 C. 50 D. 60

Q3. If 20 men can construct a road 112m long in 6 days, what length of a similar road can be construct by 25 men in 3 days?

A. 40m B. 50m C. 60m D. 70m

Q4. If 8 men working 9 hours a days can construct a road 18m long, 2 m broad and 12m high in 10 days, how many men are needed to construct a road 32m long , 3m broad and 9m high by working 6 hours a days, in 8 days?

A. 20 B. 30 C. 40 D. 50

Q5. A contract was to be completed in 56 days and 104 men were set to works, Each working 8 hours per days. After 30 days , $2/5^{th}$ of the work is completed. How many additional men are needed so that the work completes in time, each man now working 9 hours a day?

A. 36 B. 46 C. 56 D. 66

Q6. 5 men or 9 women can do a piece of work in 19 days. In how many days will 3 men and 6 women do it?

A. 12 B. 13 C. 14 D. 15

Q7. 8 women can complete the work in 10 days and 10 children take 16 days to complete the same work. How many days will 10 women and 12 children take to complete the work ?

A. 8 B. 7 C. 6 D. 5

Q8. If 6 engines consume 15 metric tonnes of coal when each is running 9 hours a days , how much coal are needed for 8 engines, each running 12 hours a days, it being given that 3 engines of former type consume as much as 4 engines of latter type?

A. 17 tonnes B. 18 tonnes C. 19 tonnes D. 20 tonnes

Q9. If 22.5 m of a uniform rod weighs 85.5 kg , what will be the weight of 6m of the same rod?

A. 22.8 kg B. 24.8 kg C. 26.8 kg D. 28.8kg

Q10. On a scale of map 1.5cm represents 24km. If the distance between two points on the map is 76.5 cm, the distance between these points is:

A. 1112 km B. 1224 km C. 1326 km D. None of these

Q11. 6 dozen eggs are bought for Rs 48. How much will 132 eggs cost?

A. Rs 79 B. Rs 82 C. Rs 85 D. Rs 88

Q 12. In a race, Nehal covers 5 km in 20 minutes, what distance will he cover in 50 minutes?

A. 10.5 km B. 11.5 km C. 12.5 km D. 13.5 km

Q13. A rope makes 140 rounds of the over a cylinder, the radius of which is 14cm How many rounds will it cover over cylinder of radius 20 cm?

A. 56 B. 77 C. 98 D. 119

Q14. A 6m tall pole casts a 4m long shadow. At the same times, another pole casts a 50 m long shadow. How long is the second pole?

A. 50m B. 75m C. 100m D. None of these

Q15. 10 pipes of the same capacity can fill a tank in 24 minutes. If 2 pipes are removed , how long will the remaining pipes take to fill the tank?

A. 20 min B. 25 min C. 30 min D. 35 min

Q16. 8 men can finish a work in 40 days . If 2 more men join them , then the same work will be finished in-

A. 30 days B. 32 days C. 36 days D. 40 days

Q17. Two persons can complete a piece of work in 9 days. How many more persons are needed to complete double of the work in 12 days?

A. 1 B. 2 C. 3 D. 4

Q18. Four examiners can examine a certain number of papers in 10 days by working for 5 hours a day. For how many hours in a day can 2 examiners have to work in order to examine twice the number of papers in 20 days?

A. 7 hours B. 8 hours C. 9 hours D. 10 hours

Q19. 400 persons working 9 hours per day complete $1/4^{th}$ of the work in 10 days . The number of additional persons , working 8 hours per day required to complete the remaining work in 20 days is:

A. 275 B. 250 C. 375 D. 675

Q20. If 42 persons consume 144kg of rice in 15 days , then in how many days will 30 persons consume 48kg of rice?

A. 4 B. 5 C. 6 D. 7

Q21. If 18 pumps can deliver 2170 tonnes of water in 10 days , running 7 hours a day , in how many days will 16 pumps can deliver 1736 tonnes, running 9 hours per day?

A. 9 days B. 8 days C. 7 days D. 6 days

Q22. A contractor employed 30 men to do a piece of work in 38 days. After 25 days he employed 5 men more and the work was finished one day earlier. How many days , he would have been behind , if he had not employed additional men?

A. 1 day B. 5/4 days C. 3 days D. 7/4 days

Q23. If 15 toys cost Rs. 234, what do 35 toys cost?

A. 128 B. 217 C. 348 D. 546

Q24. If 36 men can do a piece of work in 25 hours, in how many hours will 15 men do it ?

A. 120 B. 60 C. 30 D. 15

Q25. If the wages of 6 men for 15 days be Rs.2100, then find the wages of for 12 days.

A. 1240 B. 2520 C. 3450 D. 4320

Q26. If 20 men can build a wall 66 metres long in 6 days, what length of a similar can be built by 86men in 8 days?

A. 12 B. 21 C. 34 D. 49

Q27. If 15 men, working 9 hours a day, can reap a field in 16 days, in how many days will 18 men reap the field, working 8 hours a day?

A. 15 B. 21 C. 34 D. 43

Q28. If 9 engines consume 24 metric tonnes of coal, when each is working 8 hours day, how much coal will be required for 8 engines, each running 13hours a day, it being given that 3 engines of former type consume as much as 4 engines of latter type?

A. 12 B. 26 C. 34 D. 43

Q29. A contract is to be completed in 46 days and 117 men were said to work 8 hours a day. After 33 days, $(4/7)^{th}$ of the work is completed. How many additional men may be employed so that the work may be completed in time, each man now working 9 hours a day?

A. 52 B. 61 C. 81 D. 96

Q30. A garrison of 3300 men had provisions for 32 days, when given at the rate of 860 gns perhead. At the end of 7 days, a reinforcement arrives and it was for that the provisions will last 17 days more, when given at the rate of 826 gms per head, What is the strength of the reinforcement?

A. 1700 B. 2100 C. 3400 D. 4300

----------ANSWERS AND SOLUTION----------

Q1.C

Q1 Solution:-

Let the required cost be Rs C.

More dolls, more cost (direct)

∴ 15 : 39:: 35 : C ⇒15 xC = (39 x35)

⇒ C= (39 x35)/15 = 91.

∴ Cost of 39 chocolates = Rs 91

Q2.D

Q2 Solution:-

Let the required number of days be d.

Less men, more days (indirect)

∴ 15: 36:: 25 : d ⇒ 15 xd = (36 x 25)

⇒ d= (36 x25) / 15 = 60.

∴ Required number of days = 60.

Q3.D

Q3 Solution:-

Let the required length be L metres.

More men, more length construct (direct)

Less days, less length construct (direct)

Men 20 : 25 :: 112 : L

Days 6:3

∴ (20 x 6 xL) = (25 x 3 x112) ⇒ L= (25 x 3 x 112) / (20 x 6) = 70.

Required length 70m.

Q4.B

Q4 Solution:-

let the required number of men be n.

More length, more men (Direct)

More breadth, more men (Direct)

Less height, less men (Direct)

Less hours per day, more men (Indirect)

Less days, more men (Indirect)

Length 18:32

Breadth 2:3

Height 12:9 :: 8 : n

Hours / Day 6: 9

Days 8:10

∴ (18 x 2 x 12 x 6 x 8 x n) = (32 x 3 x 9 x 9 x 10) ⇒ n= 32x3x9x9x10 / 18x2x12x6x8 =30.

Q5.C

Q5 Solution:-

Remaining work = (1- 2/5) = 3/5 , Remaining period = (56 – 30) =26 days.

Let the additional men employed be n.

More work , more men (direct)

More days , less men (indirect)

More hours/ day, less men (indirect)

Work 2/5 : 3/5

Days 26: 30 :: 104 : (104 + n)

Hours/ day 9:8

∴ 2/5 x26 x 9 x (104 +n) = 3/5 x30 x 8 x 104

⇒ (104 +n) = 3 x 30 x 8 x 104 / 2x 26 x 9 = 160 ⇒ n = (160 – 104) = 56.

Additional men to be employed = 56.

Q6.D

Q6 Solution:-

9 women = 5 men ⇒ 1 women = 5/9 men

⇒ 6 women = (5/9 x 6) men = 10/3 men.

3 men +6 women = (3+ 10/3) men = 19/3 men.

Let the required number of days be d.

More men, less days

19/3 : 5 :: 19 : d ⇒ 19 /3 xd = (5 x19)

⇒ d= (5x 19 x 3 /19) = 15.

∴ Required number of days = 15.

Q7.D

Q7 Solution:-

1 women can complete the work in (10 x 8) days= 80 days.

1 child can complete the work in (16 x 10) days= 160 days.

1 women 1 days work = 1/80 , 1 child 1 days work= 1/160.

(10 women +12 children) 1 days work = (10 x 1/80 +12 x 1/160)

= (1/8 + 3/40) = 8/ 40 = 1 /5.

∴ 10 women and 12 children will finish the work in 5 days.

Q8.D

Q8 Solution:-

Let the required quantity of coal consumed be n tones.

More engines, more coal consumption (direct)

More hours, more coal consumption (direct)

Less rate of consumption, less consumption (direct)

Engines 6:8

Working Hours 9:12 :: 15 : n

Rate of consumption 1/3 : 1/4

∴ (6 x 9 x 1/3 x n) = (8 x 12 x 1/4 x 15 ⇒ 18n = 360 ⇒ n = 20.

Quantity of coal consumed = 20 tonnes.

Q9.A

Q9 Solution:-

Let the required weight be W kg.

Less length, less weight (direct)

22.5: 6 :: 85.5 :W ⇒ 22.5W = (6 x 85.5) ⇒ W= (6 x 85.5) / 22.5 = (6 x885 / 225) = 22.8 kg.

Required weight = 22.8 kg.

Q10.B

Q10 Solution:-

Let the actual distance be d km.

More distance on the map, more is actual distance (direct)

1.5 : 76.5 :: 24 : d ⇒ 1.5d = (76.5 x 24) ⇒ d = (76.5 x 24) / 1.5 = 1224 km.

Required distance= 1224km.

Q11.D

Q11 Solution:-

Let the required cost be Rs C.
More eggs, more cost (direct)
72: 132 :: 48 : C
⇒ 72 C = (132 x 48)
⇒ C= (132 x48) / 72 = 88.
∴ Required cost = Rs 88.

Q12.C

Q12 Solution:-

Let the required distance be d km.
More time , more distance covered (direct)
20: 50: :: 5 : d
⇒ 20d = (50 x 5)
⇒ d= (50 x 5) / 20 = 12.5 km.
Required distance = 12.5 km.

Q13.C

Q13 Solution:-

Let the required number of round be n.
More radius , less round (Indirect)
20: 14: :: 140 : n
⇒ 20n = (14x140)
⇒ n = (14 x 140/20 = 98.
Required number of round = 98.

Q14.B

Q14 Solution:-

Let the length of the second poles be L metres.
Longer is the shadow, longer is the object (Direct)
4: 50 :: 6:L
⇒ 4L = (50 x 6)
⇒ L= (50x6)/4 =75m.
Length of second poles = 75m.

Q15.C

Q15 Solution:-

Let the required time be t minutes.
Less pipes, more time (Indirect)
8: 10 ::24 : t
⇒ 8t = (10 x 24)
⇒ t= (10 x 24) /8 = 30min.

Q16.B

Q16 Solution:-

Let 10 men finish it in t days.
More men, less days (Indirect)
10 : 8 :: 40 : t ⇒ 10t = (8 x 40) ⇒ t = (8x40) /10 = 32 days.

Q17.A

Q17 Solution:-

Let the required number of persons be n .
More work, more persons (direct)
More days , less persons (Indirect)
Work 1:2 :: 2 : (2+n)
Days 12:9
1x12 x (2 + n) = (2 x 9 x2) ⇒ (2 + n) = 36/12 = 3 ⇒ n=1.

Q18.D

Q18 Solution:-

Let the number of hours per day be t.
More days, less hours per day (Indirect)
Less etaminers , more hours per day (Indirect)
More papers , more hours per day (direct)
Days 20 : 10
Etaminers 2 : 4 :: 5 : t
papers 1 : 2
∴ (20 x 2 x 1 x t) = (10 x 4 x 2x 5) ⇒ t = 400 / 40 = 10 hours per days.

Q19.A

Q19 Solution:-

Let the number of additional men be n .
Less hours per days, more men (Indirect)
More days , less men (Indirect)
More work, more men (Direct)
Hours/ days 8:9
Days 20 : 10:: 400 : (400 + n)
Work 1/4 : 3/4
∴ 8 x 20 x 1/4 x (400 + n) = 9 x 10 x 3/4 x 400
⇒ (400 + n) = 9 x 10 x 3 x 400/ 8 x 20 = 675.
Number of additional men = 675-400=275.

Q20.D

Q20 Solution:-

Let the required number of days be n.
Less persons, more days (Indirect)
Less rice, less days (Direct)
Persons 30 : 42 :: 15 : n
Quantity 144 : 48
∴ (30 x 144 x n) = (42 x 48 x15) ⇒ n = 42 x 48 x 15/ 30 x 144 = 7 days

Q21.C

Q21 Solution:-

Let the required number of days be n.
Less pumps, more days (Indirect)
Less water, less days (direct)
More working hours, less days (Indirect)
Pumps 16:18
Water Quantity. 2170 : 1736 :: 10 :n
Water hours 9:7

∴ (16 x 2170 x 9 xx) = (18 x 1736x7 x10)⇒ x=18 x 1736x7 x10/16x2170 x 9 = 7 days .

Q22.A

Q22 Solution:-

After 25 days , 35 men finish the remaining work in (38 - 25 - 1) = 12 days.
35 men can finish the remaining work in 12 days.
30 men can finish it in (12 x 35) /30 days = 14 days , i.e. 1 day behind.

Q23.D

Q23 Solution:-

Let the required cost be Rs. C. Then,
More toys, More cost (Direct Proportion)
. 15 : 35 : : 234 : C
=> (15 C C) = (35 C 234)
=> C=(35 C 234)/15 =546
So, the cost of 35 toys is Rs. 546.

Q24.B

Q24 Solution:-

Let the required number of hours be n. Then,
Less men, More hours (Indirect Proportion)
15 : 36 : : 25 : n
=> (15 n n) = (36 n 25)
=> (36 n 25)/15 = 60
So, 15 men can do it in 60 hours.

Q25.B

Q25 Solution:-

Let the required wages be Rs. W.
More men, More wages (Direct Proportion)
Less days, Less wages (Direct Proportion)
Men 6: 9 : :2100:W
Days 15:12
So (6 W 15 W W)=(9 W 12 W 2100)
=> W=(9 W 12 W 2100)/(6 W 15)=2520
So the required wages are Rs. 2520.

Q26.D

Q26 Solution:-

Let the required length be L metres
More men, More length built (Direct Proportion)
Less days, Less length built (Direct Proportion)
Men 20: 35
Days 6: 3 : : 56 : L
So (20 x 6 x L)=(35 x 3 x 56)
=> L=(35 x 3 x 56)/120=49
So, the required length is 49 m.

Q27.A

Q27 Solution:-

Let the required number of days be n.
More men, Less days (indirect proportion)
Less hours per day, More days (indirect proportion)
Men 18 : 15
Hours per day 8: 9 } : :16 : n
(18 x 8 x n)=(15 x 9 x 16)
n=(44 x 15)144 = 15
So, required number of days = 15.

Q28.B

Q28 Solution:-

Let 3 engines of former type consume 1 unit in 1 hour.
Then, 4 engines of latter type consume 1 unit in 1 hour.
So 1 engine of former type consumes(1/3) unit in 1 hour.
1 engine of latter type consumes(1/4) unit in 1 hour.
Let the required consumption of coal be x units.
Less engines, Less coal consumed (direct proportion)
More working hours, More coal consumed (direct proportion)
Less rate of consumption, Less coal consumed(direct proportion)
Number of engines 9: 8
Working hours 8 : 13 :: 24 : x
Rate of consumption (1/3):(1/4)
[9 x 8 x (1/3) x x) = (8 x 13 x (1/4) x 24)
=> 24x = 624
=> x = 26.
So, the required consumption of coal = 26 metric tonnes.

Q29.C

Q29 Solution:-

Remaining work = (1-(4/7) =(3/7)
Remaining period = (46 - 33) days = 13days
Let the total men working at it be n.
Less work, Less men (Direct Proportion)
Less days, More men (Indirect Proportion)
More Hours per Day, Less men (Indirect Proportion)
Work (4/7): (3/7)
Days 13:33 :: 117: x
Hours/day 9 : 8
So (4/7) x 13 x 9 x n =(3/7) x 33 x 8 x 117 or n=(3 x 33 x 8 x 117)/(4 x 13 x 9)=198
Additional men to be employed = (198 - 117) = 81.

Q30.A

Q30 Solution:-

The problem becomes:
3300 men taking 850 gms per head have provisions for (32 - 7) or 25 days,
How many men taking 825 gms each have provisions for 17 days?
Less ration per head, more men (Indirect Proportion)
Less days, More men (Indirect Proportion)
Ration 825 : 850
Days 17: 25 } : : 3300 : n
(825 x 17 x n) = 850 x 25 x 3300 or x = (850 x 25 x 3300)/(825 x 17)=5000
Strength of reinforcement = (5500 - 3300) = 1700.

MIXTURE AND ALLIGATION

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1. ALLIGATION:

It is the rule that enables us to find the ratio in which two or more ingredients at the given price must be mixed to produce a mixture of a desired price.

A process or rule for the solution of problems concerning the compounding or mixing of ingredients differing in price or quality.

2. MEAN PRICE:

The cost price of a unit quantity of the mixture is called the mean price.

3. BASIC FORMULA:

If two ingredients A and B of price x and y respectively are mixed and the price of resultant mixture is M (mean price)then the ratio (R) in which ingredients are mixed is given by,the rule of allegation

$R = \frac{M-y}{x-M}$

4. REPLACEMENT OF PART OF SOLUTION FORMULA:

Suppose a container contains a solution from which some quantity of solution is taken out and replaced with one of the ingredients. This process is repeated n times then,

We can use this formula:

If a container contains a solution from which some quantity of solution is taken out and replaced with one of the ingredients. This process is repeated n times then,

Final Amount of ingredient that is not replaced = Initial Amount$\times\left(\frac{\text{Vol .after removal}}{\text{Vol .after replacing}}\right)^n$

5. MIXTURE OF MORE THAN TWO ELEMENTS:

These questions may seem a little tricky at first, but it is similar concept applied repeatedly.

In order to calculate final ratio of ingredients when mixture contains more than two ingredients,

1. Take two ingredients such that 1st ingredient is LOWER than the mean value and the other one is HIGHER than the mean value.
2. Calculate the ratio of ingredients
3. Repeat for all possible pairs
4. Final ratio is the ratio obtained from step 2 (if an ingredient is common in the ratios, add values for this particular ingredient)

----------EXERCISE----------

Q1. In what ratio must rice at Rs 9.30 per Kg be mixed with rice at Rs 10.80 per Kg so that the mixture be worth Rs 10 per Kg?

A. 7:6 B. 8:7 C. 9:8 D. None

Q2. How much water must be added to 60 litres of milk at 1.5 litres for Rs. 20 So as to have a mixture worth Rs.$10\frac{2}{3}$ a litre?

A. 10 litres B. 12 litres C. 15 litres D. 18 litres

Q3. In what ratio must wheat at Rs.3.20 per kg be mixed with wheat at Rs.2.90 per kg so that the mixture be worth Rs.3.08 per kg?

A. 1 : 4 B. 2 : 3 C. 3 : 2 D. 4 : 3

Q4. In what proportion must rice at Rs. 3.10 per kg be mixed with rice at Rs. 3.60 per kg so that the mixture be worth Rs. 3.25 per kg?

A. 1 : 6 B. 3 : 5 C. 5 : 4 D. 7 : 3

Q5. In what ratio must tea at Rs. 62 per Kg be mixed with tea at Rs. 72 per Kg so that the mixture must be worth Rs. 64.50 per Kg?

A. 1 : 3 B. 2 : 1 C. 3 : 1 D. 4 : 1

Q6. Two vessels A and B contain spirit and water mixed in the ratio 5:2 and 7:6 respectively. Find the ratio in which these mixture be mixed to obtain a new mixture in vessel c containing spirit and water in the ratio 8:5?

A. 1 : 3 B. 3 : 5 C. 5 : 7 D. 7 : 9

Q7. One quantity of wheat at Rs 9.30 per Kg is mixed with another quality at a certain rate in the ratio 8:7. If the mixture so formed be worth Rs 10 per Kg, what is the rate per Kg of the second quality of wheat?

A. Rs. Rs. 10.80 B. Rs. 12.80 C. Rs. 15.20 D. Rs. 178.60

Q8. Pure ghee costs Rs 100 per kg. A shopkeeper mixes vegetable oil costing Rs 50 per kg and sells the mixtures at Rs 96 per kg, making a profit of 20%. In what ratio does he mix the pure ghee with the vegetable oil.

A. 3:2 B. 2:3 C. 4:3 D. 3:4

Q9. In a 729 litres mixture of milk and water, the ratio of milk to water is 7:2.To get a new mixture containing milk and water in the ratio 7:3, the amount of water to be added is:

A. 51 litres B. 61 litres C. 71 litres D. 81 litres

Q10. Three types of wheat of Rs. 1.27, Rs. 1.29 and Rs. 1.32 per kg are mixed together to be sold at Rs. 1.30 per kg. In what ratio should this wheat be mixed?

A. 1:2:3 B. 1:1:2 C. 2:1:3 D. 2:2:3

Q11. The milk and water in two vessels A and B are in the ratio 4:3 and 2:3 respectively. In what ratio the liquids in both the vessels be mixed to obtain a new mixture in vessel c consisting half milk and half water?

A. 8 : 3 B. 7 : 5 C. 6 : 7 D. 5 : 9

Q12. The ratio, in which tea costing Rs. 192 per kg is to be mixed with tea costing Rs. 150 per kg so that the mixed tea when sold for Rs. 194.40 per kg, gives a profit of 20%.

A. 1:2 B. 2:5 C. 3:8 D. 4:9

Q13. How many kilograms of sugar costing Rs. 9 per kg must be mixed with 27kg of sugar costing Rs.7 per kg so that there may be gain of 10% by selling the mixture at Rs.9.24 per kg?

A. 60 kg B. 63 kg C. 65 kg D. 70 kg

Q14. Bikash bought 80 kg of sugar at Rs 13.50/kg and mixed it with 120 kg sugar at Rs 16/kg. If he wants to make a profit of 16% what rate should he sell the sugar to his customers?

A. Rs 12/kg B. Rs 15.25/kg C. Rs 17/kg D. Rs 17.40/kg

Q15. How many litres of water should be added to a 30 litre mixture of milk and water containing milk and water in the ratio of 7 : 3 such that the resultant mixture has 40% water in it?

A. 5 litres B. 6 litres C. 7 litres D. None of these

Q16. A sample of x litres from a container having a 60 litre mixture of milk and water containing milk and water in the ratio of 2 : 3 is replaced with pure milk so that the container will have milk and water in equal proportions. What is the value of x?

A. 6 litres B. 10 litres C. 15 litres D. None of these

Q17. Tea worth Rs. 126 per kg and Rs. 135 per kg are mixed with a third variety in the ratio 1 : 1 : 2. If the mixture is worth Rs 153 per Kg , the price of the third variety per Kg will be?

A. Rs. 112.50 B. Rs. 125.50 C. Rs. 175.50 D. Rs. 250.50

Q18. A vessel is filled with liquid, $3/8^{th}$ parts of which are water and $5/8^{th}$ parts syrup. What part of the mixture must be drawn off and replaced with water so that the mixture may be half water and half syrup?

A. $\frac{1}{3}$ B. $\frac{1}{4}$ C. $\frac{1}{5}$ D. $\frac{1}{6}$

Q19. A milk vendor has 2 cans of milk .The first contains 25% water and the rest milk. The second contains 50% water.How much milk should he mix from each of the container so as to get 12 litres of milk such that the ratio of water to milk is 3:5?

A. 6 litres B. 7 litres C. 8 litres D. 9 litres

Q20. A can contains a mixture of two liquids A and B in the ratio 7:5 when 9 litres of mixture are drawn off and the can is filled with B, the ratio of A and B becomes 7:9. How many litres of liquid A was contained by the can initially?

A. 18 litres B. 21 litres C. 24 litres D. 30 litres

Q21. A 20 litre mixture of milk and water contains milk and water in the ratio 3 : 2. 10 litres of the mixture is removed and replaced with pure milk and the operation is repeated once more.At the end of the two removals and replacement, what is the ratio of milk and water in the resultant mixture?

A. 10 : 3 B. 9 : 1 C. 8 : 1 D. 7 : 3

Q22. An alloy contains zinc, copper and tin in the ratio 2:3:1 and another contains copper, tin and lead in the ratio 5:4:3.If equal weights of both alloys are melted together to form a third alloy, then the weight of lead per kg in new alloy will be:

A. 20 kg B. 18 kg C. 16 kg D. 15 kg

Q23. In a zoo, there are Cows and Parrots. If heads are counted, there are 200 and if legs are counted, there are 580. How many Parrots are there?

A. 90 B. 100 C. 110 D. 120

Q24. In what ratio must a person mix three kinds of wheat costing him Rs 1.20,Rs 1.44 and Rs 1.74 per Kg so that the mixture may be worth Rs 1.41 per Kg?

A. 11 : 77 : 7 B. 22 : 55 : 6 C. 33 : 44 : 5 D. 44 : 33 : 4

Q25. A man travelled a distance of 90Km in 9 hours partly on foot at 8 kmph and partly on bicycle at 17 kmph.Find the distance travelled on foot.

A. 54 km B. 56 km C. 62 km D. 65 km

Q26. How many kgs of Basmati rice costing Rs.42/kg should a shopkeeper mix with 25 kgs of ordinary rice costing Rs.24 per kg so that he makes a profit of 25% on selling the mixture at Rs.40/kg?

A. 20.0 kgs B. 22.5 kgs C. 25.0 kgs D. 40.0 kgs

Q27. 3 math Companies: X,Y and Z, take an survey on employee performance. The average performance in Company X is 83.The average performance in Company Y is 76.The average performance in Company Z is 85.The average performance of all employees in companies X and Y together is 79.The average performance of all employees in Company Y and Z together is 81.What is the average performance of all employee of Company?

A. 81 B. 81.5 C. 82 D. 84.5

Q28. 8 litres are drawn from a cask filled with wine and is then filled with water. This operation is performed three more times.The ratio of the quantity of wine now left in cask to that of the total solution is 16:81.How much wine did the cask hold originally?

A. 24 litres B. 28 litres C. 32 litres D. 40 litres

Q29. A shopkeeper purchased 80 kg of atta at Rs.13.50 per kg and mixed it with 120kg atta at Rs.16per kg. For what rupee should he sell the mixer to profit 16%?

A. 12 B. 15.60 C. 17.40 D. 24.80

Q30. Nehal bought two varieties of rice, costing 5 Rs per kg and 6 Rs per kg each, and mixed them in some ratio. Then he sold the mixture at 7 Rs per kg , making a profit of 20 percent. What was the ratio of the mixture?

A. 1:3 B. 1:5 C. 2:7 D. 2:9

This chapter contains the topics and questions I discussed and created in our classes or obtained from students as their doubts. All the questions noted, typed, redesigned and rectified by group of volunteers consisting of:

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----------ANSWERS----------

Q1.B	**Q2.C**	**Q3.C**	**Q4.D**	**Q5.C**
Q6.D	**Q7.A**	**Q8. A**	**Q9.D**	**Q10.B**
Q11.B	**Q12.B**	**Q13.B**	**Q14.D**	**Q15.A**
Q16.B	**Q17.C**	**Q18.C**	**Q19.A**	**Q20.B**
Q21.B	**Q22.B**	**Q23.C**	**Q24. A**	**Q25.B**
Q26.A	**Q27.B**	**Q28.A**	**Q29.C**	**Q30.B**

----------ANSWERS AND SOLUTION----------

Q1.B

Q1 Solution:-

C.P of 1 Kg rice of 1st kind (930p) — C.P of 1 Kg rice of 2nd kind (1080p)

\ /

Mean Price (1000p)

/ \

(1080 – 1000) : (1000 - 930)

80 : 70

So, required ratio = 80 : 70 = 8 : 7

Q2.C

Q2 Solution:-

C.P. of $1.5=\frac{3}{2}$ litre of milk = Rs. 20

C.P. of 1 litre of milk = Rs. $20\times\frac{3}{2}=\frac{40}{3}$

C.P. of 1 litre of water =0

From question,

Mean price Rs.$10\frac{2}{3}$

= Rs. $\frac{32}{3}$

By the rule of alligation, we have:

C.P of 1 litre of water (0) — C.P of 1 litre of milk (Rs.40/3)

\ /

Mean Price (Rs.32/3)

/ \

(40/3−32/3) (32/3−0)

=8/3 =32/3

Ratio of water and milk =8/3:32/3

=8/3:32/3=1:4(appx)

So, Quantity of water to be added to 60 litres of milk: (Note it is extra water that is to be added and final solution is not of 60 litre but more than that).

($\frac{1}{4}\times60$) litres

=15 Litres

Q3.C

Q3 Solution:-

C.P of a unit quantity of 1st kind = Rs. 3.20
C.P of a unit quantity of 2nd kind = Rs. 2.90
Mean price = Rs.3.08

C.P of unit quantity of 1st kind (Rs. 3.20) — C.P of unit quantity of 2nd kind (Rs. 2.90)

\ /
Mean Price (Rs.3.08)
/ \

(3.08 – 2.90) : (3.20 – 3.08)
0.18 : 0.12

Required ratio = 0.18 : 0.12 = 3 : 2

Q4.D

Q4 Solution:-

C.P of a unit quantity of 1st kind = 310p (in paise)
C.P of a unit quantity of 2nd kind = 360p
Mean price = 325p

C.P of unit quantity of 1st kind (310p) — C.P of unit quantity of 2nd kind (360p)

\ /
Mean Price (325p)
/ \

(360 – 325) : (325 – 310)
= 35 : 15

Required ratio = 35 : 15 = 7 : 3
They must be mixed in the ratio 7 : 3

Q5.C

Q5 Solution:-

C.P of a unit quantity of 1st kind = Rs. 62
C.P of a unit quantity of 2nd kind = Rs. 72
Mean price = Rs. 64.50

C.P of unit quantity of 1st kind (Rs. 62) — C.P of unit quantity of 2nd kind (Rs. 72)

\ /
Mean Price (Rs. 64.50)
/ \

(72 – 64.50) : (64.50 – 62)
7.50 : 2.50

Required ratio = 7.50 : 2.50 = 3 : 1

Q6.D

Q6 Solution:-

Spirit in 1 litre mix of A = 5/7 litre.
Spirit in 1 litre mix of B = 7/13 litre.
Spirit in 1 litre mix of C = 8/13 litre.
By rule of alligation we have required ratio X:Y

X	:	Y
5/7		7/13

\ /
(8/13)
/ \

(1/13)	:	(9/91)
7		9

So required ratio = 1/13 : 9/91
= 7:9

Q7.A

Q7 Solution:-

Let the rate of second quality be Rs x per Kg.
C.P of 1Kg wheat of 1st kind = 930p
C.P of 1 Kg wheat of 2nd kind = 100x p
Mean price = 1000p
By rule of alligation we have required ratio 8 : 7

930 x

\ /
(Mean Price)
(10)
/ \

x-10	:	0.7	::	8	:	7

So we get required ratio, (x-10) : 0.7 :: 8 : 7
⇒ x = 10.80 per Kg

Q8. A

Q8 Solution:-

Mean Cost price = Rs $\frac{100}{120}$ x 96 = Rs 80 per kg
Apply rule of allegation,
So; Required ratio = 30:20 = 3:2

Q9.D

Q9 Solution:-

Quantity of milk in 729 litre of mixture,
=(7/9)×729=567 litre
Quantity of water,
=729−567=162 litre.
Let x litre of water be added to make ratio 7:3.

Milk water
567 (162+x)
\ /
mixture
(729+x)
/ \
567 : (162+x)
77 : 33

⇒ 7/3=567/(162+x)
⇒ 162×7+7x=567×3
⇒ 7x=1701−1134=567
⇒ x=567/7
=81 litre water is to be added.

Q10.B

Q10 Solution:-

Let's say three variety of whet are A(Rs. 1.27), B(Rs. 1.29) and C(Rs. 1.32).
We first deal with type of wheat of Rs. 1.27 (A), Rs. 1.32.(C) to get mean price Rs. 1.30
In order to make calculations easier we multiply every number by 100. Since we are working on ratios, it won't finally change the answer.
So, wheat1 (w1) and wheat2 (w3) are in the ratio,

A C
127 132
\ /
mean
130
/ \
(130−132) : (127−130)
−2 −3

⇒ A:C=2:3
Now, lets take the wheat of Rs. 1.29 (B), Rs. 1.32 (C). to get mean price Rs. 1.30

B C
129 132
\ /
mean
130
/ \
(130−132) : (129−130)
−2 −1

⇒ B:C=2:1
So, final ratio,
⇒A:B:C=2:2:(3+1)
⇒A:B:C=1:1:2

Q11.B

Q11 Solution:-

Milk in 1 litre mixture of A = 4/7 litre.
Milk in 1 litre mixture of B = 2/5 litre.
Milk in 1 litre mixture of C = 1/2 litre.
By rule of alligation we have required ratio X:Y

X	:	Y
4/7		2/5

\ /
(Mean ratio)
(1/2)
/ \
(1/2 – 2/5) : (4/7 – 1/2)
1/10 1/1 4
So Required ratio = X : Y = 1/10 : 1/14 = 7:5

Q12.B

Q12 Solution:-

CP of first tea = Rs. 192 per kg.
CP of Second tea = Rs. 150 per kg.
Mixture is to be sold in Rs. 194.40 per kg, which has included 20% profit. So,
SP of Mixture = Rs. 194.40 per kg.
Let the CP of Mixture be Rs. X per kg. So,
X+20% of X=SP
$\frac{6x}{5}$=194.40
6X=194.40×5
X=Rs. 162 per kg.
Let N kg of first tea and M kg of second tea to be added.
Now, Using Alligation, We get,
So
N/M= $\frac{162-150}{192-162}$
N/M=$\frac{12}{30}$
N/M=$\frac{2}{5}$
N:M=2:5

Q13.B

Q13 Solution:-

Let the rate of second quality be Rs x per Kg.
C.P of 1 Kg sugar of 1st 980p
Step 1 :
S.P of 1 kg of mixture = Rs. 9.24
Gain = 10%
C.P of 1 kg of mixture =[100/(100+10)×9.24]
=Rs. 8.40

⇒ Mean price = Rs. 8.40

Step 2 :
C.P of 1 kg of sugar of 1st kind = 900p
C.P of 1 kg of sugar of 2nd kind = 700p
Mean price = 840p
By the rule of alligation, we have:

C.P. of 1kg of sugar of 1st kind (900p)		C.P. of 1kg of sugar of 2nd kind (700p)
	\ /	
	Mean Price (840p)	
	/ \	
840 - 700 (140)	:	900 - 840 (60)

⇒ Required ratio =140:60=7:3
Step 3:
Let x kg of sugar of 1st kind be mixed with 27 kg of 2nd kind
7:3=x:27

⇒ x=63 Kg.

Q14.D

Q14 Solution:-

CP of 200 kg of mixtures = Rs (80 x 13.50) + (120 x 16) = Rs 3000
SP = 116% of Rs 3000 = Rs (116/100)x3000 = Rs 3480

∴ Rate of SP = Rs 3480/200 = Rs 17.40/kg

Q15.A

Q15 Solution:-

30 litres of the mixture has milk and water in the ratio 7 : 3. i.e. the solution has 21 litres of milk and 9 litres of water.
When you add more water, the amount of milk in the mixture remains constant at 21 litres. In the first case, before addition of further water, 21 litres of milk accounts for 70% by volume. After water is added, the new mixture contains 60% milk and 40% water.
So, the 21 litres of milk accounts for 60% by volume.
So, 100% volume =210/6=35 litres.
We started with 30 litres and ended up with 35 litres.
So, 5 litres of water was added.

Q16.B

Q16 Solution:-

The best way to solve this problem is to go from the answer choices.
The mixture of 60 litres has in it 24 litres of milk and 36 litres of water. (2 : 3 :: milk : water)
When you remove x litres from it, you will remove 0.4x litres of milk and 0.6x litres of water from it.
Take choice (2). According to this choice, x=10.
So, when one removes, 10 litres of the mixture, one is removing 4 litres of milk and 6 litres of water.
So, there will be 20 litres of milk and 30 litres of water in the container.
Now, when you add 10 litres of milk, you will have 30 litres of milk and 30 litres of water - i.e. milk and water are in equal proportion.

Q17.C

Q17 Solution:-

Since first and second varieties are mixed in equal proportions.
So, their average price =Rs. (126+135)/2
=Rs. 130.50
So, the mixture is formed by mixing two varieties, one at Rs. 130.50 per kg and the other at say, Rs. x per kg in the ratio 2 : 2, i.e., 1 : 1.
We have to find x
By the rule of alligation, we have:

Cost of 1 kg of 1st kind (Rs. 130.50)	Cost of 1 kg of 2nd kind (Rs. x)

\ /
Mean Price
(Rs. 153)
/ \

x−153 22.50

⇒ (x−153)/22.50=1
⇒ x−153=22.50
⇒ x= 175.50 Rs.

Q18.C

Q18 Solution:-

Suppose the vessel initially contains 8 litres of liquid.
Let x litres of this liquid be replaced with water then quantity of water in new mixture
=3−3x/8+x litres
Quantity of syrup in new mixture =5−5x/8 litres
After replacement, the quantity of water and syrup is same in the new mixture.
So,
$3-3x/8+x \Rightarrow 5x+24 \Rightarrow 10/x \Rightarrow x=5-\frac{5x}{8}=40-5/x=1.6=\frac{8}{5}$
So part of the mixture replaced,
$=\frac{8}{5}\times\frac{1}{8}=\frac{1}{5}$

Q19.A

Q19 Solution:-

Milk in 1 litre mixture in 1st can = 3/4 litre.
Milk in 1 litre mixture in 2nd can = 1/2 litre.
Milk in 1 litre final mixture = 5/8 litre.
By rule of alligation we have required ratio 5 : 8

$\frac{3}{4}$ $\frac{1}{2}$

\ /
(5/8)
/ \

$\frac{1}{8}$: $\frac{1}{8}$

So ratio of two mixtures:
$=\frac{1}{8}:\frac{1}{8}$
=1:1
So, quantity of mixture taken from each can,
$=\frac{1}{2}\times 12$
=6 litres

Q20.B

Q20 Solution:-

Suppose the can initially contains 7x and 5x litres of mixtures A and B respectively.
When 9 litres of mixture are drawn off, quantity of A in mixture left:
7x−(7/12)×9=7x−21/4 litres
Similarly quantity of B in mixture left:
5x−(5/12)×9=5x−15/4 litres
So ratio becomes:
(7x−214)/(5x−154)=7/9
63
⇒ x=3
So the can contained:
7×x=7×3=21 litres of A initially.

Q21.B

Q21 Solution:-

The 20 litre mixture contains milk and water in the ratio of 3 : 2. So, there will be 12 litres of milk in the mixture and 8 litres of water in the mixture.
Step 1. When 10 litres of the mixture is removed, 6 litres of milk is removed and 4 litres of water is removed. So, there will be 6 litres of milk and 4 litres of water left in the container. It is then replaced with pure milk of 10 litres. Now the container will have 16 litres of milk and 4litres of water.
Step 2. When 10 litres of the new mixture is removed, 8 litres of milk and 2 litres of water is removed. The container will have 8 litres of milk and 2 litres of water in it. Now 10 litres of pure milk is added. So, the container will have 18 litres of milk and 2 litres of water in it at the end of the second step.
So, the ratio of milk and water is 18 : 2 or 9 : 1.

Q22.B

Q22 Solution:-

In the first alloy, ratio of Zinc, Copper and Tin is given as,
Z:C:T=2:3:1
Similarly, In the second alloy, ratio of Copper, Tin and Lead is given as,
C:T:L=5:4:3
The trick here is to arrive at a quantity where calculation becomes easy.
To do that, we take LCM of 6(=2+3+1), taken as 2 kg Zinc, 3 kg Copper and 1 Kg Lead), and 12(=5+4+3), taken as 5 kg Copper, 4 kg Tin and 3 Kg Lead, which is 12.
So we assume that both the alloys are being mixed at 12 Kgs each.
Alloys are mixed together to form third alloy. Then the ratio of content in it,
Z:C:T:L=4:(6+5):(2+4):3
Weight of the third alloy,
T=12+12=24KG.
So, weight of the Lead,
L=324
=18 kg

Q23.C

Q23 Solution:-

Heads Count = 200.
Legs count = 580.
As we know that average legs per head for Cow, C=4 and average legs per head for Parrot, P=2.
Now, average Legs count per head,
If we assume all as Cow it will give 800 legs
If we consider all as parrot it will give 400 legs

Cow, C		Parrot, P
800(assuming all as cow)		400(assuming all as parrot)
\		/
	mean 580	
/		\
(580−400)	:	(800−580)
180	:	220
9	:	11

⇒ R:P=9:11
Now Cow =(9/20)x200 =90
And Parrot =(11/20)x200 =110

Q24. A

Q24 Solution:-

Step1:

Mix wheat of first and third kind to get a mixture worth Rs 1.41 per Kg.

C.P of 1 Kg wheat of 1st kind 120p

C.P of 1 Kg wheat of 3rd kind 174p

Mean Price 141p

C.P of 1 Kg Wheat of 1st kind (120p) — C.P of 1 Kg wheat of 3rd kind (174p)

\ / Mean Price (141p) / \

33 21

By Alligation rule:

Quantity of 1st kind of wheat, Quantity of 3rd kind of wheat=33:21=11:7 Quantity of 1st kind of wheat, Quantity of 3rd kind of wheat=33:21=11:7

So they must be mixed in the ratio 11:7

Step 2:

Mix wheat of 1st kind and 2nd kind to obtain a mixture worth of Rs. 1.41per Kg

C.P of 1 Kg Wheat of 1st kind (120p) — C.P of 1 Kg wheat of 3rd kind (144p)

\ / Mean Price (141p) / \

3 21

By alligation rule:

Quantity of 1st kind of wheat, Quantity of 2nd kind of wheat=3/21=1/7

So they must be mixed in the ratio 1 : 7

So,

Quantity of 2nd kind of wheat, Quantity of 3rd kind of wheat=(Quantity of 1st kind of wheat, Quantity of 3rd kind of wheat)×(Quantity of 2nd kind of wheat, Quantity of 1st kind of wheat)⇒Quantity of 2nd kind of wheat, Quantity of 3rd kind of wheat=(11.7/7.1)=(11:1) So, Quantities of wheat of 1st:2nd:3rd=11:77:7

Q25.B

Q25 Solution:-

Distance covered in 1 hour on foot = 8 km
Distance covered in 1 hour on bicycle = 17 km
Average distance covered in 1 hour = 90/9 km
= 10km (mean distance)

Distance covered in 1 hour on foot (8 km) — Distance covered in 1 hour on bicycle (17 km)

Mean Distance (10 km)

(17 – 10) : (10 – 8)
7 : 2

So out of 9 hours, he took 7 hours on foot
Distance covered on foot =(8×7) Km
=56 Km.

Q26.A

Q26 Solution:-

As the trader makes 25% profit by selling the mixture at Rs.40/kg, his cost per kg of the mixture = Rs.32/kg.
Step 2:
C.P of 1 kg of rice of 1st kind = Rs. 42
C.P of 1 kg of rice of 2nd kind = Rs. 24
Mean price = Rs. 40
By the rule of Alligation, we have:

C.P. of 1kg of rice of 1st kind (Rs. 42) — C.P. of 1kg of rice of 2nd kind (Rs. 24)

Mean Price (Rs. 32)

40 - 24 : 42 - 32
(8) : (10)

Let the amount of Basmati rice being mixed be x kgs.
8:10(4/5)⇒x=x:25=(x/25)=20 Kgs..

Q27.B

Q27 Solution:-

Average score of Company X is 83 and that of Company Y is 76 and the combined average of X and Y is 79.

By rule of alligation ratio of employees in X:Y is given by

```
      X     :     Y
         \     /
           79
         /     \

    83          76

  3      :      4
```

Similarly, average score of Company Y is 76 and that of Company Z is 85 and the combined average is 81.

By rule of alligation ratio of employees in Y:Z is

```
   Y        :        Z
          81
       /        \
   76              85
   4        :       5
```

X:Y:Z=3:4:5

Total average for X,Y and Z

=3×83+4×76+5×853+4+5

=81.5

Q28.A

Q28 Solution:-

Let the quantity of the wine in the cask originally be x litres.

Using formula:

Final Amount of solute that is not replaced=Final Amount of solute that is not replaced=

Initial Amount×(Vol. after removal/Vol. after replacing)n --------------------(i)

Or

Final ratio of solute not replaced to total=Final ratio of solute not replaced to total=

Initial ratio×(Vol. after removal/Vol. after replacing)^n --------------------(ii)

Considering iind formula here,

Then ratio of wine to total solution in cask after 4 operations:

⇒ 1×(x−8/x)^4

⇒ (x−8)/x

⇒ 3x−24

⇒ x=24 litres.=1681=23=2x

⇒ 1×(x−8x)4=1681

⇒ x−8x=23

⇒ 3x−24=2x

⇒ x=24 litres.

Q29.C

Q29 Solution;-

C.P of 200 kg of mixture = Rs. (80 x 13.50+120x16) = Rs.3000.

S.P =116% 0f Rs.3000 =Rs.[(116/200) x3000]=Rs.3480.

=> Rate of S.P of the mixture =Rs.[3480/200] per kg =Rs.17.40 per kg.

Q30.B

Q30 Solution:-

Let x: y be the ratio in which Nehal mixed the two types of rice.

Total Price of first quality 5x

Total Price of first quality 6y

Total Price of whole quality 5x+6y

A.T.P. (5x+6y)(1+20/100)=7(x+y)

5x.(1.20)+6y.(1.20)=7x

6x+7.2y=7x+7y

0.2y =x

x/y=0.2/1=1/5

So, the required ratio is x:y= 1 : 5

FRAMING OF EQUATIONS

Framing the Equation: In mathematics framing the equations are technique here how to frame the given problems in mathematical form by translating mathematical statements using symbols and literals. Look at the examples given below:

1. Mathematical statement: Amount (A) is equal to the sum of the Principal (P) and Interest I).
Formula: A = P + I

2. Mathematical statement: The area of the rectangle (A) is equal to the product of the length (L) and breadth (B) of the rectangle.
Formula: A = L × B

3. Mathematical statement: The sum of the three angles (∠x, ∠y, ∠z) of a triangle is equal to two right angles (2 × 90° = 180°).
Formula: ∠x + ∠y + ∠z = 180°

4. Mathematical statement: One-fifth of a number subtracted from 5 gives 3.
Formula: $5 - \frac{x}{5} = 3$

5. Mathematical statement: In a right triangle, the square of the hypotenuse is equal to the sum of the squares of the remaining two sides.
Here H denotes the hypotenuse and P, B denote the remaining two sides.
Formula: $H^2 = P^2 + B^2$

Examples:1 One-fifth of the centigrade temperature is equal to one-ninth of the difference between Fahrenheit (F) temperature and 32.

Solution: $\frac{C}{5} = \frac{f-32}{9}$

Examples:2. A rectangular box is of height h cm. Its length is 3 times its height and the breadth is 7 cm less than the length. Express the length, breadth and height.

Solution: Let the length, breadth and height of the rectangle be L, B, H.
Length of the rectangle is 3 times the height.
So, Length of the rectangle = 3h
Breadth of rectangle is 7 cm less than the length

So, Breadth of the rectangle = L - 7 but L = 3h
So, Breadth of the rectangle in terms of height = 3h - 7

FRAMING OF EQUATIONS

----------**EXERCISE**----------

Q1. In a certain game, each participants scores either 2 points or 5 points. If n participants score 2 points and m participants score 5 points and the total number of points scored is 50, what is the least possible positive difference between n and m?

A. 1 B. 2 C. 3 D. 4

Q2. Abhilash purchased 40 chocolates; dairy milk and kitkat for Rs 17. Had he purchased as many as kitkat as dairy milk and as many dairy milk as kitkat, he would have paid Rs 15. Find the cost of a dairymilk and a kitkat together.

A. 40 paise B. 60 paise C. 80 paise D. 1 rupee

Q3. Santosh was asked to divide a number by 6 and add 12 to the quotient. He, however first added 12 to the number and then divided it by 6, getting 112 as the answer. The correct answer should have been:

A. 114 B. 118 C. 122 D. 124

Q4. Vikrant purchased 21 apple and 29 banana for Rs 79. But if he interchanged the number of apple and banana, the cost reduced by Rs 8. Find the cost of each banana.

A. Rs 1 B. Rs 1.5 C. Rs 2 D. Rs 2.5

Q5. What number should be subtracted from $x^3+4x^2-7x+12$, if it is to be perfectly divisible by x+3?

A. 42 B. 39 C. 13 D. None of these

Q6. Uttam buys 18 passes for Rs 110. Each V.I.P pass costs Rs 10 and each general pass costs Rs 3. What will be the cost of another lot of 18 passes in which the numbers of V.I.P pass and general passes are interchanged?

A. 120 B. 122 C. 124 D. 126

Q7. (x^3-6x^2+px+q) is exactly divisible by (x^2-3x+2) then,

A. p+q>0 and pq>0 B. p+q>0 and pq<0
C. p+q<0 and pq<0 D. p+q<0 and pq>0

Q8. In a group, each person has at most two cadbury. No person has less than three Kitkat. Considering all the persons in the group there are more cadbury than Munch, more Munch than kitkat and more kitkat than persons. Find the minimum number of persons in the groups?

A. 4 B. 5 C. 3 D. 2

Q9. Abhilash,Bikram,Chandan and Sumit have some coins. Abhilash says to Bikram If he gives him 8 coins , he will have as many as Chandan has and he himself shall have 3 less than what Chandan has. Also if he takes 6 coins from Chandan, he himself shall have twice as many as Sumit has. If Bikram and Sumit together have 50coins , how manycoins they all have together?

A. 75 B. 100 C. 125 D. 150

Q10. The age of Suraj in 2002 was $\frac{1}{90}^{th}$ of his birth year. What is his age in 2016?

A. 30 B. 32 C. 34 D. 36

Q11. Last year Sunil's age was square of number and next year it will be cube of a number. After how many years his age is again a cube of a number?

A. 18 year B. 28 year C. 38 year D. 48 year

Q12. In an objective examination of 90 questions, 5 marks are allotted for every correct answer and 2 marks are deducted for every wrong answer. After attempting all the 90 questions Sumit got a total of 387 marks. Find the number of questions that he attempted wrong.

A. 9 B. 10 C. 11 D. 12

Q13. Security guards of a company are made to stand in rows. If 4 Security guards are extra in each row, there would be 2 rows less. If 4 Security guards are less in each row, there would be 4 more rows. The number of Security guards in the company is:

A. 90 B. 94 C. 92 D. 96

Q14. The number of gift pack produced by Dexter is one more than the price, in rupees, of each gift pack. The amount of Rs 380 which Dexter had, fell short of the required amount. What is the amount by which he might have fallen short.

A. 20 B. 40 C. 21 D. 10

Q15. A Bakery produced a certain number of biscuits flavouring pineapple, mango and black-forest, charging for each biscuits as many rupees as there were biscuits of that kind; altogether they produced 23 biscuits and charged Rs 211; find the number of each kind of biscuits that they produced, if mango biscuits are cheaper than pineapple biscuits and dearer than black-forest biscuits.

A. 10, 9, 4 B. 11, 9, 3 C. 10, 8, 5 D. 11, 8, 4

Q16. Suman purchased two kitkat, 3 dairy milk and 5 munch and paid Rs 40. If Suman had purchased 3 kitkat, 5 dairy milk and 9 munch, he would have to pay Rs 64. Tripti demanded only 1 kitkat, 1 dairy milk and 1 munch. If Suman purchased only what was demanded by Tripti, then what amount would have been required?

A. 12 B. 16 C. 20 D. 24

Q17. Sukant has 1044 candles. After burning, he can make a new candle from 9 stubs left behind. Find the maximum number of candles that can be made.

A. 120 B. 130 C. 140 D. 150

Q18. A group of 630 students of Gyan Bharati school is arranged in rows for PT session. Each row contains three fewer students than the row in front of it. Which of the following number of rows is not possible?

A. 3 B. 4 C. 5 D. 6

Q19. Sudip has Rs 29 in 5-rupee and 2-rupee denominations. The number of 5-rupee notes in one-half of one less than the number of 2-rupee notes. How many 5-rupee notes and 2-rupee notes does Sudip have respectively?

A. 7,3 B. 3,7 C. 2,5 D. 5,2

Q20. In a green view apartment, the houses of a row are numbered consecutively from 1 to 49. Assuming that there is a value of x such that the sum of the numbers of the houses preceding the house numbered x is equal to the sum of the numbers of the houses following it. Then, what will be the value of x?

A. 21 B. 30 C. 35 D. 42

Q21. Bikram had a certain number of Rs 1 coins, Rs 2 coins and Rs 10 coins. If the number of Rs 1 coins he had is six times the number of Rs 2 coins Bikram had, and the total worth of his coins is Rs 160, find the maximum number of Rs 10 coins Bikram could have had.

A. 12 B. 10 C. 8 D. 6

Q22. In a Call centre, number of bonus point is related to working hour by linear equation. One day there were 1000 working hours and 8 bonus points and on another day there were 400 working hours and 5 bonus points. What is the expected number of bonus points when there were no working hours.

A. 1 B. 2 C. 3 D. 4

Q23. Agniwesh has a certain amount of money in only Rs. 1 and Rs 10 notes. The number of Rs. 1 notes multiplied by the number of Rs 10 notes is equal to the total money (in Rs) that he has. The number of Rs 10 notes is less than ten. Which of the following is a possible figure for the total number of notes he can have?

A. 18 B. 14 C. 16 D. 20

Q24. F(x) is a fourth order polynomial with integral coefficients and with no common factor. The roots of F(x) are –2, –1, 1, 2. If p is a prime number greater than 97, then the largest integer that divides F(p) for all values of p is

A. 72 B. 120 C. 240 D. 360

Q25. In a cricket match, India scored 232 runs without losing any wicket. The runs scored by byes, wides and by two batsmen, Rahul and Sumant. The runs scored by the two batsmen are 26 times wides. There are 8 more byes than wides. If the ratio of the runs scored by Rahul and Sukant is 6:7, then the total runs scored by batsman is:

A. 128 B. 168 C. 208 D. 248

Q26. The difference between a number and $\frac{2^{th}}{5}$ of the number is 30. The number is

A 50 B 75 C 57 D 60

Q27. Sum of digits of a two digit number is 10. If digits are interchanged, obtained number is 54 less than original number. What is the number?

A 46 B 64 C 82 D 98

----------ANSWERS AND SOLUTIONS----------

Q1.C

Q1 Solution:-

ATP: Points can be in the form of 2n+5m only with m and n as natural numbers.
So,
2n+5m=50
Possible values of n and m are (25,0),(10,6),(20,2),(15,4),(5,8)
So, least difference between 5 and 8 is 3

Q2.C

Q2 Solution:-

Let Abhilash buys x dairy milk at m price and y kitkat at n price,then:
x+y=40 -------- (i)
mx+ny=17 -------- (ii)
my+nx=15 --------(iii)
here we have 4 variables and 3 equations.
On solving both the equations we get:
(ii) + (iii) we get:
mx+ny + nx + my =17+15
m(x+y) + n(x+y)=32
(m+n)(x+y)=32 [from equation(i) we have x+y=40]
m+n=32/40= Rs 0.80 = 80 paise
So cost of one kitkat and one dairymilk is 80 paise

Q3.C

Q3 Solution:-

Let the number be x, then operations undertook by the student:
=(x+12)/6=112
=> x+12=672
=> x=660
Correct answer:
=660/6+12=110+12=122

Q4.C

Q4 Solution:-

Let the cost of each apple be Rs x and that of each banana be y.
21x+29y=79 -------- (i)
29x+21y=71 -------- (ii)
On solving both equations we get:
y=2

Q5.A

Q5 Solution:-

According to remainder theorem when f(x) is divisible by x+a, then the remainder is f(−a).
In this case, as x+3 divides $x^3+4x^2-7x+12$ -k perfectly (kk being the number to be subtracted), the remainder is 0 when the value of X is substituted by -3.i.e.,$(-3)^3+4(-3)^2-7(-3)+12$ -k=0
Or, −27+36+21+12=k
Or, k= 42

Q6.C

Q6 Solution:-

Let there are x vip pass

Total cost =10x+3(18−x)

=> 10x+54−3x=110

=> 7x=56

=> x=8

If the vip and general pass are interchanged.

Then total cost =10×10+3×8=124

Q7.B

Q7 Solution:-

$x^2-3x+2=(x-2)(x-1)$

=> The factors of the cubic equation is x=2 and x=1

On putting x=2, we get, 8−24+2p+q=0

=> 2p+q=16 -------- (i)

On putting x=1, we get, 1−6+p+q=0

=> p+q=5 -------- (ii)

Thus on solving these two equation we get:

p=11 and q=−6

So p+q > 0 and pq < 0

Q8.C

Q8 Solution:-

Let the total number of person be p.

So, cadbury(Let a) > munch(Let g) > kitkat(b) > person(p)

Going by the choices, p must be at least 2, If p=2,a≤4

But to satisfy the above inequality, aa must be at least 5.

So p is not equal to 2.

If p=3, to satisfy the inequality above, a must be at least 6.

As, a≤6. It can be satisfied.

Minimum value of f=3

Q9.C

Q9 Solution:-

Let Abhilash has A coins, Bikram has B coins, Chandana has C coins and Sumit has S coins.

So ATP

B+8=C

A−8=C−3

A+6=2S

B+S=50

solving these we get A=40,B=27, C=35,S=23

So number of total coins-40+27+35+23=125

Q10.D

Q10 Solution:-

Let age of Suraj in 2002 = x

So,2002−x/90=x
=> x=22
So, Suraj's age in 2016 is,
=22+14=36 yrs

Q11.C
Q11 Solution:-
By inspection we get Sunil's present age = 26.
He will be 4^3=64
So, required time is,
=(64−26)
=38 years

Q12.A
Q12 Solution:-
Let the number wrong answers be x.
We get the equations:
(90−x)×5−x×2=387
=> x=9

Q13.D
Q13 Solution:-
Let number of rows be x and number of Security guards in each row be n.
Then, total number of Security guards =x.n
Again,
(n+4)(x−2)=(x−4)(n+4)=xn
=> nx+4x-2n-8=xn
=> 4x-2n=8 ----------(i)
and
nx+4x-4n+16=xn
=> 4x-4n=-16 ----------(ii)
Solving (i) and (ii) we get:
=> n=12 and x=8
So number of Security guards =12×8=96

Q14.B
Q14 Solution:-
Let the price of gift pack be a
Then number of packs produced =a+1
So total cost is a(a+1)
It is given that 380<a(a+1)
If a=19, the total cost =19×20=380
Dexter would not have fallen short, If:
a=20, a(a+1)=420
So he would have fallen short by Rs 40.
This is the minimum amount by which he may have fallen short.

Q15.B

Q15 Solution:-

Let the number of pineapple, mango and black-forest biscuits be p,m and b respectively.

Given, p+m+b=23 -------- (i)

$p^2+m^2+b^2=211$ -------- (ii)

From equations (i) and (ii), we get:

p=11,m=9, and m=3. [these equation has 3 variable and 2 equation so its not possible to obtain the values so we generally put values to find the values]

Q16.B

Q16 Solution:-

Let the cost of each kitkat, dairy milk and Munch be x,y and z respectively.

Given,

2x+3y+5z=40 -------- (i)

3x+5y+9z=64 -------- (ii)

From 2(i) - (ii):

=> x+y+z=16

Q17.B

Q17 Solution:-

1 candle is made from 9 stubs

So, 116 candles will be made from 1044 stubs

From 116 candles, 12 candles can be made with 8 stubs left.

Now total stubs left =(12+8)=20 out of which two candles can be made with two stubs left.

So, Maximum number of candles that can be made

=(116+12+2)=130

Q18.D

Q18 Solution:-

Let the no. of students in front row be x.

So, the no. of students in next rows be x–3,x–6,x–9 ... so on

If n i.e. no. of rows be then no. of students (n=3)

x+(x–3)+(x–6)=630

3x=639

x=213

So possible,

Similarly for n=4

x+(x–3)+(x–6)+(x–9)=630

4x–18=630

=>x=162

If n=5

x+(x–3)+(x–6)+(x–9)+(x-12) =630

5x=630+30=660

=> x=132

if n=6

x+(x–3)+(x–6)+(x–9)+(x-12)+(x-15)=630

=> 6x+45=630

=> 6x=585=> x is a fraction so 6 rows are not possible.

Q19.B

Q19 Solution:-

Let x be the number of 5-rupee notes and y be the number of 2-rupee notes.

5x+2y=29-------- (i)

x=y−12

2x−y=−1-------- (ii)

On solving both the equation we get:

x=3 and y=7

Q20.C

Q20 Solution:-

From the given information,

Sum of the first (x−1) natural numbers = Sum of natural number from (x+1) to 49.

Sum of the first (x−1) natural numbers = Sum of natural number from 1 to 49 - (Sum of natural number from 1 to x).

1 + 2 + 3 + ... (x-1) = [1+2+3 + ...50] – [1+2+3 + ...x]

(x−1)(x-1 + 1)/2=49×50/2−x(x+1)/2

$(x^2 – x)/2+(x^2+x)/2 = (49x50)/2$

$2x^2=49×50$

=> x=7×5=35

Q21.A

Q21 Solution:-

If the Bikram had x Re 1, y Rs 2 coins and z Rs 10 coins, the total value of coins he had:

=x(1)+y(2)+z(10)=x+2y+10z=160

Since, 6y=x

So, 8y+10z=160 i.e 8y is a multiple of 10 i.e. y=5 or y=10

i.e. (x,y,z)=(30,5,12) or (60,10,8)

So, the maximum value of z is 12

Q22.C

Q22 Solution:-

Number of bonus points x=a+by

Where y is the number of working hour.

8=a+1000b -------- (i)

5=a+400b -------- (ii)

On solving both the equations, we get:

a=3,b=1200

For, y=0, a=x=3

Q23.A

Q23 Solution:-

Let Agniwesh have n Rs 10 notes and m Rs 1 notes.

Given 10n+m=nm

=> $m = \frac{10n}{n-1}$

Since, n<10 the possible values of n for which m is an integer are 2,3 and 6
Corresponding m=20,15 and 12
n+m is either 22 or 18

Q24.D

Q24 Solution:-

Given that F(x)=(x+2)(x+1)(x−1)(x−2)
Putting x=P, we have F(P)=(P+2)(P+1)(P−1)(P−2)
Since P is a prime number, P is in the form 6K±1, where K is positive integer
F(6K+1)=(6K+3)(6K+2)(6K)(6K−1)
=(36)(2K+1)(3K+1)(K)(6K−1)-------- (1)
F(6K−1)=(6K+1)(6K+2)(6K)(6K−3)
=36(6K+1)(3K+1)(K)(3K−1)-------- (2)
Please note that the value of K≥17 and expression F(6K+1) and F(6K−1) always bear the factor 10.
So 360 is the correct choice.

Q25.C

Q25 Solution:-

Let the runs scored by byes, wides and batsman be x,y and z respectively:
x+y+z=232 --------- (i)
Runs scored by the two batsmen are 26 times the wides:
z=26y --------- (ii)
There are 8 more byes than wides:
x=y+8 --------- (iii)
Solving above equations,
we get, y=8,z=208
The runs scored by Rahul and Sukant was in the ratio 6:7
Let the runs scored by Rahul be 6k and by Sukant 7k.
13r=208
=> k=16
Runs scored by Rahul =16×6=96
Runs scored by Sukant =16×7=112
Sum of runs of batsman=96+112=208

Q26.A

Q26 Solution:-

Let the number be y.
According to question:

$$y - \frac{2y}{5} = 30$$

Or, $\frac{3y}{5} = 30$

Or, $y = 50$

Q27.C

Q27 Solution:-

Let the ten's digit is x and unit digit of number is y.

Then $x + y = 10$ ----------(i)

$(10x + y) - (10y - x) = 54$

=> $9x - 9y = 54$

=> $x - y = 6$ ----------(ii)

Adding (i) and (ii)

$2x = 16$

=> $x = 8$

Using (i)

$y = 10 - x = 2$

∴ number is 82.

"Don't take rest after your first victory because if you fail in second, more lips are waiting to say that your first victory was just luck." - A.P.J Abdul Kalam

Algebric Formulas:

1. Binomial Theorem:

$(a+b)^0=1$

$(a+b)^1=a+b$

$(a+b)^2=a^2+2ab+b^2$

$(a-b)^2=a^2-2ab+b^2$

$(a+b)^3=a^3+3a^2b+3ab^2+b^3$

$(a-b)^3=a^3-3a^2b+3ab^2-b^3$

$(a+b)^4=a^4+4a^3b+6a^2b^2+4ab^3+b^4$

2. Difference of Two Squares Formula:

$x^2-y^2=(x+y)(x-y)$

3. Sum / Difference of Two Cubes:

$x^3+y^3=(x+y)(x^2-xy+y^2)$

$x^3-y^3=(x-y)(x^2+xy+y^2)$

Example:1

Evaluate: $(x+3)^2$

Using the formula for a perfect square: $(a+b)^2=a^2+2ab+b^2$

=> $(x+3)^2=x^2+2(x)(3)+(3)^2$

=> $(x+3)^2=x^2+6x+9$

Example 2:

Evaluate: $(2x-6)^2$

Using the formula for binomial difference squared:

$(a-b)^2=a^2-2ab+b^2$

=> $(2x-6)2=(2x)2-2(2x)(6)+(6)2(2x-6)2=(2x)2-2(2x)(6)+(6)2$

=> $(2x-6)2=4x2-24x+36(2x-6)2=4x2-24x+36$

Example 3:

Evaluate: $(2x-5)^3$

Using the binomial theorem for cube

$(a-b)^3=a^3-3a^2b+3ab^2-b^3$

=> $(2x-5)^3=(2x)^3-3(2x)^2(5)+3(2x)(5)^2-(5)^3$

=> $(2x-5)^3=8x^3-3(4x^2)(5)+3(2x)(25)-125$

=> $(2x-5)^3=8x^3-60x^2+150x-8$

Example 4:

Evaluate: $(2x+5)(2x-5)$

From the Difference of the Squares Formula, we know that

$a^2-b^2=(a+b)(a-b)$

=> $(2x+5)(2x-5)=(2x)^2-(5)^2$

=> $(2x+5)(2x-5)=4x^2-25$

Example 5:

Factorize: x^3+64

We can express the given expression as the sum of cubes form:

$x^3+64=x^3+(4)^3$

=> $x^3+64=(x+4)[x^2-(x)(4)+(4)^2]$

=> $x^3+64=(x+4)(x^2-4x+16)$

----------EXERCISE----------

Q1. If $x^2+y^2+z^2=xy+yz+zx$, then the value of $\frac{x+y}{z}$ is,

A. 0 B. 2 C. 3 D. None

Q2. If $\sqrt{(4x-9)}+\sqrt{(4x+9)}=5+\sqrt{7}$, find the value of x.

A. 1 B. 2 C. 3 D. 4

Q3. If $2(x^2+1/x^2)-(x-1/x)-7=0$, then the two values of x are,

A. $2,-\frac{1}{2}$ B. 3,-2 C. $3,\frac{1}{3}$ D. None

Q4. If $5^{\sqrt{x}}+12^{\sqrt{x}}=13^{\sqrt{x}}$ then value of x is,

A. 0 B. 1 C. 2 D. 4

Q5. For any real number x the maximum value of $4-6x-x^2$ is,

A. 7 B. 11 C. 13 D. 17

Q6. If $a^2+b^2+c^2=2(a-b-c)-3$, then $4a-3b+5c$ is,

A. 1 B. 2 C. 3 D. None

Q7. If $x(x-3)=-1$ then the value of $x^3(x^3-18)$ will be,

A. 0 B. -1 C. -2 D. None

Q8. If $1.5x=0.04y$ then the value of $(y^2-x^2)/(y^2+2xy+x^2)$ will be,

A. $\frac{71}{77}$ B. $\frac{72}{77}$ C. $\frac{73}{77}$ D. None

Q9. If $x=\sqrt{5}+2$, then the value of $(2x^2-3x-2)/(3x^2-4x-3)$ is,

A. 0.125 B. 0.425 C. 0.625 D. None

Q10. If $x=5^{n-1}+5^{-n-1}$ where n is real, the minimum value of x is,

A. $\frac{1}{5}$ B. $\frac{2}{5}$ C. $\frac{3}{5}$ D. $\frac{4}{5}$

Q11. If $a=\sqrt{[7+2\sqrt{12}]}$ and $b=\sqrt{[7-2\sqrt{12}]}$, then value of a^3+b^3 is,

A. 41 B. 52 C. 63 D. 74

Q12. If $x^3+y^3=9$ and $x+y=3$ then the value of x^4+y^4 is,

A. 17 B. 18 C. 19 D. None

Q13. If $x^{1/3}+y^{1/3}-z^{1/3}=0$ then value of $(x+y-z)^3+27xyz$ is,

A. 0 B. 1 C. 2 D. 4

Q14. If $(a-4)^2+(b-9)^2+(c-3)^2=0$, then the value of $\sqrt{(a+b+c)}$ is,

A. 1 B. 2 C. 3 D. 4

Q15. If $a^{1/3}=11$ then a^2-331a is

A. 1333100 B. 1331000 C. 13333310 D. None

Q16. If $a+b+c=0$ then the value of is, $\frac{a2+b2+c2}{a2-bc}$

A. 0 B. 1 C. 2 D. 4

Q17. If $a = \frac{xy}{x+y}$, $b = \frac{xz}{x+z}$ and $c = \frac{yz}{y+z}$, where a, b and c are all non-zero numbers, then the value of x is:

A. $\frac{2abc}{ac+bc-ab}$ B. $\frac{2abc}{ac-bc-ab}$ C. $\frac{2abc}{ac+bc+ab}$ D. $\frac{2abc}{ac-bc+ab}$

Q18. The value of $\sqrt{(x-4)^2} + \sqrt{(x-2)^2}$, where $2<x<3$, is,

A. 1 B. 2 C. 3 D. 4

Q19. If $4y-3x=13$ and $xy=14$, then $64y^3-27x^3$ is,

A. 8739 B. 8749 C. 8759 D. 8769

Q20. If $x^2+2=2x$ then the value of $x^4-x^3+x^2+2$ will be,

A. 0 B. 1 C. 2 D. 4

Q21. If $x=(0.19)^2$, $y=1/(0.19)^2$ and $z=(1-0.19)^2-1$, then which of the following relations is true?,

A. $z<x<y$ B. $z<y<x$ C. $x<y<z$ D. None

Q22. If $x+2/x=1$, then $(x^2+x+2)/[x^2(1-x)]$ is,

A. 1 B. 2 C. 3 D. 4

Q23. If $a/(1-a)+b/(1-b)+c/(1-c)=1$, then the value of $1/(1-a)+1/(1-b)+1/(1-c)$,

A. 1 B. 2 C. 3 D. 4

Q24. If $x=(\sqrt{2}+1)/(\sqrt{2}-1)$ and $xy=1$ find the value of $(2x^2+3xy+2y^2)/(2x^2-3xy+2y^2)$.

A. 73/65 B. 71/65 C. 69/65 D. 67/65

Q25. Find the value of α when the expression $x^2y^2+\alpha x+1/\sqrt{2}$ is a perfect square.

A. 1 B. 2 C. 3 D. 4

Q26. If $a+1/b=1$ and $b+1/c=1$, then value of $c+1/a$ is,

A. 3 B. 5 C. 7 D. 9

Q27. If $(x+1/x)^2=3$ then the value of, $x^{206}+x^{200}+x^{90}+x^{84}+x^{18}+x^{12}+x^6+1$ is,

A. 0 B. 5 C. 7 D. None

Q28. If $n=7+3\sqrt{5}$, then the value of $\sqrt{n} + 1/\sqrt{n}$ is,

A. $(9+\sqrt{5})/2\sqrt{2}$ B. $(7+\sqrt{5})/2\sqrt{2}$ C. $(9+\sqrt{6})/2\sqrt{2}$ D. $(9+\sqrt{5})/2$

Q29. If $p+1/p=5$, then the value of $(p^4+1/p^2)/(p^2-3p+1)$ is,

A. 14 B. 31 C. 55 D. 125

Q30. If $\sqrt{2}x-\sqrt{3}y=0$ and $\sqrt{7}x+\sqrt{2}y=0$ then the value of $x+y$ is,

A. 0 B. 2 C. 3 D. 4

Q31. If $x+1/x=-2$, then the value of $x^{2n+1}+1/x^{2n+1}$ where n is a positive integer is,

A. 1 B. -2 C. 3 D. -4

Q32. Find the remainder when $x^5-9x^2+12x-14$ is divided by $(x-3)$.

A. 180 B. 182 C. 184 D. None

Q33. If $x^3+3/x=4(a^3+b^3)$ and $3x+1/x^3=4(a^3-b^3)$, then a^2-b^2 is,

A. 1 B. -2 C. 3 D. -4

Q34. If x=2015, y=2014 and z=2013 then the value of $x^2+y^2+z^2-xy-yz-zx$ is,

A. 3 B. 5 C. 7 D. None

Q35. If x=20, y=19, the value of $(x^2+y^2+xy)/(x^3-y^3)$ is,

A. 1 B. 2 C. 3 D. 4

Q36. If (x+y):(y+z):(z+x)=6:7:8 and x+y+z=14, then value of z is,

A. 3 B. 6 C. 9 D. None

Q37. If $2^{x-1} + 2^{x+1} = 1280$, then find the value of x.

A. 1 B. 4 C. 9 D. 16

Q38. If x is real then the minimum value of $4x^2-x-1$ is,

A. -1 B. -2 C. -4 D. $-4\frac{1}{4}$

Q39. If $p=1+\sqrt{2}+\sqrt{3}$, then $p+1/(p-1)$ is,

A. $1+3\sqrt{3}$ B. $1+2\sqrt{3}$ C. $1+\sqrt{3}$ D. None

Q40. If a and b are positive integers such that $a^2-b^2=19$ then a+b is,

A. 3 B. 6 C. 10 D. 19

Q41. If a−b=3, and $a^3-b^3=117$, then absolute value of (a+b)/(a-b) is,

A. $\frac{3}{7}$ B. $1\frac{1}{4}$ C. $2\frac{1}{3}$ D. None

Q42. If $x=\sqrt[3]{5}+2$, then the value of $x^3-6x^2+12x-13$, is,

A. 0 B. 1 C. 2 D. None

Q43. If p/a+q/b+r/c=1, and a/p+b/q+c/r=0, where p, q, r, a, b and c are non-zero, the value of $p^2/a^2+q^2/b^2+r^2/c^2$ is,

A. 0 B. 1 C. 2 D. None

Q44. If $x^2-4x+1=0$, then x^3+1/x^3 is,

A. 41 B. 52 C. 63 D. 74

Q45. If $2x^2-7xy+3y^2=0$, then the value of x:y is,

A. 3:1 B. 1:2 C. 2:3 D. A and B

Q46. If $(1/5)^{3y} = 0.008$, then find the value of $(1/4)^{2y}$.

A. 0.0125 B. 0.0225 C. 0.0625 D. 1

Q47. If $9\sqrt{x}=\sqrt{12}+\sqrt{147}$ then the value of x is,

A. 1 B. 2 C. 3 D. 4

Q48. If p+2p/3+p/2+p/7=9/7, then the value of 97p is,

A. 30 B. 36 C. 42 D. 48

Q49. When the expression $12x^3-13x^2-5x+7$ is divided by 3x+2 the remainder is,

A. 0 B. 1 C. 2 D. None

Q50. If x+1/x=3 then the value of x^5+1/x^5 is,

A. 121 B. 122 C. 123 D. 125

Q51. If p=124, then the value of $[p(p^2+3p+3)+1]^{1/3}$ is,

A. 0 B. 27 C. 125 D. 216

Q52. The expression x^4-2x^2+k will be a perfect square if value of k is,

A. 1 B. -2 C. 3 D. -4

Q53. One of the factors of $(a^2-b^2)^3+(b^2-c^2)^3+(c^2-a^2)^3$ is,

A. (b−c)(b−c) B. (a+b)(a−b) C. (a+b)(a+b) D. (a−b)(a−b)

Q54. If 6+1/x=x, then the values of x^4+1/x^4 is,

A. 6000 B. 1442 C. 1222 D. None

Q55. If $x^4+1/x^4=119$ and x>1, then positive value of x^3-1/x^3 is,

A. 16 B. 26 C. 36 D. 46

Q56. If x=2.361, y=3.263, and z=5.624, then the value of $x^3+y^3-z^3+3xyz$ is,

A. 0 B. 1 C. 2 D. None

Q57. If $x^2+1/x^2=66$, then the value of $(x^2-1+2x)/x$ is,

A. 10,-6 B. 10,6 C. 12,4 D. None

Q58. If $(x+1/x)^2=3$ then the value of $(x^{72}+x^{66}+x^{54}+x^{36}+x^{24}+x^6+1)$ is,

A. 1 B. $\frac{1}{\sqrt{3}}$ C. -√3 D. None

Q59. Find the minimum value of $2x^2-(x-3)(x+5)$, where x is real,

A. 10 B. 12 C. 14 D. None

Q60. If x+y=7 then the value of x^3+y^3+21xy is,

A. 100 B. 121 C. 343 D. None

Q61. If $3x+1/2x=5$, then the value of $8x^3+1/27x^3$ is,

A. $10\frac{10}{27}$ B. $20\frac{10}{27}$ C. $30\frac{10}{27}$ D. None

Q62. If 2a+1/3a=6, then find the value of the expression 3a+1/2a is,

A. 0 B. 3 C. 6 D. 9

Q63. If $p^3+3p^2+3p=7$ then the value of p^2+2p is,

A. √3 B. 3 C. 9 D. None

Q64. If $x^2+y^2-2x+6y+10=0$, then (x^2+y^2) is,

A. 0 B. 10 C. 20 D. None

Q65. If x=√3/2 then the value of $[\sqrt{(1+x)}+\sqrt{(1-x)}]/[\sqrt{(1+x)}-\sqrt{(1-x)}]$ will be,

A. √3 B. $\frac{1}{\sqrt{3}}$ C. -√3 D. None

Q66. If $x^3+y^3=9$ and x+y=3, then value of $\frac{1}{x}+\frac{1}{y}$ will be,

A. $\frac{1}{2}$ B. $\frac{1}{3}$ C. $1\frac{1}{2}$ D. $2\frac{1}{2}$

Q67. If $x^2=2$, then x+1 is,

A. (x−2)/(3−2x). B. (x−4)/(3−2x). C. (x−1)/(3−2x). D. None

Q68. If $x+1/16x=1$, then the value of $64x^3+1/64x^3$ is,
A. 30 B. 41 C. 52 D. None

Q69. If $a^2+b^2+1/a^2+1/b^2=4$ then a^2+b^2 is,
A. 0 B. 1 C. 2 D. None

Q70. If $a+b+c=6$, $a^2+b^2+c^2=14$ and $a^3+b^3+c^3=36$, then the value of abc is,
A. 0 B. 2 C. 4 D. 6

Q71. If $(x-a)(x-b)=1$ and $(a-b)+5=0$, then $(x-a)^3-1/(x-a)^3$ is
A. 100 B. 140 C. 200 D. 280

Q72. If a, b and c are non-zero and $a+1/b=1$ and $b+1/c=1$, the value of abc is,
A. 0 B. -1 C. -2 D. None

Q73. If $x^2+y^2+z^2=xy+yz+zx$, then the value of, $(4x+2y-3z)/2x$ is,
A. 1/10 B. 2/15 C. 3/2 D. None

Q74. If $a^4+a^2b^2+b^4=8$ and $a^2+ab+b^2=4$, then the value of ab is,
A. 0 B. 1 C. 2 D. None

Q75. If $a+b+c=2s$, then $[s^2+(s-a)^2+(s-b)^2+(s-c)^2]/(a^2+b^2+c^2)$ is,
A. 0 B. 1 C. 2 D. None

Q76. If $ax^2+bx+c=a(x-p)^2$, then the relation between a, b and c can be expressed as,
A. $b^2=4ac$ B. $b^2=ac$ C. $a+b=c$ D. None

Q77. If a:b=2:3 and b:c=4:5, then the value of a2:b2:bc is,
A. 16:36:43 B. 16:32:45 C. 10:36:45 D. 16:36:45

Q78. If $a^2-4a-1=0$, then $a^2+1/a^2+3a-3/a$ is,
A. 20 B. 30 C. 50 D. None

Q79. If $x^{x\sqrt{x}}=(x\sqrt{x})^x$ then x is equal to,
A. 1/4 B. 4/9 C. 9/4 D. 16/9

Q80. The value of $a=b^2/(b-a)$, then the value of a^3+b^3 is,
A. 0 B. 1 C. 2 D. None

Q81. The minimum value of $(a-2)(a-9)(a-2)(a-9)$ is,
A. 27/4 B. -49/4 C. 81/4 D. None

Q82. If a=11 and b=9, then the value of, $(a^2+b^2+ab)/(a^3-b^3)$ is,
A. 1 B. 1/2 C. 1/3 D. 1/4

Q83. If $x(3-\frac{2}{x})=\frac{3}{x}$, and $x\neq0$ then x^2+1/x^2 is,
A. 0 B. 11/9 C. 22/9 D. None

Q84. The value of $a=b^2/(b-a)$, then the value of a^3+b^3 is,
A. 0 B. 1 C. 2 D. None

Q85. If $x=y^a$, $y=z^b$ and $z=x^c$, then find the value of abc.
A. 1 B. 2 C. 3 D. 4

Q86. If $a+\frac{1}{a-2}=4$, then $(a-2)^2+1/(a-2)^2$ is,

A. 0 B. 1 C. 2 D. None

Q87. If $x\neq0$, $y\neq0$ and $z\neq0$, and $1/x^2+1/y^2+1/z^2=1/xy+1/yz+1/zx$, then the relation between x, y and z is,

A. $x=y=z$ B. $x>y>z$ C. $x<y<z$ D. None

Q88. If a:b=3:2, then the ratio of, $(2a^2+3b^2):(3a^2-2b^2)$ is,

A. 10:11 B. 20:13 C. 30:19 D. None

.

Q89. If $xy(x+y)=1$, then $1/(x^3y^3)-x^3-y^3$ is,

A. 0 B. 1 C. 2 D. 3

This chapter contains the topics and questions I discussed and created in our classes or obtained from students as their doubts. All the questions noted, typed, redesigned and rectified by group of volunteers consisting of:

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----------ANSWER----------

Q1.B	**Q2.D**	**Q3.A**	**Q4.D**	**Q5.C**
Q6.B	**Q7.B**	**Q8.C**	**Q9.C**	**Q10.B**
Q11.B	**Q12.A**	**Q13.A**	**Q14.D**	**Q15.B**
Q16.C	**Q17.A**	**Q18.B**	**Q19.B**	**Q20.A**
Q21.A	**Q22.A**	**Q23.D**	**Q24.B**	**Q25.B**
Q26.C	**Q27.A**	**Q28.A**	**Q29.C**	**Q30.A**
Q31.B	**Q32.C**	**Q33.A**	**Q34.A**	**Q35.A**
Q36.B	**Q37.C**	**Q38.D**	**Q39.B**	**Q40.D**
Q41.C	**Q42.A**	**Q43.B**	**Q44.B**	**Q45.D**
Q46.C	**Q47.C**	**Q48.C**	**Q49.B**	**Q50.C**
Q51.C	**Q52.A**	**Q53.B**	**Q54.B**	**Q55.C**
Q56.A	**Q57.A**	**Q58.A**	**Q59.C**	**Q60.C**
Q61.C	**Q62.D**	**Q63.B**	**Q64.B**	**Q65.A**
Q66.C	**Q67.C**	**Q68.C**	**Q69.C**	**Q70.D**
Q71.B	**Q72.B**	**Q73.C**	**Q74.B**	**Q75.B**
Q76.A	**Q77.D**	**Q78.B**	**Q79.C**	**Q80.A**
Q81.B	**Q82.B**	**Q83.C**	**Q84.A**	**Q85.A**
Q86.C	**Q87.A**	**Q88.C**	**Q89.D**	

----------ANSWER WITH SOLUTION----------

Q1.B

Q1 Solution:-

Given:

$x^2+y^2+z^2=xy+yz+zx$

Or, $2x^2+2y^2+2z^2-2xy-2yz-2zx=0$

Or, $(x-y)^2+(y-z)^2+(z-x)^2=0$

=> $x=y=z$

So, $\frac{x+y}{z}=\frac{x+x}{zx}=\frac{2x}{xz}=2$

Q2.D

Q2 Solution:-

Raising the given equation to the power of 2,

$[\sqrt{(4x-9)}+\sqrt{(4x+9)}]^2=(5+\sqrt{7})^2$,

Or, $8x+2\sqrt{(16x^2-81)}=32+10\sqrt{7}$.

Equating the non-square-root terms of LHS and RHS,

$8x=32$,

Or, $x=4$.

Q3.A

Q3.Solution:-

Let $(x-1/x)=p$.

Squaring both sides,

$(x^2+1/x^2-2)=p^2$,

Or, $(x^2+1/x^2)=p^2+2$.

$2(x^2+1/x^2)-(x-1/x)-7=0$,

Or, $2(p^2+2)-p-7=0$,

Or, $2p^2-p-3=0$, a very simple quadratic equation.

Or, $(2p-3)(p+1)=0$.
So we get
$p=3/2$,
Or, $p=3/2$. By reverse substitution of the original expression value of pp,
$x-1/x=3/2$,
Or, $2x^2-3x-2=0$,
Or, $(2x+1)(x-2)=0$,
So values of x, as, 2 and $-1/2$.

Q4.D
Q4 Solution:-
we know:
$12^2 + 5^{2=} 13^2$
Comparing with
$5^{\sqrt{x}}+12^{\sqrt{x}}=13^{\sqrt{x}}$ we get $\sqrt{x} = 2 \Rightarrow x = 4$

Q5.C
Q5 Solution:-
Given:
$4-6x-x^2$
$= 4+9-9-6x-x^2$
$=13 -(9 + 6x + x^2)$
$=13 - (3 + x)^2$
Clearly value of expression will be maximum when $(3 + x)^2$ is minimum, its minimumu value is zero so value of expression will be maximum as 13

Q6.B
Q6 Solution:-
We analyze the given expression and gather friendly terms on the LHS,
$a^2+b^2+c^2=2(a-b-c)-3$,
Or, $(a-1)^2+(b+1)^2+(c+1)^2=0$
As the sum of squares is 0, each of the squares must be 0.
So, $a=1$, $b=-1$ and $c=-1$.
So, the expression is,
$4a-3b+5c=4+3-5=2$.

Q7.B
Q7 Solution:-
$x+1/x=3$
Or, $x^2+1/x^2+2x.1/x=9$.
Or, $x^2+1/x^2+2=9$.
Or, $x^2+1/x^2=9-2=7$.
Now we can get the sum of cubed inverses,
$x^3+1/x^3=(x+1/x)(x^2-1+1/x^2)$
$=3\times(7-1)=3x6$
$=18$.
$x^6 + 1 = 18x^3$
$x^6-18x^3=-1$
Or, $x^3(x^3-18)=-1$

Q8.C
Q8 Solution:-
$1.5x=0.04y$,

Or, $3/2x=4/100y$,
Or, $x/y=2/75$.
Now:
$(y^2-x^2)/(y^2+2xy+x^2)=[(x+y)(y-x)]/(x+y)^2$
$=(y-x)/(x+y)=(1-x/y)/(1+x/y)=(1-2/75)/(1+2/75)=73/77$

Q9.C
Q9 Solution:-
Working on the expression now,
$(2x^2-3x-2)/(3x^2-4x-3)$
$=[2x(x-1/x-3/2)]/[3x(x-1/x-4/3)]=[2(4-3/2)]/[3(4-4/3)]=5/8=0.625$

Q10.B
Q10 Solution:-
$x=5^{n-1}+5^{-n-1} \geq 2.\sqrt{5^{n-1}.5^{-n-1}}=2.\sqrt{5^{n-1-n-1}}=2\sqrt{.5^{-2}}=2/\sqrt{5^2}=2/5$ $[a+b\geq 2\sqrt{ab}]$

Q11.B
Q11 Solution:-
$a^3+b^3=(a+b)(a^2-ab+b^2)$
$a^2=7+2\sqrt{12}$ and $b^2=7-2\sqrt{12}$, and so, $a^2+b^2=14$.
Again, $ab=7^2-4\times12=1$, and so, $(a^2-ab+b^2)=13$.
Now we have to transform a+b and find its value.
$a^2+b^2=14$ and $ab=1$,
So,
$a^2+2ab+b^2=(a+b)^2=14+2=16$
=> $a+b=4$
And so, $a^3+b^3=(a+b)(a^2-ab+b^2)=4(16-3)=4\times13=52$.

Q12.A
Q12 Solution:-
$x^3+y^3=(x+y)\times(x^2-xy+y^2)$
$9=3\times[(x+y)^2-3xy]=3\times(9-3xy)=27-9xy$
Or, $9xy=27-9=18$.
Or $xy=2$
Now, $x^4+y^4=(x^2)^2+(y^2)^2$
$=(x^2+y^2)^2-2x^2y^2$
$=[(x+y)^2-2xy]^2-2(xy)^2$
$=[3^2-2.2]^2-2(2)^2$ $=(9-4)^2-2.4$ $=5^2-8$ $=25-8$ $=17$.

Q13.A
Q13 Solution:-
We are given:
$x^{1/3}+y^{1/3}=z^{1/3}$
Now cubing both sides we get,
$x+3x^{1/3}y^{1/3}(x^{1/3}+y^{1/3})+y=z$
Or, $(x+y-z)=-3x^{1/3}y^{1/3}z^{1/3}$
Cubing again both sides, $(x+y-z)^3=-27xyz$.
So answer is 0.

Q14.D
Q14 Solution:-
In our given problem we have,
$(a-4)=0$,

Or, $a=4$.
$(b-9)=0$,
Or, $b=9$, and
$(c-3)=0$,
Or, $c=3$.
So, $\sqrt{(a+b+c)}=\sqrt{16}=4$.

Q15.B
Q15 Solution:-
$a^2-331a=a(a-331)$.
Let's now find the value of a.
$a^{1/3}=11$
Or, $a=11^3=1331$
$a(a-331)=1331(1331-331)=1331x1000=1331000$

Q16.C
Q16 Solution:-
We have
$b + c = -a$
Squaring we get $b^2 + c^2 +2bc=a^2$.
$b^2 + c^2=a^2 – 2bc$
So, $a^2 + b^2 +c^2 = a^2+b^2+c^2-2bc=a^2+a^2-2bc=2a^2-2bc=2(a^2-bc)$
Putting in , $\frac{a2+b2+c2}{a2-bc}$ we get $\frac{2(a2-bc)}{(a2-bc)} = 2$

Q17.C
Q17Solution:-
$a = \frac{xy}{x+y}$

Or, $\frac{1}{a}=\frac{x+y}{xy}=\frac{1}{x}+\frac{1}{y}$. ----------(i)

Similarly,

$\frac{1}{b}=\frac{x+z}{xz}=\frac{1}{x}+\frac{1}{z}$ ----------(ii)and

$\frac{1}{c}=\frac{z+y}{zy}=\frac{1}{z}+\frac{1}{y}$ ----------(iii)

Adding all the equations we get,

$\frac{1}{a}+\frac{1}{b}+\frac{1}{c}=\frac{2}{x}+\frac{2}{y}+\frac{2}{z}$----------(iv)

(iv) – 2x(iii) gives:

$\frac{2}{x}=\frac{1}{a}+\frac{1}{b}+\frac{1}{c}-\frac{2}{c}$

$\frac{2}{x}=\frac{bc+ac+ab-2ab}{abc}$

$X = \frac{2abc}{ac+bc-ab}$

Q18.B

Q18. Solution:-

As given $2<x<3$,$x-2$ and $4-x$ is positive.

So,

$\sqrt{(x-4)^2}+\sqrt{(x-2)^2}$

$=x-2+4-x$

$=2.$

Q19.B

Q19. Solution:-

$4y-3x=13,$

Or, $(p-q)^2=p^2-2pq+q^2=169,$

Or, $p^2+pq+q^2=169+3pq$, the term $3pq$ added to both sides,

Or, $p^2+pq+q^2=169+504=673.$

So, $64y^3-27x^3=p^3-q^3$

$=(p-q)(p^2+pq+q^2)$

$=13\times673$

$=8749.$

Q20.A

Q20 Solution:-

Given $x^2-2x=-2.$

Given expression:- $x^2(x^2-2x)+2x^3-x^3+2x=x^3-2x^2+2x= x(x^2-2x)+2x=-2x+2x=0$

Q21.A

Q21 Solution:-

By substitution, $p=0.09$, where $p<1$ we have the transformed given equations as,

$x=p^2,$

$y=1/p^2,$ and

$z=(1-p)^2-1=p^2-2p.$

When comparing x with y we can conclude that,

$y>x$, as $p<1$ (dividing 1 by a value less than 1 makes y larger than 1, whereas x is less than 1).

Comparing x with z we can conclude that,

$x>z$, as p is positive.

These two conclusions are sufficient to finally form the desired comparative relation between the three variables as,

$y>x>z,$

Or, $z<x<y.$

Q22.A

Q22 Solution:-

$x+2/x=1$

Or, $x^2-x+2=0.$

$(x^2+x+2)/[x^2(1-x)]=(x^2-x+2+2x)/[x^2(1-x)] = (0+2x)/[x^2(1-x)]$

$=2x/[x^2(1-x)]$

$=2/x(1-x)$

$=2/(x-x^2)$

$=2/(x-x^2) -1 + 1$

$=(x^2-x+2)/(x-x^2) + 1$

$=0/(x-x^2) + 1$ [As $(x^2-x+2) = 0$]

$=0+1$

$=1$

Q23.D

Q23. Solution:-

Adding 3 to both sides of the first expression we get,

$3+a/(1-a)+b/(1-b)+c/(1-c)=4$,

Or, $[1+a/(1-a)]+[1+b/(1-b)]+[1+c/(1-c)]=4$

Or, $1/(1-a)+1/(1-b)+1/(1-c)=4$.

Q24.B

Q24 Solution:-

$x+y=(\sqrt{2}+1)/(\sqrt{2}-1) + (\sqrt{2}-1)/(\sqrt{2}+1)$

$=[(\sqrt{2}+1)^2 + (\sqrt{2}-1)^2] /(2-1)$

$=2.(2+1)/1$

$=6$

Now

$x^2 + y^2 = (x+y)^2-2xy=6^2-2.1=36-2=34$

$(2x^2+3xy+2y^2)/(2x^2-3xy+2y^2)=(2.34+3)/(2.34-3)=71/65$

Q25.B

Q25 Solution:-

$a^2=(xy)^2$ and

$b^2=(1/y)^2$.

For the quadratic equation to be a perfect square then the mid-term must be,

$2ab=2\times xy\times 1/y=x$.

So, for the given equation to be a perfect square,

$\alpha x=2x$,

Or, $\alpha=2$

Q26.C

Q26 Solution:-

Finding b in terms of a from the first equation,

$a+1/b=1$

Or, $1/b=1-a$,

Or, $b=1/1-a$.

Substituting this value in the second equation,

$b+1/c=1$,

Or, $1/(1-a)+1/c=1$,

Or, $1/c=1-1/(1-a)=-a/(1-a)$,

Or, $c=-1-a/a$,

Or, $c+1/a=1$

Or, Value of $a+b=7$

Q27.A

Q27 Solution:-

$(x+1/x)^2=3$

Or, $x^2+1/x^2+2=3$,

Or, $x^2+1/x^2-1=0$.

Using our sum of cubes expression concept,

$x^3+1/x^3=(x+1/x)(x^2-1+1/x^2)=0$

$x^{206}+x^{200}+x^{90}+x^{84}+x^{18}+x^{12}+x^6+1$

$=x^{203}(x^3+1/x^3)+x^{87}(x^3+1/x3)+x^{15}(x^3+1/x^3)+x^3(x^3+1/x^3)$

$=0$.

Q28.A

Q28 Solution:-

$n=7+3\sqrt{5}$

$=(14+6\sqrt{5})/2$

$=(1/2)(3+\sqrt{5})^2$,

Or, $\sqrt{n}=(3+\sqrt{5})/\sqrt{2}$. ----------(i)

Inversing we get:

$1/\sqrt{n}=\sqrt{2}/(3+\sqrt{5})$

$=\sqrt{2}(3-\sqrt{5})/4$, [rationalization multiplying numerator and denominator by $3-\sqrt{5}$]

$=(3-\sqrt{5})/2\sqrt{2}$. ----------(ii)

Adding equation (i) and (ii)

$\sqrt{n}+1/\sqrt{n}=(9+\sqrt{5})/2\sqrt{2}$.

Q29.C

Q29 Solution:-

Let us take care of the numerator expression first.

$p+1/p=5$

Or, $p2-1+1p2=25-3=22$.

So, $p^3+1/p^3=(p+1/p)(p^2-1+1/p^2)$

$=5\times22$

$=110$.

So, numerator $=110p$.

Expanding the given expression and rearranging we get,

$p^2-5p+1=0$.

So denominator is,

$p^2-3p+1=2p$.

Finally then the desired value of expression as,

$(p^4+1/p^2)/(p^2-3p+1) = 110p/2p=55$.

Q30.A

Q30 Solution:-

Given:-

$\sqrt{2}x-\sqrt{3}y=0$

Or, $\sqrt{(4x/3)}-\sqrt{2}y=0$. [Dividing by $\sqrt{3}$]

Adding this equation with the second equation $\sqrt{7}x+\sqrt{2}y=0$ we get,

$\sqrt{(4x/3)}+\sqrt{7}x=0$,

Or, $\sqrt{x}(\sqrt{(4/3)}+\sqrt{7})=0$.

So, $\sqrt{x}=0=>x=0$ and substituting it in any of the two equations we get $y=0$ also.

So $x+y=0+0=0$.

Q31.B

Q31 Solution:-

$x+1/x=-2$

Squaring both sides and rearranging,

$x^2+1=-2x$

$x^2+1+2x=$,

Or, $(x+1)^2=0$,

Or, $x+1=0$.

Or, $x=-1$.

$x^{2n+1}+1/x^{2n+1}$

$=(-1)^{2n+1}+1/(-1)^{2n+1} = -1 -1 =-2$

Q32.C

Q32 Solution:-

Put x-3=0 or x=3
$3^5-9.3^2+12.3-14$
243-9.9+36-14
=343-81+36-14
=184.

Q33.A
Q33 Solution:-
First we add the two equations giving,
$8a^3=x^3+3/x+3x+1/x^3$
$=x^3+3(x^2\times1/x)+3(x\times1/x^2)+1/x^3$
$=(x+1/x)^3$
Or, $(x+1/x)=2a$
In the same way, we would get,
$(x-1/x)=2b$
Squaring the two and subtracting we get,
$4(a^2-b^2)=4$,
Or, $a^2-b^2=1$.

Q34.A
Q34 Solution:-
We reproduce from the remembrance of rich algebraic concepts,
$(x-y)^2+(y-z)^2+(z-x)^2$
$=2(x^2+y^2+z^2-xy-yz-zx)$.
Or, $(x^2+y^2+z^2-xy-yz-zx)=\frac{1}{2}[(x-y)^2+(y-z)^2+(z-x)^2]$
$=\frac{1}{2}(1+1+4)$
$=\frac{1}{2}x6$
$=3$

Q35.A
Q35 Solution:-
$x^3-y^3=(x-y)(x^2+xy+y^2)$.
$=(x^2+y^2+xy)/(x^3-y^3)$
$=(x^2+y^2+xy)/(x-y)(x^2+xy+y^2)$
$=1/(x-y)$
$=120-19$
$=1$.

Q36.B
Q36 Solution:-
Let $x+y=6k$ ----------(i)
$y+z=7k$
$z+x=8k$
Adding all We get:
$2x+2y+2z=21k$
Or, $x+y+z=21k/2$ ----------(ii)
$14=21k/2$
$K=4/3$
(ii) – (i) gives
$Z=9k/2=9x2/3=6$

Q37.C

Q37 Solution:-

$2^{x-1} + 2^{x+1} = 1280$

⇨ $2^{x-1}(1+2^2) = 1280$

⇨ $2^{x-1} = 1280 / 5 = 256 = 2^8$

⇨ $x - 1 = 8$

⇨ $x = 9$.

So, $x = 9$.

Q38.D

Q38 Solution:-

$4x^2-x-1$

$=(2x)^2-2\times2x\times(1/4)+(1/4)^2-1-(1/4)^2$

$=(2x-1/4)^2-17/16$.

So, the minimum value of the given expression will be $-17/16$ when $x=1/8$.

Q39.B

Q39 Solution:-

$p+1/(p-1)$

$=1+(p-1)+1/(p-1)$

$=1+q+1/q$, where $q=p-1$

$p=1+\sqrt{2}+\sqrt{3}$,

Or, $p-1=q=\sqrt{3}+\sqrt{2}$.

And $1/q=1/(\sqrt{3}+\sqrt{2})$

$1/q=\sqrt{3}-\sqrt{2}$. [Rationalizing the surd expression on the]

So, $q+1/q=2\sqrt{3}$.

Finally then the expression,

$p+1/(p-1)=1+q+1/q =1+2\sqrt{3}$.

Q40.D

Q40 Solution:-

$a^2-b^2=(a+b)(a-b)=19$

As 19 is a prime number and a and b are positive integers, So there is only one possibility that $a-b=1$ and $a+b=19$.

So, $a=10$ and $b=9$.

Q41.C

Q41 Solution:-

$(a-b)^3=a^3-b^3-3ab(a-b)$,

Or, $9ab=117-27=90$,

So $ab=10$, and

$(a+b)^2=(a-b)^2+4ab=49$,

=> $a+b=7$

So, value of $(a+b)/(a-b) = 7/3$

Q42.A

Q42 Solution:-

$x=\sqrt[3]{5}+2$,

Or, $(x-2)^3=5$

Or, $x^3-6x^2+12x-8=5$,

Or, $x^3-6x^2+12x-13=0$.

Q43.B

Q43 Solution:-

substituting x=p/a, y=q/b and z=r/c.
The given expressions are then transformed to,
x+y+z=1 and 1/x+1/y+1/z=0.
Given: 1/x+1/y+1/z=0.
Or, xy+yz+zx=0, a simple result.
Now we take up the first expression intending to square it, as the has the squares,
x+y+z=1,
Or, $(x+y+z)^2=1$.
Or, $x^2+y^2+z^2+2(xy+yz+zx)=1$
Or, $x^2+y^2+z^2=1$.

Q44.B
Q44 Solution:-
$x^2-4x+1=0$
Or, $x^2+1=4x$
Or, $x+1/x=4$
We have
$x^3+1/x^3=(x+1/x)(x^2-1+1/x^2) = 4((x+1/x)^2-3) = 4\times(4^2 - 3)=4\times(16-3)=4\times13=52$

Q45.A
Q45 Solution:-
Factorising we get
$2x^2-7xy+3y^2=(2x-y)(x-3y)=0$.
So Either 2x=y
Or x=3y.
Either x:y=1:2 and in the second case,
Or x:y=3:1.

Q46.C
Q46 Solution:-
$(1/5)^{3y} = (0.2)^3 = (1/5)^3$
=> 3y = 3
=> Y = 1.
=> $(1/4)3y=(0.25)^{2y}$
=> $(0.25)^2 = 0.0625$.

Q47.C
Q47 Solution:-
$9\sqrt{x}=\sqrt{12}+\sqrt{147}=2\sqrt{3}+7\sqrt{3}=9\sqrt{3}$
So, $\sqrt{x}=\sqrt{3}$
x=3

Q48.C
Q48 Solution:-
Essentially this problem turns out to be an evaluation of sum of fractions,
p+2p/3+p/2+p/7=9/7,
Or, p(1+2/3+1/2+1/7)=9/7,
Or, p(42+28+21+6)/42=9/7,
Or, p(97/42)=9/7,
Or, 97p=54.

Q49.B
Q49 Solution:-

$12x^3-13x^2-5x+7$
$=4x^2(3x+2)-8x^2-13x^2-5x+7$
$=4x^2(3x+2)-7x(3x+2)+14x-5x+7$
$=4x^2(3x+2)-7x(3x+2)+3(3x+2)-6+7$
$=4x^2(3x+2)-7x(3x+2)+3(3x+2)+1.$
So, remainder will be 1.

Q50.C
Q50 Solution:-
To get the sum of inverse squares,
$x+1/x=3,$
Or, $x^2+1/x^2=3^2-2=7.$
Carrying on further to get sum of inverse cubes,
$x^3+1/x^3=(x+1/x)(x^2-1+1/x^2)$
$=3\times(7-1)=18$
Now
$(x^2+1/x^2)(x^3+1/x^3)$
$=(x^5+1/x^5)+(x+1/x)$
Or, $7\times18=(x^5+1/x^5)+3,$
Or, $(x^5+1/x^5)=126-3=123$

Q51.C
Q51 Solution:-
$[p(p^2+3p+3)+1]^{1/3}$
$=(p^3+3p^2+3p+1)^{1/3}$
$=[(p+1)^3]^{1/3}$
$=p+1$
$=124+1=125.$

Q52.A
Q52 Solution:-
x^4-2x^2+k
$= x^4-2x^2+1 + k - 1$
$=(x^2 -1)^2 +k -1$
Clearly above expression will be perfect square if k-1=0 that is k =1.

Q53.B
Q53 Solution:-
assume, $p-q=x$, $q-r=y$ and $r-p=z$ transforming the expression again to,
$x^3+y^3+z^3$, but we have one additional helping expression, $x+y+z=0$.
We know under these conditions,
$x^3+y^3+z^3=3xyz$, that is all three of $x=a^2-b^2$, $y=b^2-c^2$ and $z=c^2-a^2$ are factors of the given expression. Out of the choices we detect only a^2-b^2 in product form.

Q54.B
Q54 Solution:-
$x-1/x=6,$
Or, squaring both sides,
$x^2-2+1/x^2=36$
Or, $x^2+1/x^2=38.$
Squaring both sides again,
$x^4+2+1/x^4=38^2=1444,$
Or, $x^4+1/x^4=1444-2=1442.$

Q55.C

Q55 Solution:-

We have,

$x^4+1/x^4=119$

Or, $x^4+2+1/x^4=121$

Or, $(x^2+1/x^2)^2=121$

Or, $x^2+1/x^2=11$,

Again, $x^2+1/x^2=11$

Or, $x^2-2+1/x^2=9$

Or, $(x-1/x)=3$, as $x>1$, $1/x<x$ and $x-1/x$ is positive (it could have been -3).

Now from the expression we have,

$x^3-1/x^3=(x-1/x)(x^2+1+1/x^2)$

$=3\times(11+1)=36$

Q56.A

Q56 Solution:-

We have $x+y=z$

Or, $x^3+y^3+3xy(x+y)=z^3$

Or, $x^3+y^3-z^3+3xyz=0$.

Q57.A

Q57 Solution:-

$x^2+1/x^2=66$,

Or, $x^2-2+1/x^2=64$,

Or, $(x-1/x)^2=82$

Or, $x-1/x=\pm8$

So, $x-1/x+2=\pm8+2=10,-6$.

Q58.A

Q58 Solution:-

$(x+1/x)^2=3$,

Or, $x^2+2+1/x^2=3$

Or, $x^2+1/x^2=1$,

Or, $x^2+1/x^2-1=0$.

Now, $x^3+1/x^3=(x+1/x)(x^2-1+1/x^2)=0$.

$=(x^{72}+x^{66}+x^{54}+x^{36}++x^{24}+x^6+1)$

$=x^{69}(x^3+1/x^3)+x^{54}+x^{36}+x^{24}+x^6+1$

$=x^{54}+x^{36}+x^{24}+x^6+1$.

$=x^{54}+x^{36}+x^{24}+x^6+1$

$=x^{54}+x^{48}-x^{48}-x^{42}+x^{42}+x^{36}+x^{24}+x^6+1$

$=x^{51}(x^3+1/x^3)-x^{45}(x^3+1/x^3)+x^{42}+x^{36}+x^{24}+x^6+1$ [putting $x^3+1/x^3=0$]

$=x^{42}+x^{36}+x^{24}+x^6+1$.

$=x^{24}+x^{18}-x^{18}-x^{12}+x^{12}+x^6+1$

$=x^{21}(x^3+1/x^3)-x^{15}(x^3+1/x^3)+x^9(x^3+1/x^3)+1$ [[putting $x^3+1/x^3=0$]]

$=1$, as taking common x^{21},x^{15} and x^3 will make three pairs of terms combine to 0.

Q59.C

Q59 Solution:-

$2x^2-(x-3)(x+5)$

$=2x^2-(x^2+5x-3x-15)$

$=2x^2-x^2-2x+15$

$=x^2-2x+15$
$=(x-1)^2+14.$
Minimum value of $(x-1)^2$ is 0.
So Minimum value will be 0+14=14.

Q60.C
Q60 Solution:-
$(x+y)^3=x^3+y^3+3xy(x+y)$
$=x^3+y^3+3xy\times7$
$=x^3+y^3+21xy,$
Or, $7^3=x^3+y^3+21xy,$
Or, $x^3+y^3+21xy=343.$

Q61.C
Q61 Solution:-
$3x+1/2x=5,$
Multiplying both sides by 2/3 for making the coefficients between the given and the expressions conform we have,
$2x+1/3x=10/3.$
So by the sum of cubes expression,
$(2x)^3+(1/3x)^3$
$=(2x+1/3x)((2x+1/3x)2-3\times2x\times1/3x)$
$=10/3((10/3)^2-2)$
$=10/3(82/9)$
$=820/27$

Q62.D
Q62 Solution:-
$2a+1/3a=6$
Or, $a+1/6a=3$ [Dividing by 2]
Or, $3a+1/2a=9.$ [Multiplying by 3]

Q63.B
Q63 Solution:-
$p^3+3p^2+3p=7,$
Or, $p^3+3p^2+3p+1=8,$
Or, $(p+1)^3=2^3,$
Or, $p+1=2,$
Or, $(p+1)^2=p^2+2p+1=4.$
So finally,
$p^2+2p=3.$

Q64.B
Q64 Solution:-
We have
$x^2+y^2-2x+6y+10=0,$
Or, $(x^2-2x+1)+(y^2+6y+9)=0,$
Or, $(x-1)^2+(y+3)^2=0,$
$x-1=0,$ and $y+3 = 0,$
Or, $x=1,$ and $y=-3,$
Or, $x^2+y^2=1+9=10$

Q65.A

Q65 Solution:-

$\sqrt{1+x}=\sqrt{1+\sqrt{3}/2}$
$=(\sqrt{2}+\sqrt{3})/2$
$=(\sqrt{4}+2\sqrt{3})/2$
$=(\sqrt{3}+1+2\sqrt{3})/2$
$=1/2\sqrt{(\sqrt{3}+1)^2}$
$=1/2(\sqrt{3}+1)$.

Similarly,

$\sqrt{1-x}=1/2(\sqrt{3}-1)$.

Now, $[\sqrt{1+x}+\sqrt{1-x}]/[\sqrt{1+x}-\sqrt{1-x}]$
$=[\sqrt{3}+1+\sqrt{3}-1]/[\sqrt{3}+1-\sqrt{3}+1]$, the 1/2 canceled out.
$=2\sqrt{3}/2$
$=\sqrt{3}$

Q66.C

Q66 Solution:-

We have,

$1/x+1/y=(x+y)/xy=3/xy$. We need only to get the value of xy.
Now we turn our attention to the given expressions, especially the first one.
$x^3+y^3=9=(x+y)(x^2-xy+y^2)$
$=3(x^2+2xy+y^2-3xy)$
$=3((x+y)^2-3xy)$

Or, $9-3xy=3$,

Or, $xy=2$.

So, $1/x+1/y=3/xy=3/2$.

Q67.C

Q67 Solution:-

Given:

$x^2=2$

Or, $2x^2=4$

Or, $3x-2x^2+3-2x=x-1$

Or, $(x+1)(3-2x)=x-1$

Or, $x+1=(x-1)/(3-2x)$,

Q68.C

Q68 Solution:-

Given,

$x+1/16x=1$,

Or, $4x+1/4x=4$, [multiplying each terms by 4]

Or, $(4x+1/4x)^2=16$, [squaring both sides]

Or, $(16x^2+1/16x^2)=14$.

Again,

$64x^3+1/64x^3$
$=(4x+1/4x)(16x^2 - 4x.1/4x+1/16x^2)$
$=(4x+1/4x)(16x^2 +1/16x^2 - 1)$
$=4x(14 – 1)$
$=4\times13$
$=52$

Q69.C

Q69 Solution:-

$a^2+b^2+1/a^2+1/b^2=4$,

Or, $(a^2-2+1/a^2)+(b^2-2+1/b^2)=0$,
Or, $(a-1/a)^2+(b-1/b)^2$.
And so, $a=1/a$, or, $a^2=1$, and,
$b=1/b$, or, $b^2=1$,
Or, $a^2+b^2=2$

Q70.D
Q70 Solution:-
We have,
$a^3+b^3+c^3= a^3+b^3+c^3 -3abc+3abc=(a+b+c)\times(a^2+b^2+c^2-ab-bc-ca)+3abc$.
Or, $a^3+b^3+c^3=(a+b+c)\times(a^2+b^2+c^2-ab-bc-ca)+3abc$,
Or, $36=6(14-ab-bc-ca)+3abc$.
Given,
$(a+b+c)^2=36$
$=a^2+b^2+c^2+2(ab+bc+ca)$,
Or, $ab+bc+ca=11$.
So, $36=6(14-(ab+bc+ca))+3abc$,
Or, $36=6(14-11)+3abc$,
Or, $3abc=18$,
Or, $abc=6$.

Q71.B
Q71 Solution:-
Clearly,
$(x-a)-(x-b)=5$
$(x-a)(x-b)=1$,
$(x-b)=1/(x-a)$.
$(x-a)-(x-b)=5$,
Or, $(x-a)-1/(x-a)=5$,
$p-1/p=5$, [Let p =x-a]
Squaring both sides we get,
$p^2+1/p^2=25+2=27$
$p^3-1/p^3 =(p-1/p)(p^2+1/p^2+1)$
$=5\times(27+1)=140$

Q72.B
Q72.Solution:-
We are given:
$a+1/b=1$
Or, $ab+1=b$ ----------(i)
And, $b+1/c=1$
Or, $bc+1=c$.
Or, $bc-c= -1$ ----------(ii)
Or, $abc+c=bc$, [Multiplying eq (i) by c]
Or, $abc=bc-c=-1$ [As we have bc-c= -1 from equation Number (ii)]

Q73.C
Q73 Solution:-
Cleraly
$2(x^2+y^2+z^2)=2(xy+yz+zx)$, [multiplying given expression by 2]
Or, $(x-y)^2+(y-z)^2+(z-x)^2=0$
Again the use of Principle of sum of squares.
So, $(x-y)=(y-z)=(z-x)=0$

Or, $x=y=z$
So, $(4x+2y-3z)/2x=3x/2x=3/2$

Q74.B
Q74 Solution:-
$a^4+a^2b^2+b^4+2ab(a^2+ab+b^2)= 8 + 2x4 = 16,$
Or, $8+2ab\times4=16,$ $[a^4+a^2b^2+b^4=8$ and $a^2+ab+b^2=4]$
Or, $8ab=8,$
Or, $ab=1.$

Q75.B
Q75 Solution:-
We have,
$s^2 + (s-a)^2+(s-b)^2+(s-c)^2=4s^2+a^2+b^2+c^2-2s(a+b+c)$
$=4s^2+a^2+b^2+c^2-2s(a+b+c)$
$=4s^2+a^2+b^2+c^2-2s.2s$ [substituting the value of a+b+c=2s]
$=4s^2+a^2+b^2+c^2-4s^2$
$=a^2+b^2+c^2$
So, $[s^2 + (s-a)^2+(s-b)^2+(s-c)^2]/(a^2+b^2+c^2)$
$=(a^2+b^2+c^2)/(a^2+b^2+c^2)$
$=1$

Q76.A
Q76. Solution:-
Let, $ax^2+bx+c=a(x-p)^2$
$=ax^2-2pax+ap^2.$
ax^2 cancels out and equating coefficients of xx and the constants on both sides of the equation we get,
$b=-2pa,$ and $c=ap^2.$
$b=-2pa,$
Or, $p=-b/2a.$
Putting this value in the second equation we get,
$c=a(-b/2a)^2=b^2/4a.$
Or, $b^2=4ac.$

Q77.D
Q77 Solution:-
we have a:b=2:3 which gives, $a^2:b^2=4:9.$
But the second ratio we don't square. Instead we multiply numerator and denominator by b to get, $b^2:bc=4:5.$
Now we have the common middle term of b2 same in both the transformed ratios.
To join these two ratios, the ratio values corresponding to b2 have to be equalized to the LCM of their values in two ratios, which is 4×9=36.
Transforming So, , the two ratios are changed to,
$a^2:b^2=16:36,$ and $b^2:bc=36:45.$
Now we can join these two ratios to get the desired ratio,
$a^2:b^2:bc=16:36:45.$

Q78.B
Q78 Solution:-
Given:
$a^2-4a-1=0$
Or, $a-4-1/a=0$

Or, $a-1/a=4$
Or, $a^2-2+1/a^2=16$ [squaring]
Or, $a^2+1/a^2=18$
Now.
$a^2+1/a^2+3a-3/a$
$= a^2+1/a^2+3(a-1/a)$
$=18+3\times4=18+12$
$=30$

Q79.C
Q79 Solution:-
Given:$x^{x\sqrt{x}} = (x\sqrt{x})^x=(x^{3/2})^x=x^{3x/2}$.
Now equating powers on both sides, we get,
$x\sqrt{x} = 3x/2$
$\sqrt{x} = 3/2$
or $x=9/4$.

Q80.A
Q80 Solution:-
$a=b^2/(b-a)$,
Or, $ab-a^2=b^2$,
Or, $a^2-ab+b^2=0$.
As,we know $a^3+b^3=(a+b)(a^2-ab+b^2)$,
So, $a^3+b^3=(a+b)(a^2-ab+b^2)$,
$=(a+b).0$

Q81.B
Q81 Solution:
We have,
$(a-2)(a-9)=a^2-11a+18$
$=[a^2-2\times(11/2)a+(11/2)^2]-(11/2)^2+18$
$=(a-11/2)^2-49/4$
Clearly it will be minimum when $(a-11/2)^2$ is minimum that is 0.
So Minimum it's value is: -49/4

Q82.B
Q82 Solution:-
$(a^2+b^2+ab)/(a^3-b^3) = (a^2+b^2+ab)/[(a-b)(a^2+ab+b^2)]$ [As $a^3-b^3=(a-b)(a^2+ab+b^2)$]
$=1/(a-b)=1/(11-9) = 1/2$

Q83.C
Q83 Solution:-
Given:
$x(3-2/x)=3/x$,
Or, $3-2/x=3/x^2$
Or, $3-2/x-3/x^2=0$
Or, $3x-3/x-2=0$
Or, $x-1/x=2/3$
$x^2+1/x^2-2=4/9$ [Squaring the equation]
$x^2+1/x^2 = 22/9$

Q84.A

Q84 Solution:-

$a=b^2/(b-a)$,
Or, $ab-a^2=b^2$,
Or, $a^2-ab+b^2=0$.
As, $a^3+b^3=(a+b)(a^2-ab+b^2)$,
$=(a+b).0$
$=0$

Q85.A

Q85 Solution:-

$z^1= x^c =(y^a)^c$ [since $x= y^a$]
$=y^{(ac)} = (z^b)^{ac}$ [since $y=z^b$]
$=z^{b(ac)}= z^{abc}$
$abc = 1$.

Q86.C

Q86.Solution:-

We are given:
$a+1/(a-2)=4$
Or, $(a-2)+1/(a-2)=2$
And we are to find the value of
$(a-2)^2+1/(a-2)^2$
Let $a-2 = p$
So Now we are to find the value of
p^2+1/p^2 with condition that $p+1/p=2$
We are given:
$p+1/p=2$
Or, $(p+1/p)^2=4$,
Or, $p^2+2+1/p^2=4$,
Or, $p^2+1/p^2=2$.

Q87.A

Q87 Solution:-

Given:
$1/x^2+1/y^2+1/z^2=1/xy + 1/yz + 1/zx$
Let $1/x =a$, $1/y =b$ and $1/z = c$.
So we get
$a^2+b^2+c^2=ab+bc+ca$
Or, $2(a^2+b^2+c^2)=2(ab+bc+ca)$
Or, $a^2 - 2ab+b^2+b^2-2bc+c^2+c^2-2ca+a^2$
Or, $(a-b)^2+(b-c)^2+(c-a)^2=0$
Or, $a=b=c$
Or, $x=y=z=0$

Q88.C

Q88 Solution:-

$a:b=3:2$
Or, $2a=3b$,
Or, $4a^2=9b^2$
$2a^2+3b^2=(4a^2+6b^2)/2$
$=(9b^2+6b^2)/2$
$=15b^2/2$.
$3a^2-2b^2=(12a^2-8b^2)/4$

$=(27b^2-8b^2)/4$
$=19b^2/4.$
Taking the ratio of the two,
$(2a^2+3b^2) : (3a^2-2b^2)=30:19$

Q89.D
Q89 Solution:-

$x+y=1/xy$
Or, $(x+y)^3=1/x^3y^3$
Or, $x^3+y^3+3xy(x+y)=1/x^3y^3$
Or, $1/x^3y^3-x^3-y^3=3xy(x+y)=3$

"Man needs difficulties in life because they are necessary to enjoy the success." - A.P.J Abdul Kalam

SOME DEFINITIONS, AXIOMS AND POSTULATES:

A solid has three dimensions, a surface has two, a line has one and a point has none. Euclid summarized these statements as definitions. Some of them are:

(i) A point is that which has no parts
(ii) A line is a breadth less length
(iii) The end of a line are points
(iv) A straight line is a line which lies evenly with the points on itself.
(v) A surface is that which has length and breadth only.
(vi) A plane surface is a surface which lies evenly with straight lines on itself.

BASIC GEOMETRICAL CONCEPTS:

Axioms: The basic facts which are taken for granted, without proof, are called axioms.

(i) Things which are equal to the same thing are equal to one another.
If a = b, b = c => a = c
(ii) The equals are added to equals, the whole are equal
a + c = b + c
(iii) If equals are subtracted from equals, the remainders are equal
If a = b => a – c = b – c
(iv) Things which are double of the same things are equal to one another.
If a = b => 2a = 2b
(v) Things which are halves of the same things are equal to one another.
If a = b => a/2 = b/2
(vi) Things which are greater than the same thing are greater than one another.
If a > b, b > c => a > c
(vii) Things which coincide with one another are equal to one another.
(viii) The whole is greater than the part.

POSTULATES :

Postulate – 1 :

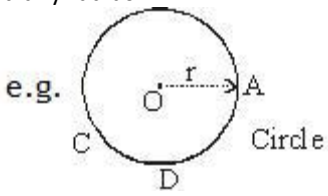
A straight line may be drawn from any one point to any another point.

Postulate – 2 :

A terminated line can be produced indefinitely

Postulate – 3 :

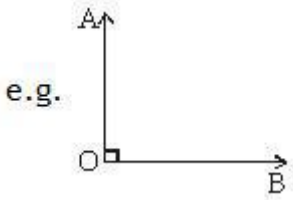
A circle can be drawn with any centre and any radius.



where O is the centre of the circle and OA = (r) radius of the circle.

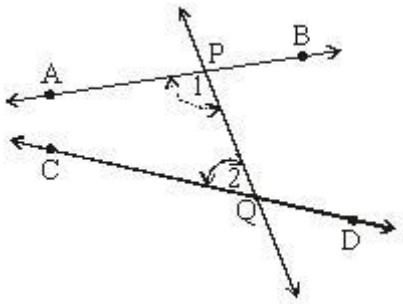
Postulate – 4 :

All right angles are equal to one another



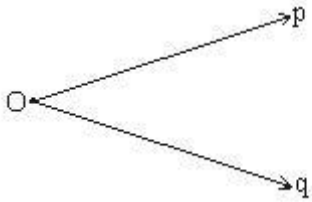
the measurement of Because each and every right angle is always 90^{o}.

Postulate – 5 :
If a straight line falling on two straight lines makes the interior angles on the same side of it taken together less than two right angles, then the two straight lines, if produced indefinitely, meet on that side on which the sum of angles is less than two right angles.

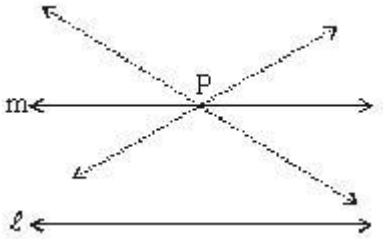


e.g. Line PQ falls on lines AB and CD such that the sum of interior angles $\angle 1 + \angle 2 < 180^{o}$ is on the left side of PQ. So, the lines AB and CD will eventually intersect on the left side of PQ.

Theorem: Two distinct lines cannot have more than one point in common given.



Two distinct intersecting lines cannot be parallel to the same line.



Euclid's fifth postulate is very significant in the history of Mathematics. By implication, we can see that no intersection of lines will take place when the sum of the measures of the interior angles on the same side of the falling line is exactly 180^{o}.

2. LINES AND ANGLES

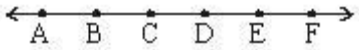
BASIC TERMS AND DEFINITIONS:

I A line: When two or more than two points are joined end point, it is called aline. It is denoted by $\overleftrightarrow{MN}$.

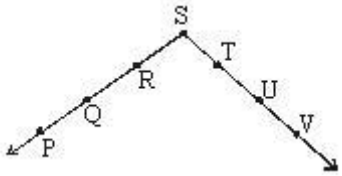
II A line Segment: A part (or portion) of a line with two end points is called a line segment e.g. AB is a line segment and denoted by AB.

III A ray: A part of line with one end point is called a ray; e.g. PQ is a ray and denoted by $\overrightarrow{PQ}$

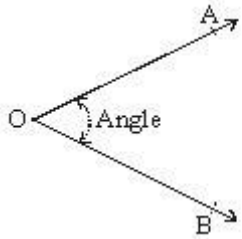
IV Collinear points : If three or more points lie on the same line, they are called collinear points. i.e. A, B, C, D, E and F are collinear points.



V Non-collinear points : If three or more points do not lie on the same line, they are called non-collinear points. i.e. P, Q, R, S, T, U and V are non-collinear points.



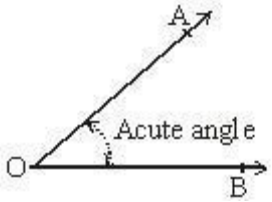
VI An Angle: When two rays originate from the same end point, an angle is formed ; e.g. ∠AOB is an angle and OA and OB are called the arms of an angle ∠AOB. The measurement of an angle is degree.



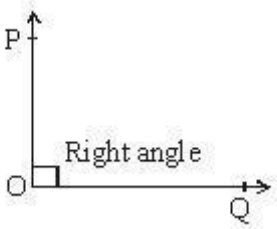
VII Vertex: The end point of the arms of an angle is called the vertex of an angle; e.g. O is the vertex of an angle ∠AOB.

KINDS OF ANGLE:

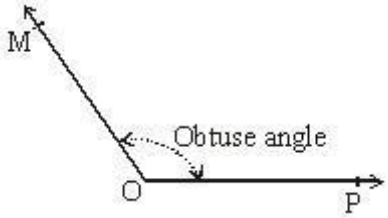
(i) **An acute angle:** The angles between 0^o and 90^o are called acute angles. i.e. 0^o < acute angle < 90^o;
e.g. ∠AOB is an acute angle.



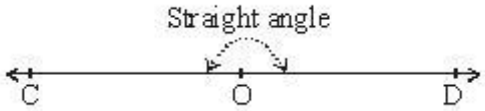
(ii) **A right angle:** A right angle is exactly equal to 90^o, i.e., right angle = 90^o
e.g. ∠POQ is 90^o (a right angle)



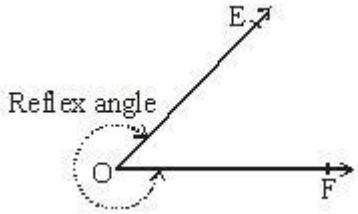
(iii) **An obtuse angle:** An angle greater than 90^o but less than 180^o is called an obtuse angle,
i.e. 90^o < obtuse angle < 180^o e.g. ∠MOP is an obtuse angle.



(iv) **Straight angle:** A straight angle is equal to 180^o, i.e. a straight angle is 180^o or is $2 \times 90^o = 2$ right angles;
e.g. ∠COD is a straight angle.



(v) **Reflex angle:** An angle which is greater than 180^o but less than 360^o is called a reflex angle,
i.e., $180^o <$ reflex angle $< 360^o$; e.g. ∠EOF is a reflex angle.



(vi) **Complementary angles:** Two angles whose sum is 90^o are called complementary angles

i.e., $\angle x + \angle y = 90^o$

e.g. $\angle ABD + \angle DBC = 90^o$ [Complementary angles]

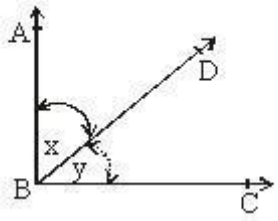
$40^o + 50^o = 90^o$ [Complementary angles]

$60^o + 30^o = 90^o$ [Complementary angles]

$70^o + 20^o = 90^o$ [Complementary angles]

$80^o + 10^o = 90^o$ [Complementary angles]

$45^o + 45^o = 90^o$ [Complementary angles]



(vii) **Supplementary angles:** Two angles whose sum is 180^o are called supplementary angles

i.e., $\angle x + \angle y = 180^o$ [Two right angles = 2× 90o = 180o]

e.g. $\angle ABD + \angle DBC = 180^o$ [supplementary angles]

$90^o + 90^o = 180^o$ [supplementary angles]

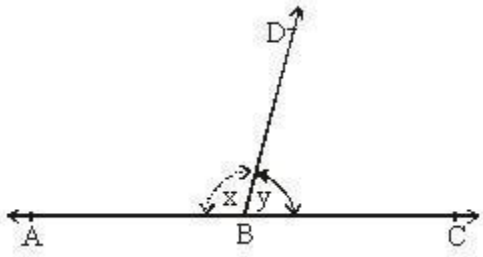
$100^o + 80^o = 180^o$ [supplementary angles]

$110^o + 70^o = 180^o$ [supplementary angles]

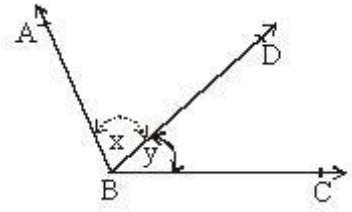
$120^o + 60^o = 180^o$ [supplementary angles]

$130^o + 50^o = 180^o$ [supplementary angles]

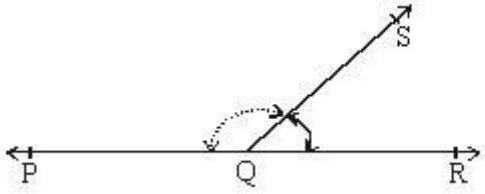
$90^o + 90^o = 180^o$ [supplementary angles]



(viii) **Adjacent angles:** If two angles have a common vertex and a common arm, they are called adjacent angles, i.e. ∠ABD and ∠DBC have common arm BD and also common vertex B, so, they are djacent angles. e.g. ∠x and ∠y are adjacent angles.



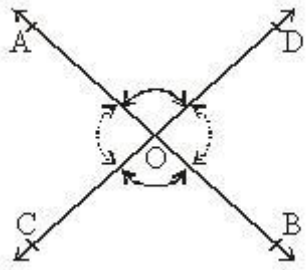
(ix) **Linear pair of angles:** If the non common arms QP and QR in the given figure, from a line, then the angles ∠PQS and ∠SQR are called linear pair of angles.



(x) **Vertically opposite angles:** When two lines intersect each other at a point, they make two pairs of vertically opposite angles such type of angles are also equals.

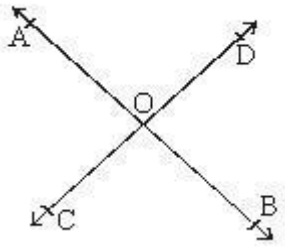
e.g. ∠AOC = ∠BOD [Vertically opposite angles]

∠COB = ∠AOD [Vertically opposite angles]

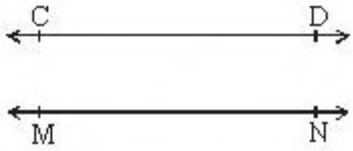


INTERSECTING LINES AND NON-INTERSECTING LINES:

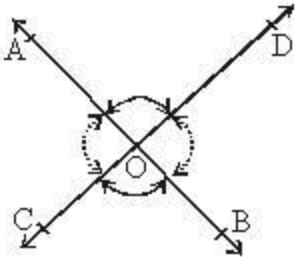
(i) **Intersecting Lines:** If two lines intersect each other at any point, they are called intersecting lines. e.g. AB and CD are intersecting lines because they intersect each other at a point O.



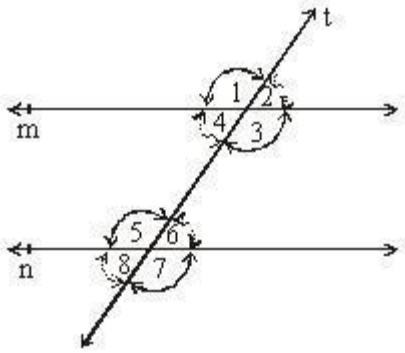
(ii) **Non-intersecting (parallel) lines:** If two lines never intersect each other and the distance between them is always equal (same), they are called non-intersecting (parallel) lines, i.e., parallel lines do not intersect even at infinity e.g. CD || MN



Theorem: If two lines intersect each other, then vertically opposite angles are equal.



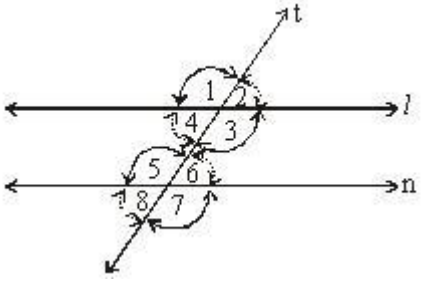
Parallel Lines and a TRANSVERSAL:
If *l* || *m* and t is a transversal.



Then, (i) Corresponding angles:
∠1 = ∠5
∠2 = ∠6
∠4 = ∠8
∠3 = ∠7
(ii) Alternate interior angles:
∠4 = ∠6
∠3 = ∠5
(iii) Alternate exterior angles:
∠1 = ∠7
∠2 = ∠8
(iv) Interior angles on the same side of the transversal:
$\angle 4 + \angle 5 = 180^{o}$ and $\angle 3 + \angle 6 = 180^{o}$

CORRESPONDING ANGLES AXIOM:â€‹

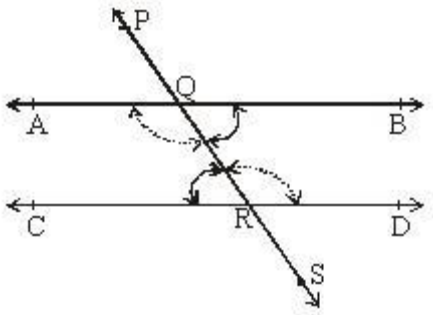
Axiom 1: If a transversal intersects two parallel lines, then each pair of corresponding angles is equal.



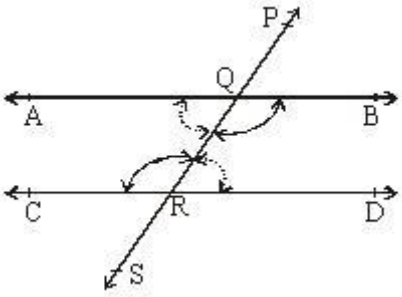
If *l* || *m* and t is a transversal, then corresponding angles:
∠1 = ∠5
∠2 = ∠6
∠4 = ∠8
∠3 = ∠7

Axiom 2: If a transversal intersects two lines such that a pair of corresponding angles is equals, then the two lines are parallel to each other.

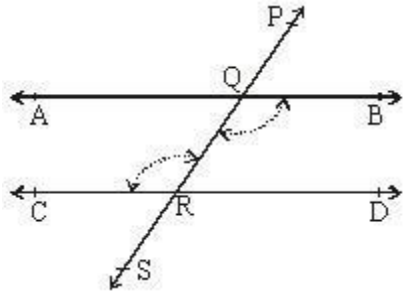
If transversal PS intersects two lines AB and CD such that
∠AQP = ∠CRQ [Pair or corresponding angles]
or ∠BQP = ∠DRQ [Pair of corresponding angles]
then, AB || CD



Theorem: If a transversal intersects two parallel lines, then each pair of alternate interior angles is equal. If transversal PS intersects two parallel lines AB and CD respectively,
Then, ∠AQR = ∠QRD [Pair of alternate interior angles]
And ∠BQR = ∠CRQ [Pair of alternate interior angles]



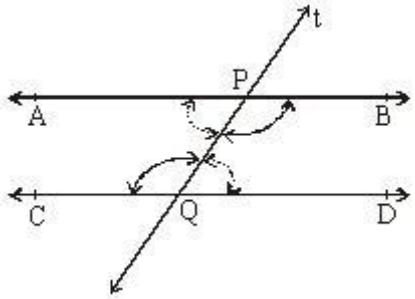
Theorem: If a transversal intersect two lines such that a pair of alternate interior angles is equal, then the two lines are parallel



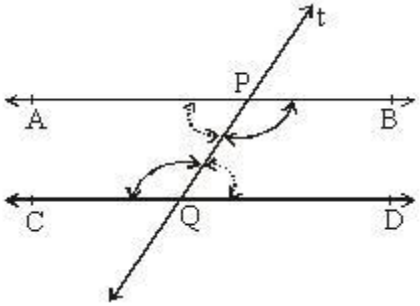
If PS transversal intersect two lines AB and CD such that
$\angle BQR = \angle CRQ$ [A pair of alternate interior angles]
Then, B || CD

Theorem: If a transversal intersects two parallel lines, then each pair of interior angles on the same side of the transversal is supplementary.

If a transversal t intersects two parallel lines AB and CD at P and Q points respectively,
Then, $\angle APQ + \angle CQP = 180^o$ [Pair of interior angles]
And $\angle BPQ + \angle DQP = 180^o$ [Pair of interior angles]



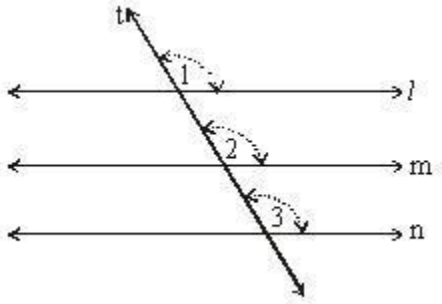
Theorem: If a transversal intersect two lines such that a pair of interior angles on the same side of the transversal is supplementary, then the two lines are parallel.



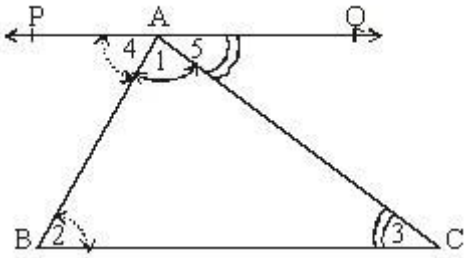
If a transversal t intersects two lines AB and CD such that a pair of interior angles on the same side of the transversal is supplementary, i.e.,
$\angle APQ + \angle BPQ = 180^o$ [Supplementary]
And $\angle CQP + \angle DQP = 180^o$ [Supplementary]
Then, AB || CD

LINES PARALLEL TO THE SAME LINE

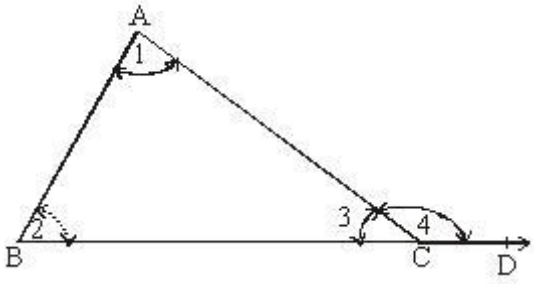
Theorem: Lines which are parallel to the same line are parallel to each other.



Theorem: The sum of the angles of a triangle is 180^{o}.



Theorem: If a side of a triangle is produced, then the exterior angle so formed is equal to the sum of the two interior opposite angles.

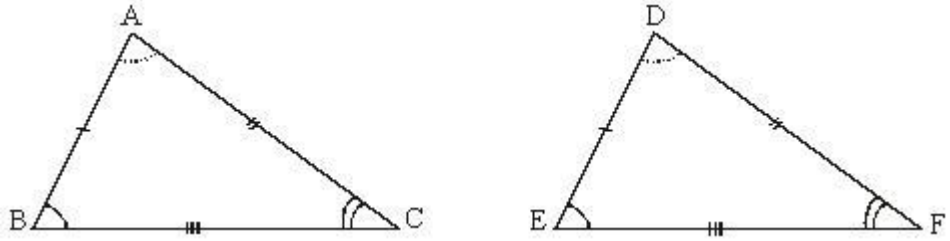


∠1 + ∠2 = ∠4
∠BAC + ∠ABC = ∠ACD

3. TRIANGLES

CONGRUENCE OF TRIANGLES:â€‹

Congruent means equal in all the respect or geometrical figures whose shapes and sizes are same
Let ABC and DEF be two triangles in which AB = DE, BC = EF, AC = DF and ∠A = ∠D, ∠B = ∠E, ∠C = ∠F respectively. Then, △ABC ≅ △DEF

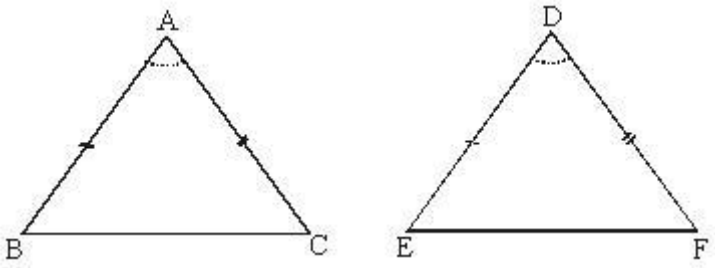


"CPCT" means corresponding parts of congruent triangles.

CRITERIA FOR CONGRUENCE OF TRIANGLES:

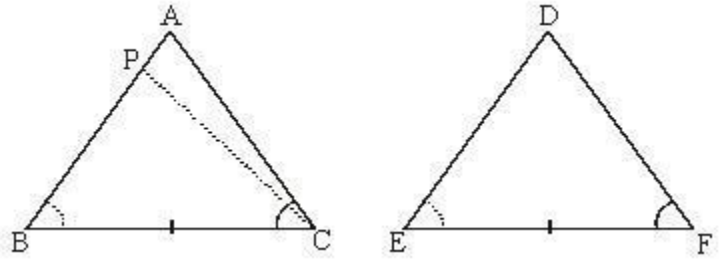
Side-angle-Side:

I SAS) Congruence rule: Two triangles are congruent if two sides and the included angle of one triangle are equal to the corresponding sides and the included angle of the other triangle.



If inΔ^{s}ABC and DEF, AB = DE, AC = DF and ∠BAC =∠EDF
Then, ΔABC ≅ ΔDEF
It is called SAS congruence rule i.e. side-angle-side]

II Angle-Side-Angle (ASA) Congruence rule: Two triangles are congruent if two angles and the included side of one triangle are equal to two corresponding angles and the included side of other triangle.

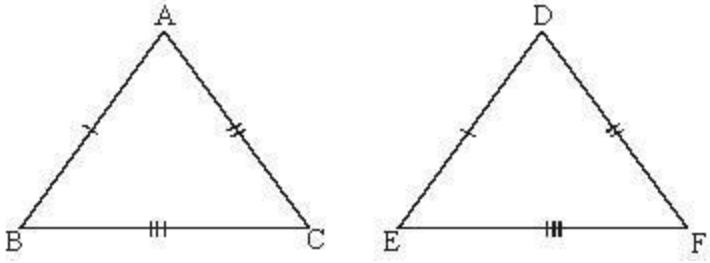


CONGRUENCE RULE:

i.e. Angle-Side-Angle(ASA) congruence rule may be called Angle-Angle-Side (AAS) congruence rule.

III Side-Side-Side(SSS) congruence rule:

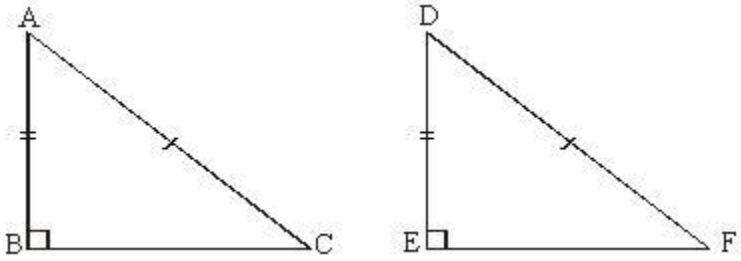
If three sides of one triangle are equal to the three sides of another triangle, then the two triangles are congruent.



If in Δ^{s}ABC and DEF, AB = DE, BC = EF and AC = DF
Then, ΔABC ≅ ΔDEF
[It is called SSS congruence rule i.e. side-side-side]

IV Right angle-Hypotenuse-Side (RHS) congruence rule:

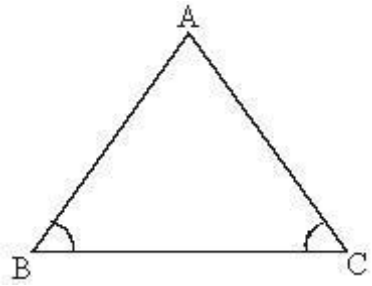
If in two right triangles the hypotenuse and one side of one triangle are equal to the hypotenuse and one side of the other triangle, then the two triangles are congruent.



If ABC and DEF are two right triangles in which
$\angle B = \angle E = 90^{o}$, AC = DF and AB = DE
Then, $\triangle ABC \cong \triangle DEF$

Theorem: Angles opposite to equal sides of an isosceles triangle are equal

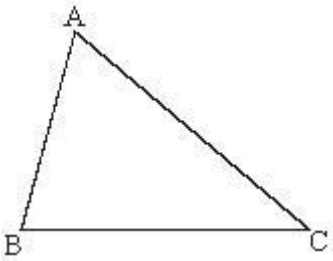
Converse of Theorem: The sides opposite to equal angles of a triangle are equal:



In $\triangle ABC$ if $\angle B = \angle C$
Then, AB = AC

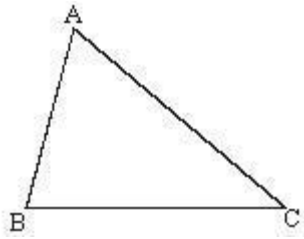
INEQUALITIES IN A TRIANGLE:

Theorem: If two sides of a triangle are unequal, the angle opposite to the longer side is greater (or greater)



Let ABC be a triangle in which AC > AB and AC > BC.
Then, $\angle B > \angle A$ and $\angle B > \angle C$
The side opposite to the largest angle is the longest.

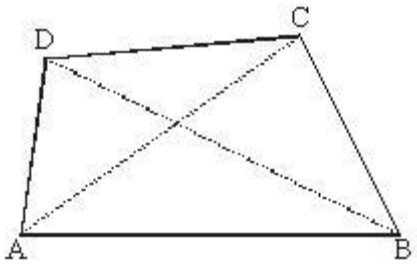
Theorem: The sum of any two sides of a triangle is greater than the third side.



Let ABC be a triangle and AB, BC and AC are its corresponding sides.
Then, AB + BC > AC
AB + AC > BC
and AC + BC > AB

4. QUADRILATERIALS

Quadrilateral is a closed figure with four sides:



Angles' Sum property of a Quadrilateral:

Theorem: The sum of the angles of a quadrilateral is 360o

Types of Quadrilaterals:

I A Trapezium: In a quadrilateral if one pair of opposite sides is parallel, then it is called a trapezium (Fig.3) i.e. If AB || CD then quadrilateral ABCD is a trapezium.

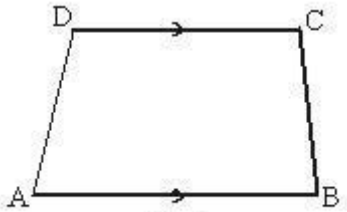


Fig.3

II A parallelogram: In a quadrilateral if both pairs of opposite sides are parallel and equal, then it is called a parallelogram (Fig.4) i.e., AB || CD and AB = CD; AD || BC and AD = BC, then ABCD is a parallelogram.

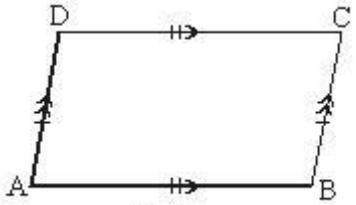


Fig.4

III A Rectangle: In a quadrilaterals (parallelogram) if all angles are right angles, then it is called a rectangle (Fig.5) i.e. AB || CD, AB = CD, AD || BC; AD = BC and ĐA = ĐB = ĐC = ĐD = 90o, then ABCD is a rectangle.

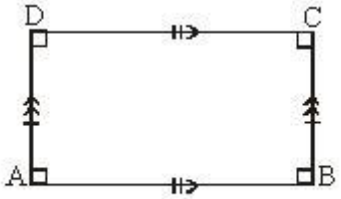


Fig.5

IV A Rhombus: In a quadrilaterals (parallelogram) if all sides are equal, then it is called a rhombus (Fig.6), i.e., AB || CD, AD || BC and AB = BC = CD = DA, then ABCD is a rhombus.

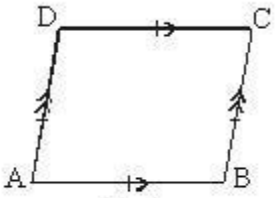


Fig.6

V A Square: In a quadrilateral (parallelogram) if all sides are equal and all angles are 90°, then it is called a square (Fig.7) i.e. AB || CD, AD || BC, AB = BC = CD = DA and $\angle A = \angle B = \angle C = \angle D = 90^{\circ}$

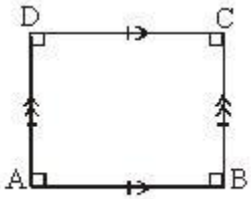


Fig.7

VI A Kite: In a quadrilateral ABCD (Fig.8), if AD = CD and AB = CB, then it is called a kite; i.e., two pairs of adjacent sides are equal but it is not a parallelogram.

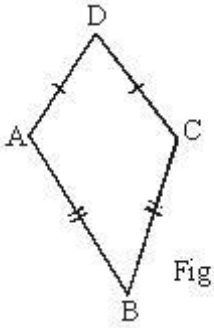


Fig.8

PROPERTIES OF A PARALLELOGRAM:

Theorem: A diagonal of a parallelogram divides it into two congruent triangles.

Theorem: If each pair of opposite sides of a quadrilateral is equal, then it is a parallelogram.

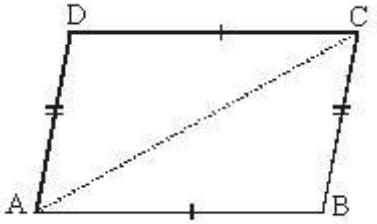


Fig.10

Theorem: In a parallelogram, opposite angles are equal.

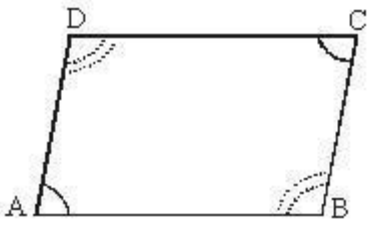


Fig.11

Here, $\angle A = \angle C$ and $\angle B = \angle D$

Theorem: If in a quadrilateral, each pair of opposite angles is equal, then it is a parallelogram.

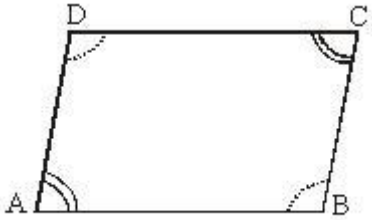


Fig.12

Theorem: The diagonals of a parallelogram bisect each other.

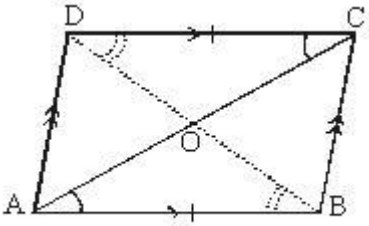


Fig.13

Here, OA = OC and OB = OD

Converse of above Theorem: If the diagonals of a quadrilateral bisect each other, then it is a parallelogram.

Theorem: A quadrilateral is a parallelogram if a pair of opposite sides is equal and parallel

Theorem: The line segment joining the mid-points of two sides of a triangle is parallel to the third side.

Converse of above Theorem: The line drawn through the mid-point of one side of a triangle, parallel to another side bisects the third side.

5. CIRCLES

The collection of all the points in a plane which are at a fixed distance from a fixed point n the plane, is called circle.

Centre of the Circle: The fixed point is called the centre of the circle O is the centre of the circle in Fig.1.

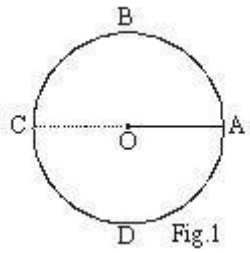


Fig.1

Radius of the circle: The fixed distance from the centre and circumference of the circle is called the radius of the circle. OA = OC = r is the radius of the circle. We can draw infinite Radius in a circle and all are equal in length.

Chord of the circle: The line segment which joins two points on the circumference of a circle is known as the chord of the circle. The chord of a circle does not pass through the centre of the circle. CD is a chord of the circle in Fig.2.

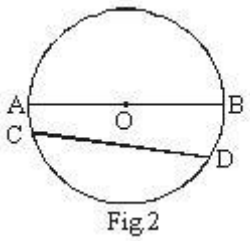


Fig.2

Diameter of the circle: The chord, which passes through the centre of the circle, is called a diameter of the circle. We can drawn infinite diameters in a circle and all are equal in length. In Fig.2, AOB is a diameter of the circle. It is denoted by d.

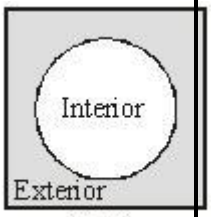


Fig 3

It is said that a diameter is the longest chord of a circle.
A circle divides the plane on which it lies into following three parts in Fig.3

(i) **Interior of the circle:** The plane which exists inside of a circle or the region inside of a circle is known as the interior of the circle.
(ii) **Circle:** The geometrical figure which is surrounded by a circular line segment or a circle is a collection of all those points in a plane that are at given constant distance from a given fixed point in the plane.
(iii) **Exterior of the circle:** The plane which exists outside of a circle or the region out side of a circle is known as the exterior of the circle.
Arc of a circle: A continuous piece of a circle is called an arc of the circle.
Minor arc: The shorter (smaller) arc of a circle is called minor arc. In Fig.4, PQ is the minor arc.

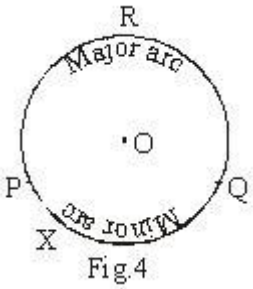


Fig.4

Major arc: The longer arc of a circle is called major arc. In Fig.4; PRQ is the major arc in Fig.4.

Semi circle: If P and Q are ends of a diameter then both arcs are equal and each is called a semi circle, i.e., PXQ and PYQ are equal arcs having a semi-circle in Fig.5. It is also called semicircular region.

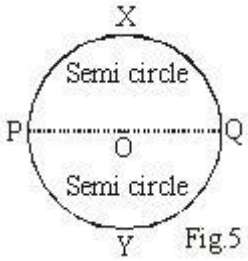


Fig.5

Circumference: The length of the complete circle is called the circumference of the circle. It is denoted by C in Fig.6,

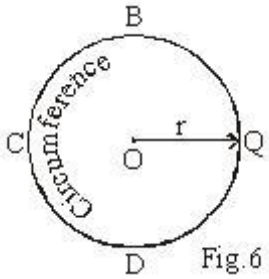


Fig.6

i.e. Circumference of the circle (C) = $2\pi r$; where $\pi = 22/7$ or 3.14

Semi Circumference: Half length of the complete circle is called the semi-circumference of the circle. Both semi-circumferences of the circle are equal in length in Fig.7,

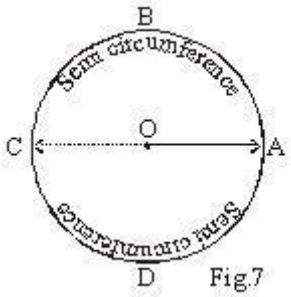


Fig.7

i.e. Semi circumference = π.r

Segment of the circle: The region between a chord and either of its arcs is called a segment of the circle.

Minor Segment: The smaller region between a chord and smaller arc is called the minor segment of the circle, i.e. PXQ is the minor segment of the circle in Fig.8

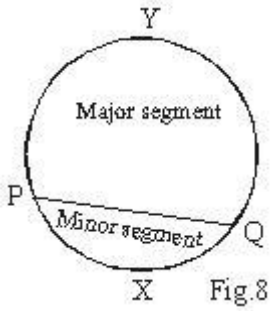


Fig.8

Major segment: The bigger region between a chord and bigger arc is called the major segment of the circle, i.e., PYQ is the major segment of the circle in Fig.8.

Minor sector: When a circle is divided by its two Radius, the smaller region of the circle is called minor sector, e.g., OAXB is the minor sector of the circle in Fig.9.

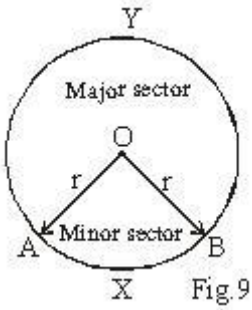


Fig.9

Major Sector: When a circle is divided by its two Radius, the bigger region of the circle is called major sector, e.g. OAYB is the major sector of the circle Fig.9.

Theorem: Chords of a circle subtend equal angles at the centre.

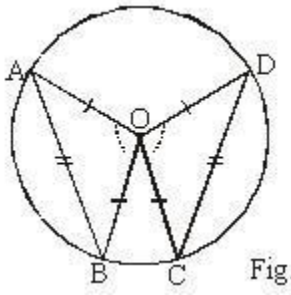


Fig.10

Converse Theorem: Prove that if the angles subtended by the chords of a circle at the centre are equal, then the chords are equal.

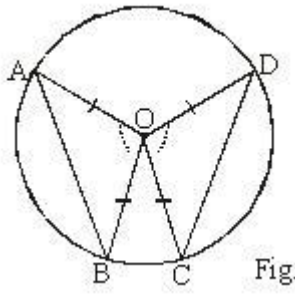


Fig.11

Theorem: Prove that the perpendicular from the centre of a circle to a chord bisects the chord.

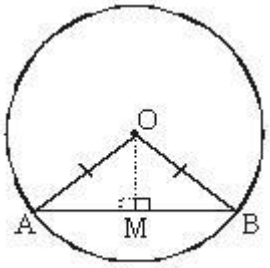


Fig.12

Converse Theorem: The line drawn through the centre of a circle to bisect a chord is perpendicular to the chord.

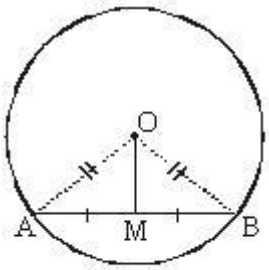


Fig.13

Theorem: There is one and only one circle passing through three non-collinear points.

Theorem: The length of the perpendicular from a point to a line is the distance of the line from the point.

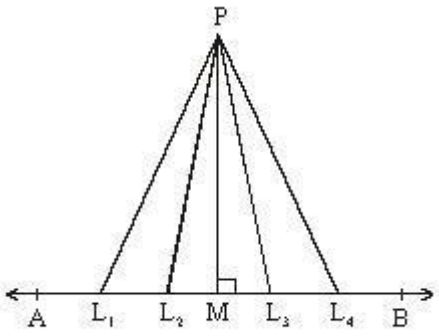


Fig.14

Out of these line segments, the perpendicular from P to AB i.e. PM will be the least. So, this least length PM has to be the distance of AB from P.

Theorem: Equal chords of a circle are equidistant from the centre.

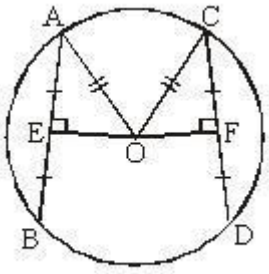


Fig.15

Converse Theorem: Prove that chords equidistance from the centre of a circle are equal in length

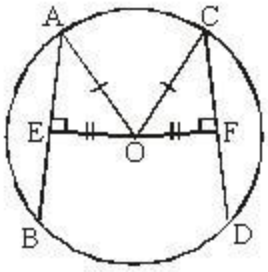


Fig.16

ANGLES SUBTENDED BY AN ARC OF A CIRCLE:

Theorem: If two chords of a circle are equal, then their corresponding arcs are congruent and conversely, if two arcs are congruent, then their corresponding chords are equal.

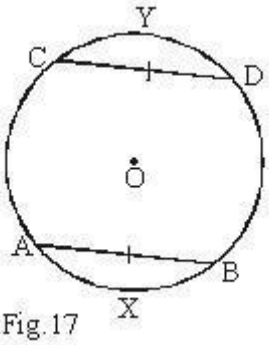


Fig.17

Let AB and CD be two chords of a circle with centre O.

Then, AXB = CYD

Converse: If AXB = CYD in a circle with centre O, then chord AB = chord CD

The angle subtended by an arc at the centre is double the angle subtended by it at any point on the remaining part of the circle.

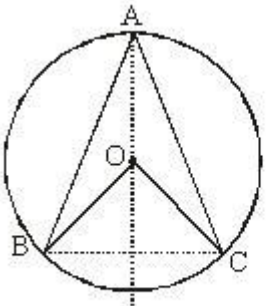


Fig.18(i)

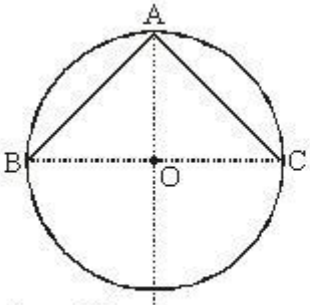


Fig.18(ii)

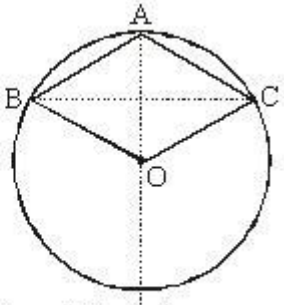


Fig.18(iii)

Here, ∠BOC = 2 × ∠BAC

Theorem: Angles in the same segment of a circle are equal

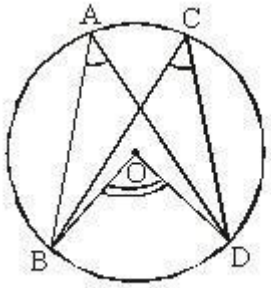


Fig.19(i)

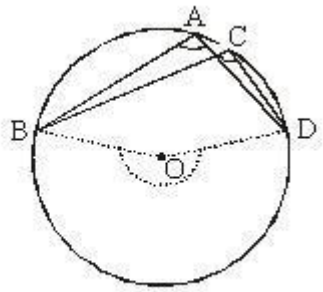


Fig.19(ii)

Here, ∠BAD = ∠BCD

Theorem: Angle in a semicircle is a right angle.

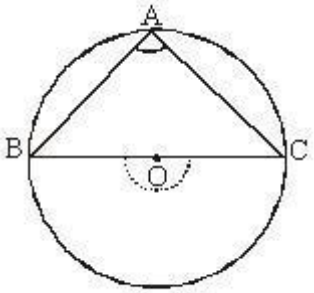


Fig.20

Here, ∠BAC = 90^{o}

Theorem: If a line segment joining two points subtends equal angles at two other points lying on the same side of the line containing the line segment; four points lie on a circle (i.e., they arc concyclic). In Fig.21

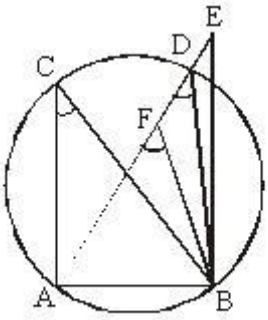


Fig.21

Here, A, B, C, D are concylic.

Cyclic Quadrilateral: A quadrilateral is called cyclic if all the four vertices of it lie on a circle.

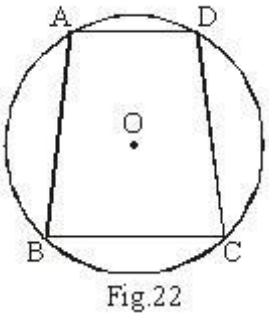


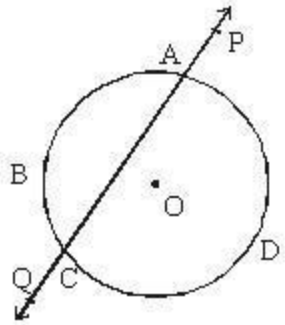
Fig.22

Theorem: The sum of either pair of opposite angles of cyclic quadrilateral is 180^{o}.

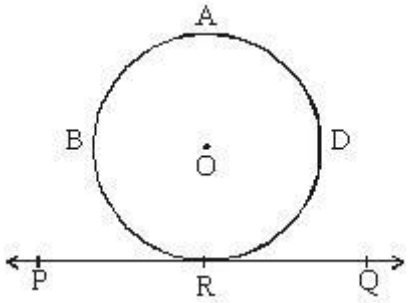
Here, $\angle A + \angle C = 180^o$ and $\angle B + \angle D = 180^o$.

Converse Theorem: If the sum of a pair of opposite angles of a quadrilateral is 180o, the quadrilateral is cyclic.

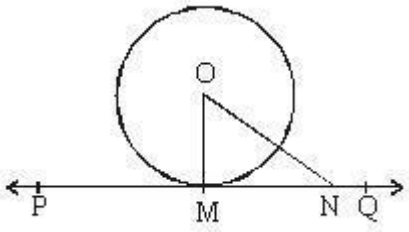
Secant: A line which intersects a circle in two distinct points is called a secant of the circle, e.g. in figure PQ is the secant of a circle ABCD with centre O in figure.



Tangent: A tangent to a circle is a line that intersects the circle in exactly one point. i.e., PQ is a tangent of a circle ABCD with centre O. And the touching point (point of contact) of the tangent PQ be R in figure. We can also say that there is only one tangent at a point of the circle, i.e., the common point of the tangent and the circle is called the **point of contact** and the tangent is said to **touch** the circle at the common point.



Theorem: The tangent at any point of a circle is perpendicular to the radius through the point of contact.



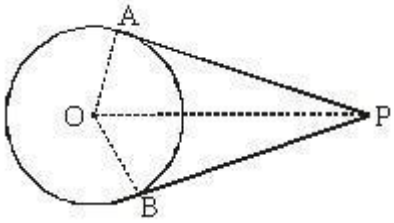
Important:

(i) At any point on a circle there can be one and only one tangent.

(ii) The line containing the radius through the point of contact is also called the '**normal'** to the circle at the point.

Theorem: The lengths of tangents drawn from an external point to a circle are equal.

So, if PA and PB are two tangents from a point P to a circle with centre O***, then*** PA = PB

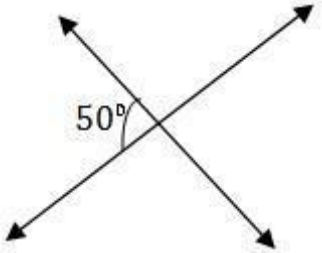


----------EXERCISE----------

Q1. An angle which is greater then 180° but less than 360° is called

A. Acute Angle B. Obtuse Angle C. Straight Angle D. Reflex Angle

Q2. Two Lines AB and CD intersect at O. If $\angle AOC = 50^o$, Then $\angle BOD$ is:



A. 45^o B. 50^o C. 60^o D. 75^o

Q3. The shortest distance between two intersecting lines is

A. 0 B. 1 C. 2 D. None of these

Q4. Two lamp post of heights 6m and 11m stand vertically on opposite side of a road. If the road is 12m broad, what is the distance between the tops of both lamp post?

A. 13 m B. 14 m C. 15 m D. 12.8 m

Q5. In $\triangle ABC$, line DE cuts AB and BC at D and E respectively so that AC is parallel to DE. Then $\triangle ABC$ and $\triangle DBE$ must be:

A. always similar B. always congruent C. neigther of A and B D. CBD.

Q6. O and C are the Orthocentre and the Circumcentre of $\triangle PQR$. If the points P and O are joined and produced to meet the side QR at S and if $\angle QCR = 130^0$ and $\angle PQS = 60^0$ then $\angle RPS$ will be:

A. 35^0 B. 45^0 C. 50^0 D. 60^0

Q7. Sum of angles of a triangle is always

A. Less than 180^0 B.Greater than 180^0 C. Equal to 180^0 D. All of these

Q8. If I is the incentre of $\triangle ABC$, and $\angle ABC = 65^0$ and $\angle ACB = 55^0$, the$\angle BIC$ will be:

A. 90^0 B. 105^0 C. 120^0 D. 135^0

Q9. The ratio between the number of sides of two regular polygons is 1:2 and the ratio between their interior angles is 2:3. The number of sides of the polygons are respectively:

A. 4, 8 B. 5, 8 C. 6,9 D. 10,8

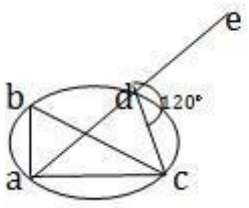
Q10. In a Δ ABC, if $2\angle A = 3\angle B = 6\angle C$, Then $\angle B$= ?

A. 30^o B. 45^o C. 60^o D. 90^o

Q11. If PN is the perpendicular from a point P on the circumference of a circle of radius 7cm to its diameter AB and the length of the chord PB is 12cm, the length of BN is,

A. 72/7 cm B. 75/7 cm C. 92/7 cm D. 100/7 cm

Q12. In the given figure, measure of ∠ABC is



A. 20^o B. 40^o C. 60^o D. 80^o

Q13. If the angle subtended by a chord at its centre is 60^0, the ratio between the lengths of the chord and the radius is,

A. 1:1 B. 2:1 C. 1:2 D. 3:2

Q14. AB and CD are two parallel chords of respective lengths 8cm and 6cm on the same side of the centre of a circle. The distance between them is 1cm. Then the radius of the circle is,

A. 5cm B. 6cm C. 8cm D. 10cm

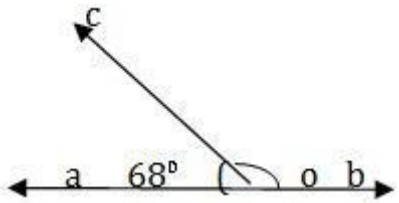
Q15. AD is a median of △ABC and O is the centroid such that AO=10cm. Length of OD is:

A. 1cm B. 3cm C. 5cm D. 7cm

Q16. In rhombus ABCD, a straight line through C cuts extended AD at P and extended AB at Q. If AB = 2DP then $\frac{BQ}{AB}$ is:

A. 1 B. 2 C. 3 D. 4

Q17. In the given figure, AOB is a straight line, ∠AOC = 68° and ∠BOC = x°. The value of the x is:



A. 96^0 B. 104^0 C. 112^0 D. 120^0

Q18. The complement of 62° is.

A. 28° B. 32° C. 36° D. 40°

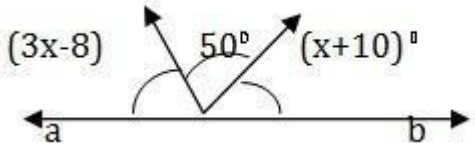
Q19. The complement of 72° 40' is

A. 10°20' B. 17°20' C. 27°20' D. 42°40'

Q20. An angle is 24° more than its complement.The measure of the angle is:

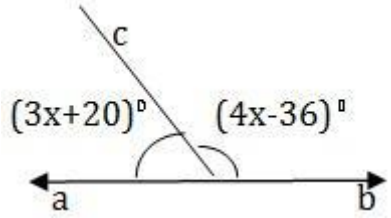
A. 37° B. 47° C. 57° D. 67°

Q21. In the following figure , AOB is a straight line, ∠AOC = (3x-8)° and ∠COD =50^0 and ∠BOD° =(x+10)°. Then the value of x will be:



A. 28° B. 32° C. 36° D. 40°

Q22. In the following figure , AOB is a straight line, ∠AOC = (3x+20)° and ∠BOC =(4 x-36)°. The value of the x is:



A. 22° B. 28° C. 36° D. 44°

Q23. If an angle is its own complementary angle, then its measure is:
A. 30° B. 45° C. 60° D. 90°

Q24. An angle is $\frac{1}{5}^{th}$ of its supplement. The measure of the angle is
A. 15° B. 30° C. 75° D. 150°

Q25. The supplement of 60° is
A. 30° B. 60° C. 120° D. 240°

Q26. An angle is 32° less than its supplement. The measure of the angle is
A. 36° B. 48° C. 60° D. 74°

Q27. Two Supplementary angles are in th ratio 3:2. The smaller angle measures
A. 63° B. 72° C. 81° D. 90°

Q28. The angle of a triangle are $3x^o$, $(2x-7)^o$ and $(4x-11)^o$. The value of x is :
A. 18^o B. 20^o C. 22^o D. 30^o

Q29. △ABC is an isosceles triangle with AB=AC and AD is the on base BC. If ∠ABC=35^0, the ∠BAD is
A. 55^0 B. 65^0 C. 75^0 D. 90^0

Q30. The length of 3 sides of a triangle are 6cm, 8cm and 10cm. The length of the median to the greatest side is will be:
A. 2cm B. 3cm C. 4cm D. 5cm

Q31. In isosceles triangle △ FGH, FG<3cm and GH=8cm. Then the correct relation is,
A. GH<FH B. GH=FH C. GF>GH D. NONE

Q32. The sum of three altitudes of a triangle is,

A. equal to the sum of three sides B. twice the sum of sides

C. greater than the sum of sides D. less than the sum of sides

Q33. In a right angled triangle the product of its two sides equals half of the square of the third side which is the hypotenuse. One of the acute angles must then be,

A. 20^0 B. 30^0 C. 40^0 D. 45^0

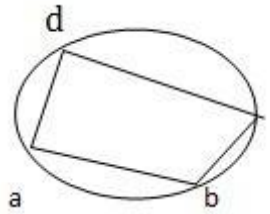
Q34. ABCD is a trapezium whose side AD is parallel to BC. Diagonals AC and BD intersect at O. If AO=3, CO=x−3, BO=3x−19 and DO=x−5, the value(s) of x will be,

A. 6, 10 B. 7,8 C. 8,9 D. 9, 4

Q35. In a cyclic quadrilateral ABCD, side AB is extended to E so that BE=BC. If $\angle ADC=70^0$ and $\angle BAD=95^0$ then $\angle DCE$ is,

A. 60^0 B. 90^0 C. 120^0 D. 140^0

Q36. In the given figure ,ABCD is a cyclic quadrilateral in which AB || DC and $\angle BAD = 100^o$. Then , $\angle ABC$=?



A. 60^o B. 75^o C. 100^o D. 150^o

Q37. The length of the diagonal BD of the parallelogram ABCD is 18cm. If P and Q are the centroids of Δ ABC and Δ ADC respectively, length of PQ is:

A. 2cm B. 4cm C. 6cm D. 8cm

Q38. A, B and C are three points on the circumference of a circle. If AB=AC=5√2cm and $\angle BAC=90^0$ the length of radius is,

A. 5cm B. 7cm C. 10cm D. 15cm

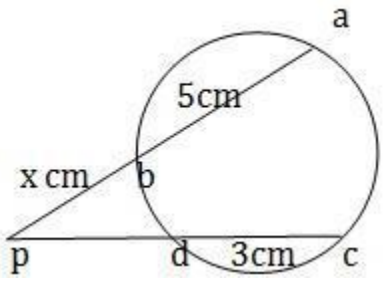
Q39. If the median drawn on the base of a triangle is half its base, the triangle will be,

A. acute-angled B. right-angled C. obtuse-angled D. equilateral

Q40. The angle in a semi circle is

A. An acute angle B. an obtuse angle C. a right angle D. a reflex angle

Q41. In the given figure, chords AB and CD of a circle intersect externally at P. If AB =6cm, CD = 3cm and PD= 5cm then PB= ?



A. 4 cm B. 5 cm C. 6 cm D. 7 cm

Q42. A quadrilateral ABCD circumscribes a circle and AB=6cm, CD=5cm and AD=7cm. The length of side BC is,

A. 1cm B. 2cm C. 4cm D. 8cm

This chapter contains the topics and questions I discussed and created in our classes or obtained from students as their doubts. All the questions noted, typed, redesigned and rectified by group of volunteers consisting of:

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----------ANSWERS AND SOLUTION----------

Q1.D	**Q2.B**	**Q3.A**	**Q4.A**	**Q5.A**	**Q6.A**
Q7.C	**Q8.C**	**Q9.A**	**Q10.C**	**Q11.A**	**Q12.C**
Q13.A	**Q14.A**	**Q15.C**	**Q16.B**	**Q17.C**	**Q18.A**
Q19.B	**Q20.C**	**Q21.B**	**Q22.A**	**Q23.B**	**Q24.B**
Q25.C	**Q26.D**	**Q27.B**	**Q28.A**	**Q29.A**	**Q30.D**
Q31.B	**Q32.C**	**Q33.D**	**Q34.C**	**Q35.D**	**Q36.C**
Q37.C	**Q38.A**	**Q39.B**	**Q40.C**	**Q41.A**	**Q42.C**

----------**ANSWERS AND SOLUTION**----------

Q1.D

Q Solution:-

An angle which is greater than 180° but less than 360° is called a reflex angle.

Q2.B

Q2 Solution:-

$\angle BOD = \angle AOC = 50^o$ [As opposite angles are always equal]

$\angle AOC + \angle AOD = 180^o$

$\Rightarrow$ $50^o + \angle AOD = 180^o$

$\Rightarrow$ $\angle AOD = 130^o$

$\therefore$ $\angle BOD = 50^o$

Q3.A

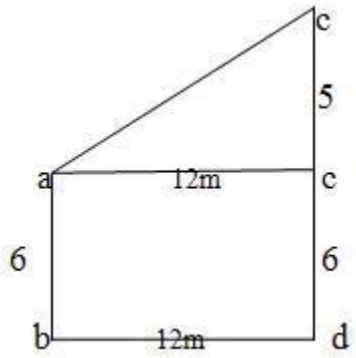
Q3 Solution:-

The shortest distance between two intersecting lines is 0.

Q4.A

Q4 Solution:-

Drawing the figure according to question we get:



Where AB and CD be the poles such that

AB = 6m , CD = 11 m and BD =12m

Drawing AE ⊥ CD . Then , AE = BD = 12m

CE = CD. DE = CD. AB = (11 - 6) m =5m.

from right angled ΔAEC we have

$AC^2 = AE^2 + CE^2 = (12)^2 + 5^2 = (144 + 25) = 169$

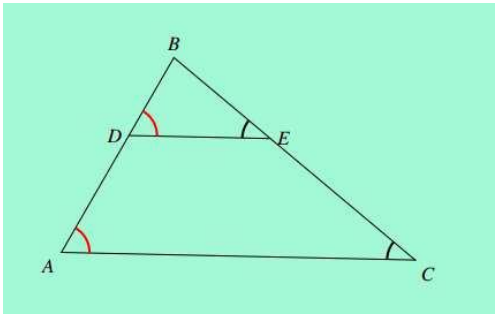
$\Rightarrow$ AC = $\sqrt{169}$ = 13m

$\therefore$ Distance between their tops= 13m

Q5.A

Q5 Solution:-

The picture below depicts the problem.



As AC||DE, in two triangles △ABC and △DBE,

∠CAB=∠EDB,

and ∠ACB=∠DEB.

And ∠B is common,

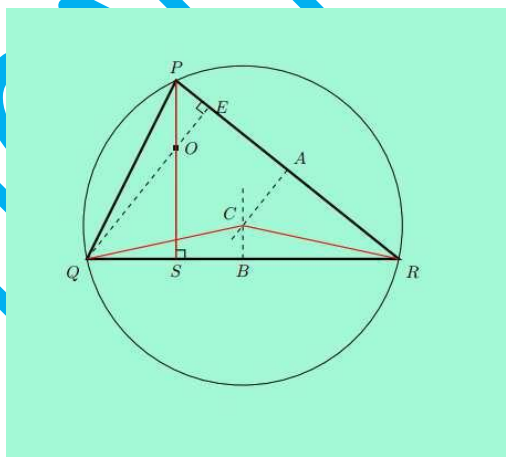
So, all three angles of △ABC equal the corresponding angles of △DBE. So the two triangles are similar to each other.

As D and E are on the sides BA and BC respectively so that AC||DE ,So the two triangles △ABC and △DBE remain similar to each other .

Q6.A

Q6 Solution:-

Refering to the figure:



We see that the chord QR subtends an angle $\angle QCR=130^0$ at the centre

And $\angle QCR=130^0 = 2x\angle QCR$

So, $\angle RPQ=65^0$.

Again in right-angled △PQS, $\angle PQS=60^0$.

So, the other angle in the △PQS, $\angle QPS=30^0$.

So, We get:

$\angle RPS=\angle RPQ-\angle QPS=65^0-30^0=35^0$.

Q7.C

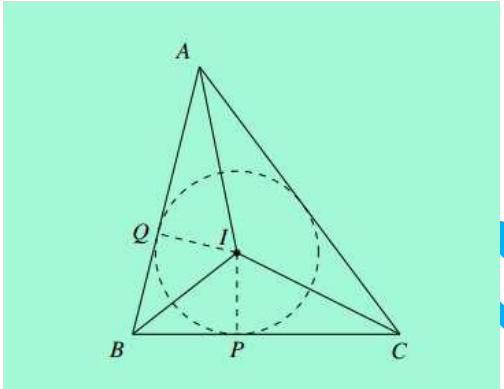
Q7 Solution:-

For any ΔPQS, $\angle P + \angle Q + \angle R = 180^0$

Q8.C

Q8 Solution:-

Let us draw a figure according to questions we get:



In ΔBIC Since BI and CI are angle bisectors,

We have:

$\angle BIC = 180^0 - 1/2(\angle ABC + \angle ACB)$

$= 180^0 - 12(65^0 + 55^0)$

$= 120^0$.

Q9.A

Q9 Solution:-

For an n-sided polygon with sum of all internal angles = $\pi(n-2)$.

And For the two polygons with sides n_1 and n_2 the ratio of sides, $n_1:n2=1:2$.

So, $n_2=2n_1$.

Again, ratio of their internal angles is, $a_1:a_2=2:3$, or, $a_2=3/2a_1$.

From its number of sides, total internal angle of the second triangle is,

$I_2=\pi(n_2-2)=\pi(2n_1-2)$

Again it has n_2 number of a_2 internal angles and Let I_2 be the sum total of internal angles for the second polygon

$I_2=n_2a_2=3/2n_2(a1)=3n_1a_1$.

Or, $n_1a_1=2/3\pi(n_1-1)$ ----------(i)

For the first polygon, its total internal angle is,

$n_1a_1=\pi(n_1-2)$. ----------(ii)

Substituting the values we get:

$3(n_1-2)=2(n_1-1)$,

Or, $n_1=4$,

putting in $n_2=2n_1$ we get:

and $n_2=8$.

Q10.C

Q10 Solution:-

let $2\angle A = 3\angle B = 6\angle C = k$. Then $\angle A = k/2$, $\angle B = k/3$ and $\angle C = k/6$

As given:

$\angle A + \angle B + \angle C = 180^o$

$\therefore \quad \frac{k}{2} + \frac{k}{3} + \frac{k}{6} = 180 \Rightarrow 3k + 2k + k = 180 \times 6$

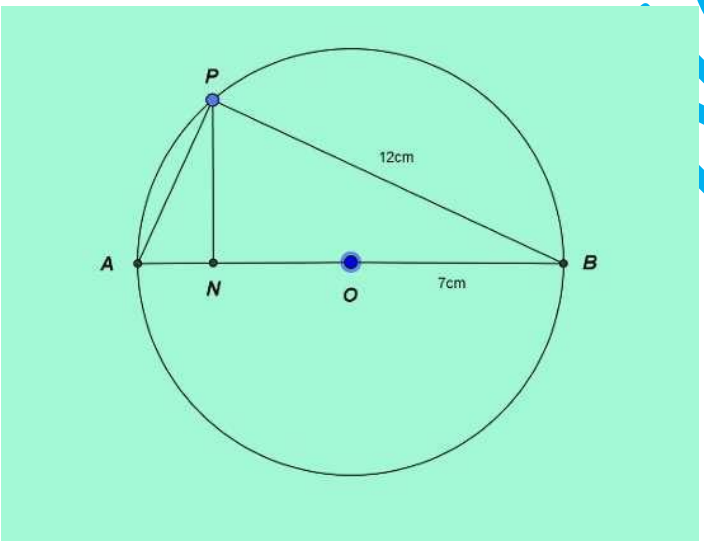
$\Rightarrow \quad 6k = 180 \times 6$

$\Rightarrow \quad k = 180$

$\Rightarrow \quad \angle B = 180^0/3 = 60^o$

Q11.A

Q11 Solution:-



In the triangles, $\triangle APB$ and $\triangle PNB$, apart from the equal right angles (diameter subtends an angle of 90^0 at peripheral point P), the $\angle B$ is common to both triangles. So the third angles are also same and the triangles are similar.

The ratio of corresponding sides in these two similar triangles, BN:PB=PB:ABBN:PB=PB:AB,

Or, $BN = PB^2/AB = 12^2/14 = 144/14 = 72/7$cm.

Q12.C

Q12 Solution:-

$\angle ADC + \angle EDC = 180^o$

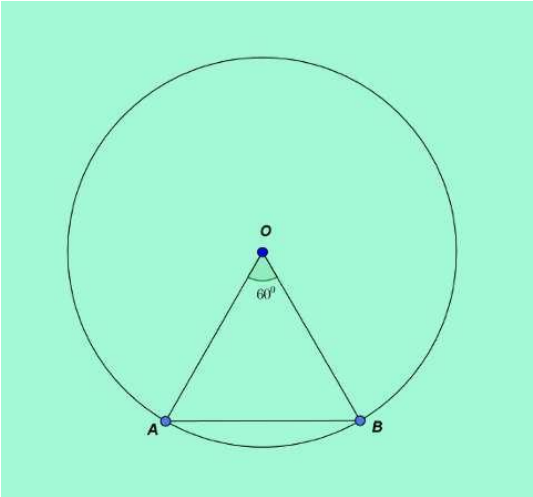
$\Rightarrow \quad \angle ADC + 120^o = 180^o$

$\Rightarrow \quad \angle ADC = 60^o$

$\angle ABC = \angle ADC = 60^o$

Q13.A

Q13 Solution:-



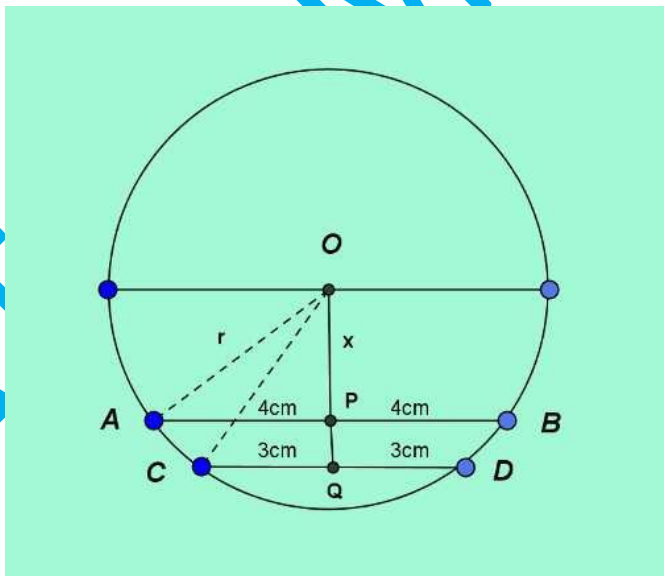
Radius AO=BO makes,

$\angle OAB = \angle OBA = 1/2(180^0 - 60^0) = 120^0/2 = 60^0$.

So the triangle is equilateral and the ratio between the chord and the radius is 1:1.

Q14.A

Q14 Solution:-



In the two triangles Δ APO and Δ CQO all values of the sides are known except the portion OP which we assume here for this reason as unknown x. From the two triangles we get two equations by applying Pythagoras theorem,

$r^2 = AP^2 + x^2 = x^2 + 16$, and

$r^2 = CQ^2 + (x+1)^2 = 9 + x^2 + 2x + 1 = x^2 + 2x + 10$.

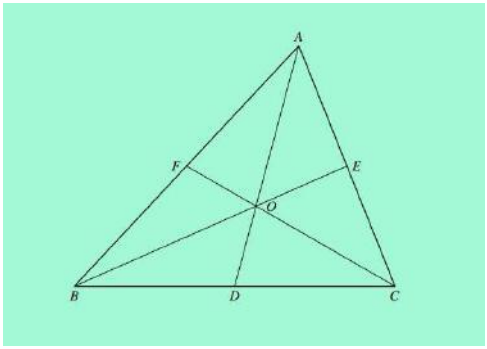
Solving we get:

x=5cm.

Q15.C

Q15 Solution:-

Drawing the figure according to uestion we get:



O is the centroid of the triangle ∆ABC and so it's the point of intersection of its three medians. Since the centroid divides a median in the ratio of 2 : 1 from the vertice.

So we have,

AO:OD=2:1.

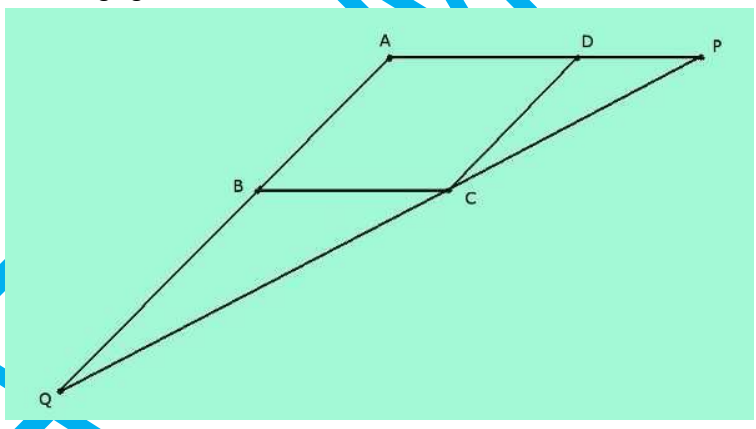
As AO=10cm,

So OD is, 5cm.

Q16.B

Q16 Solution:-

ATP, We get following figure:



Where,If AB = 2 unit then ATP DP = 1 unit

AS we have AP||BC in triangle ∆APQ the two triangles ∆APQ and ∆BCQ are similar.

The base AP=AD+DP=3 unit while, the base BC of the ∆BCQ is 2 unit.

As the corresponding sides in the two similar triangles are in equal ratio, AQ:BQ=3:2,

Or, $\frac{BQ}{AQ} = \frac{BQ}{AQ-BQ} = \frac{2}{1} = 2.$

Q17.C

Q17 Solution:-

Since ∠AOB is a straight line , we have:

X+ 68 = 180^0 [As sum of angles formed on a straight line is 180^0]

⇒ x= (180-68)° = 112°

Q18.A

Q18 Solution:-

Complement of 62°= (90° – 62°) = 28°. [As sum of complementary angle is 90^0]

Q19.B

Q19. Solution:-

Complement of 72° 40' = (90°-72° 40') =17° 20'. [As sum of complementary angle is 90^0]

Q20.C

Q20 Solution:-

x – (90-x) = 24 [As sum of complimentary angles is 90^0]

⇒ 2x = 114

⇒ x = 57

∴ Required angle is 57°.

Q21.B

Q21 Solution:-

Since ∠AOB is a straight angle , we have

∠AOC + ∠COB + ∠BOD = 180° [As sum of angles formed on a straight line is 180^0]

⇒ (3X – 8)° + 50° + (X+ 10)° = 180°

⇒ 4X = 128 ⇒ X = 32.

Q22.A

Q22 Solution:-

Since ∠AOB is a straight angle , we have

∠AOC + ∠BOC =180° [As sum of angles formed on a straight line is 180^0]

⇒ 3x + 20 +4x – 36 = 180

⇒ 7x = 164 ⇒ x = 22.

Q23.B

Q23 Solution:-

x=(90-x) [As sum of complimentary angles is 90^0]

⇒ 2x = 90

⇒ x = 45° .

Q24.B

Q24 Solution:-

ATP:

$x = \frac{180 - x}{5}$

⇒ 5x = 180 – x

⇒ 6x = 180

⇒ x = 30°.

Q25.C

Q25 Solution:-

Supplement of 60° = (180°-60°) =120°. [As sum of supplementary angles is 180^0]

Q26.D

Q26 Solution:-

(180 –X) – X = 32 ⇒ 2x = 180 – 32 = 148 ⇒ x = 74.

Required angle is 74°.

Q27.B

Q27 Solution:-

Let the measures of the angle be (3x)° and (2x)°. Then,

3x+2x=180 [As sum of supplementary angles is 180^0]

⇒ 5x = 180

⇒ x = 36.

Smaller angle = (2x)° = (2.36)° = 72°.

Q28.A

Q28 Solution:-

The sum of the angle of a triangle is 180^o.

∴ 3x = 2x - 7 + 4x -11 = 180 [As sum of supplementary angles is 180^0]

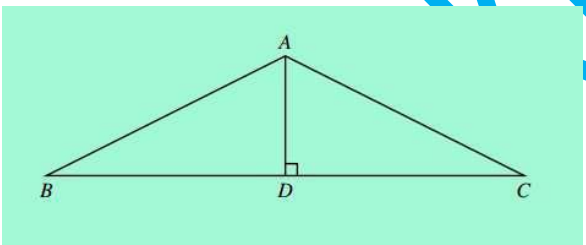
⇒ 9x =162 ⇒ x = 18.

So, x = 18.

Q29.A

Q29 Solution:-

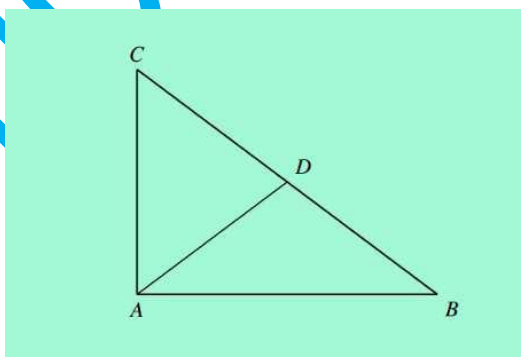
The following isosceles triangle has its ∠ABC=35^0 and AB = AC.



As AD is median to the base BC, it bisects the side BC so that, BD=DC. In two triangles, △ABD and △ACD with common side AD all three pairs of corresponding sides are equal to each other and so the triangles are congruent. So we get, ∠ADB=∠ADC=90^0. And so the ∠BAD=180^0–35^0–90^0=55^0.

Q30.D

Q30 Solution:-



Clearly we have $6^2+8^2=10^2$ so we have given triangle is a right triangle.

Clearly hypotenuse largest and it is BC and AD is the median drawn from A to centre point D of largest side BC.

We know that the diameter of a circle subtends an angle of 90^0 at its circumference and so we may consider the three vertices of the triangle to lie on the circumference of the circumscribing circle with diameter as BC and centre at D. So, AD will be another radius and will be equal to BD=5cm.

Q31.B

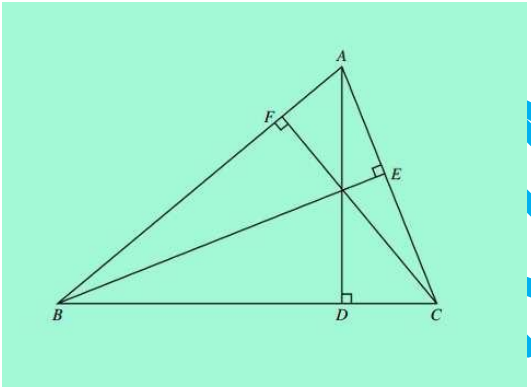
Q31 Solution:-

If FG<3cm, it is less than half of the second side GH=8cm. It means if in the isosceles triangle, the third side equals the smaller side, the two of them will be smaller than the other side GH which contradicts the basic condition of a triangle i.e sum of lengths of any two sides of a triangle must be greater than the third side.

So,, the equal sides are the greater sides, that is, GH=FH=8cm.

Q32.C

Q32 Solution:-



The altitudes of the triangle △ABC are AD, BE and CF. As these are the heights, these are the shortest distances to the opposite sides, that is, a height is lesser in length than both its adjacent sides. To be specific, the length of AD will be less than both the adjacent sides, AB and AC. This will be true for the other two altitudes BE and CF. So if you add up One adjacent side corresponding to each height, the sum of heights will always be less than the sum of three sides.

For example we may add up, BA for AD, AC for CF and CB for BE.

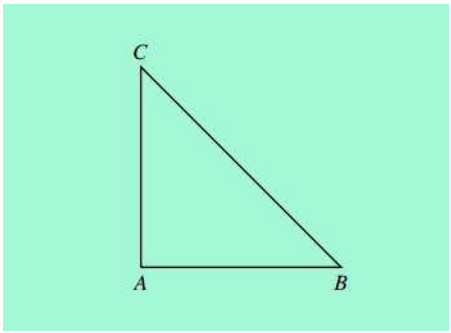
Or, (AD+CF+BE)<(BA+AC+CB),

as, AD<BA, CF<AC and BE<CB.

Q33.D

Q33 Solution:-

The following picture depicts the problem.



By the definition of the problem we have,

$AC \times AB = 1/2.BC^2$,

Or, $2AC \times AB = BC^2$.

Again by Pythagoras theorem,

$AC^2+AB^2=BC^2$.

Subtracting the first equation from the second we have,

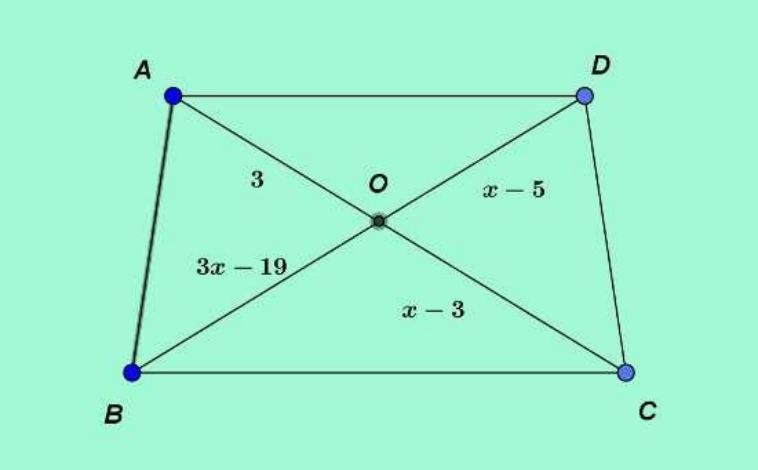
$(AC-AB)^2=0$,

Or, $AC=AB$.

It means the right-angled triangle is also an isosceles triangle with angles = 45^0.

Q34.C

Q36 Solution:-



The sides AD||BC so that, ∠ADO=∠CBO and ∠DAO=∠BCO and so the triangle △ AOD is similar to △BOC.

In a pair of similar triangles ratio of corresponding sides are equal.

AO/CO=DO/BO,

Or, $3/(x-3)=(x-5)/(3x-19)$,

Or, $3(3x-19)=(x-3)(x-5)$

Or, $x^2-17x+72=0$

Or, $x^2-8x-9x+72=0$.

Or, $x(x-8)-9(x-8)=0$.

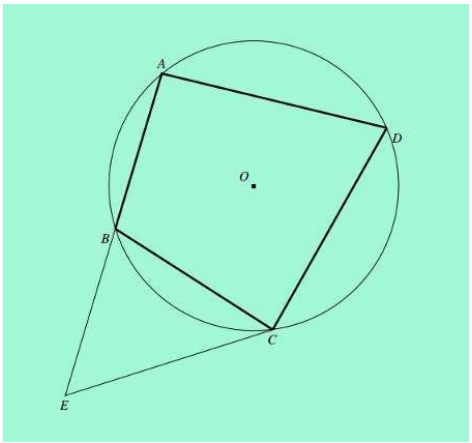
Or, $(x-8)(x-9)=0$.

So, $x=8,9$

Q35.D

Q35 Solution:-.

Refering to the figure:

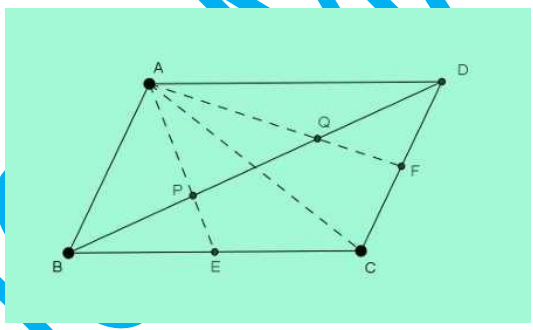


As $\angle ADC=70^0$, its opposite angle in the cyclic quadrilateral is,
$\angle ABC=180^0-70^0=110^0$, [since sum of opposite angle in a cyclic quadrilateral is 180^0]
As being the external angle in the triangle $\triangle BEC$,
$\angle ABC=\angle BEC+\angle BCE=2\angle BCE$, as BC=BE and so, $\triangle BCE$ is isosceles.
So, $\angle BCE=110^0/2 = 55^0$, half of 110^0.
On the other hand as it is opposite to $\angle BAD=95^0$,
$\angle DCB=180^0-95^0=85^0$.
Finally We get,
$\angle DCE=85^0+55^0=140^0$.

Q36.C
Q36 Solution:-

AB DC and AD is the transversal.
$\therefore$ $\angle ADC + \angle DAB=180^o$
$\Rightarrow$ ADC $=100^o=180^o$
$\Rightarrow$ ADC$=80^o$.
Opposite angles of a cyclic quadrilateral are supplementary.
$\therefore$ $\angle ADC +\angle ABC = 180^o$
$\Rightarrow$ $80^o+ \angle ABC =180^o$
$\Rightarrow$ ABC $= 100^o$.

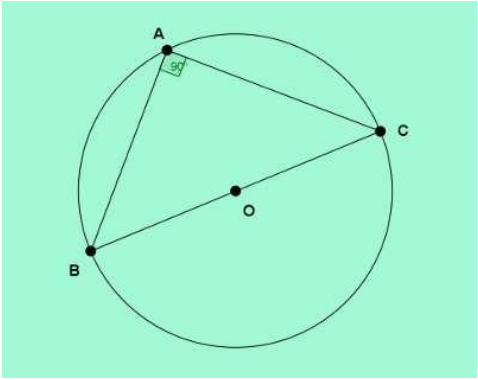
Q37.C
Q37 Solution:-



Being a parallelogram its diagonals bisect each other and so BD is a median to both the triangles $\triangle$ ABC and $\triangle$ ADC. AE and AF are the two other medians drawn to opposite sides intersecting the other medians at P and Q respectively which are then the centroids of the two triangles.
Now BD=18cm and half of it is 9cm. This is the length of the median divided by P and Q in ratio 2:1 from vertices. Between vertices then, out of 18cm, 2 portions out of 6 is the length of PQ, which is,
PQ=26×18=6cm.

Q38.A

Q38 Solution:-



As subtended angle at the circumference by the chord BC is 90^0, the chord is a diameter of the circle, and forms the hypotenuse of the right angled isosceles Δ ABC.

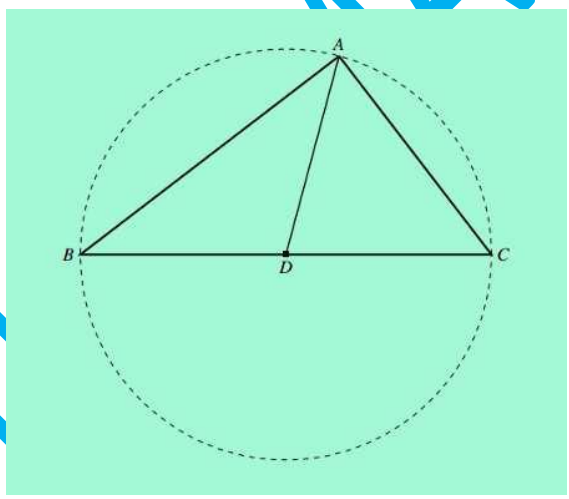
By Pythagoras theorem then,

$BC^2=AB^2+AC^2=5\sqrt{2}^2 + 5\sqrt{2}^2 = 50+50=100$.

So, diameter BC=10, or, radius=5cm.

Q39.B

Q39 Solution:-



The median AD drawn on the base BC of the triangle ΔABC, is equal to half of BC, that is, AD=BD=DC. This is the situation where we can consider the point D as the centre of a circle with the three points A, B and C lying on the circumference of the circle and AD=BD=CD as the Radius and BC as the diameter. As the diameter subtends an angle of 90^0, the triangle is a right angled triangle.

Q40.C

Q40 Solution:-

The angle in a semi-circle is a right angle.

Q41.A

Q41 Solution:-

PA.PB + PC.PD

$\Rightarrow$ (x+6).x=8.5

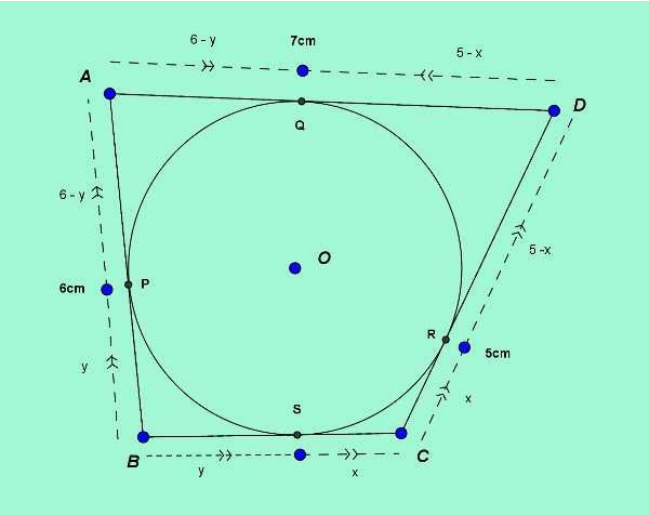
$\Rightarrow$ x^2 +6x - 40 =0

$\Rightarrow$ x^2+10x - 4x - 40 =0

⇒ x(x+10) - 4(x+10) =0
⇒ (x+10) (x-4) =0
⇒ x=4
∴ PB= 4 cm

Q42.C

Q42 Solution:-



The sides of the circumscribed quadrilateral are all tangents to the inscribed circle. The tangent points are respectively, P, Q, R and S. By property of two tangents from a single external point to a circle, the tangent segment lengths are equal. In our case for example, BP=BS.

Using this property we will arrive at the solution.

Let us assume the two parts of side BC length of which is to be found out, are, CS=x and BS=y, so that its length is BC=x+y.

For the adjacent side AB, BP=y, and PA=6−y; for the side CD, CR=x and RD=5−x.

Finally reaching the side AD, DQ=5−x and AQ=6−y. Their sum is,

5−x+6−y=7,

Or, x+y=11−7=4.

This is the desired length of the fourth side.

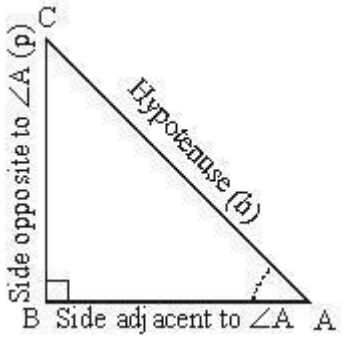
"If you want to shine like a sun. First burn like a sun." - A.P.J Abdul Kalam

TRIGONOMETRY

Trigonometry is a branch of mathematics and by using some mathematical techniques, we can find the distances or heights. The word "Trigonometry" is derived from the Greek words "tri" (means three), 'gon' (means sides) and 'metron' (measure). Actually, Trigonometry is the study of relationships between the sides and angles of a triangle. Trigonometry is one of the most ancient subjects studied by scholars all over the world. The astronomers used trigonometry to calculate distance from the Earth to the planets and stars. Trigonometry is also used in geography to construct maps, determine the position of an island in relation to the longitudes and latitudes, etc.

Trigonometric Ratios :

Let ABC be a right triangle. In figure, ∠CAB is an acute angle. BC(p) is the side opposite to ∠A, AB (b) is the side adjacent to ∠A and AC is the hypotenuse.



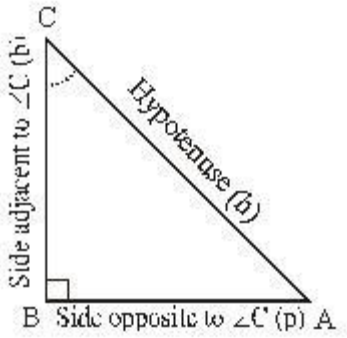
Similarly, in figure, ∠ACB = ∠C is an acute angle. BC (b) is the side adjacent to ∠C, AB (p) is the side opposite to ∠C and AC is the hypotenuse (h), 'p' is perpendicular and 'b' is the base.

Now, The Trigonometric Ratios of ∠A in right triangle ABC (in figure.) are as given below:

$$\text{Sin}\,A = \frac{\text{side opposite to } \angle A}{\text{hypotenuse}} = \frac{BC}{AC} = \frac{p}{h}$$

$$\cos A = \frac{\text{side adjacent to } \angle A}{\text{hypotenuse}} = \frac{AB}{AC} = \frac{b}{h}$$

$$\tan A = \frac{\text{side opposite to } \angle A}{\text{side adjacent to } \angle A} = \frac{BC}{AB} = \frac{p}{b}$$



$$\cot A = \frac{\text{side adjacent to } \angle A}{\text{side opposite to } \angle A} = \frac{AB}{BC} = \frac{b}{p}$$

$$\sec A = \frac{\text{hypotenuse}}{\text{side adjacent to } \angle A} = \frac{AC}{AB} = \frac{h}{b}$$

$$\text{cosec} A = \frac{\text{hypotenuse}}{\text{side opposite to } \angle A} = \frac{AC}{BC} = \frac{h}{p}$$

So, the trigonometric ratios of an acute angle in a right triangle express the relationship between the angle and the length of its sides.

In fact, the ratios CosecA, SecA and CotA are the reciprocals of the ratios sinA, cosA and tanA.

i.e., sinA = 1/cosecA ; cosecA = 1/sinA

cosA = 1/secA ; secA = 1/cosA

tanA = 1/cotA ; cotA = 1/tanA

Also,

tanA = $\frac{\sin A}{\cos A}$; cotA = $\frac{\cos A}{\sin A}$

The values of the trigonometric ratios of an angle do not vary with the lengths of the sides of the triangle, if the angle remains the same.

All six trigonometric ratios of an acute angle can be represented by θ (theta), ß (Bita), Y (Gama), π (pie), ψ (Sie), λ (Lamda), δ (delta) etc.

Trigonometric Ratios of Some Specific Angles:

Values of Trigonometric ratios of 0° to 90° : (Table) :

	$\sqrt{\frac{0}{4}}$	$\sqrt{\frac{1}{4}}$	$\sqrt{\frac{2}{4}}$	$\sqrt{\frac{3}{4}}$	$\sqrt{\frac{4}{4}}$
Angles / Trigonometric ratios	0^o	30^o	45^o	60^o	90^o
Sin	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1
Cos	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0
Tan	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	n.d
Cot	n.d	$\sqrt{3}$	1	$\frac{1}{\sqrt{3}}$	0
Sec	1	$\frac{2}{\sqrt{3}}$	$\sqrt{2}$	2	n.d
Cosec	n.d.	2	$\sqrt{2}$	$\frac{2}{\sqrt{3}}$	1

Some Basic Trigonometric Identities:

(1) $\sin^2 A + \cos^2 A = 1$

(2) $1 + \tan^2 A = \sec^2 A$

(3) $1 + \cot^2 A = \operatorname{cosec}^2 A$

(4) $\sin(90^o - A) = \cos A$

(5) $\cos(90^o - A) = \sin A$

(6) $\tan(90^o - A) = \cot A$

(7) $\cot(90^o - A) = \tan A$

(8) $\sec(90^o - A) = \operatorname{cosec} A$

(9) $\operatorname{cosec}(90^o - A) = \sec A$

----------EXERCISE----------

Q1. What is the value of $\cos 20^\circ \cos 40^\circ \cos 60^\circ \cos 80^\circ$?

A. $\frac{1}{4}$ B. $\frac{1}{16}$ C. $\frac{3}{4}$ D. $\frac{3}{16}$

Q2. What is the value of sin 20osin 40osin 60osin 80o?

A. $\frac{1}{4}$ B. $\frac{1}{16}$ C. $\frac{3}{4}$ D. $\frac{3}{16}$

Q3. The value of $\cot 18^0[\cot 72^0 \cos^2 22^0 + 1/(\tan 72^0 \sec^2 68^0)]$ is,

A. 0 B. 1 C. 2 D. 3

Q4. The value of $\tan 1^0 \tan 2^0 \tan 3^0 \ldots\ldots \tan 89^0$ is,

A. 0 B. 1 C. 2 D. 3

Q5. The value of $\sin^2 1^0 + \sin^2 3^0 + \sin^2 5^0 + \ldots\ldots + \sin^2 87^0 + \sin^2 89^0$ is,

A. 0 B. $22\frac{1}{2}$ C. $45\frac{1}{2}$ D. $89\frac{1}{2}$

Q6. Which one is greater? sin1° or sin1 ?

A. sin1°> sin1 B. sin1°< sin1 C. sin1°= sin1° D. CBD

Q7. The greatest value of $\sin^4\theta + \cos^4\theta$ is,

A. 0 B. 1 C. 2 D. 3

Q8. The minimum value of $\tan^2\theta + \cot^2\theta$ is,

A. 0 B. 1 C. 2 D. 3

Q9. The minimum value of $\cos^2\theta + \sec^2\theta$ is,

A. 0 B. 1 C. 2 D. 3

Q10. The minimum value of $\sin^2\theta + \operatorname{cosec}^2\theta$ is,

A. 0 B. 1 C. 2 D. 3

Q11. If $\frac{\sin\theta + \cos\theta}{\sin\theta - \cos\theta} = 3$ then the numerical value of $\sin^4\theta - \cos^4\theta$ is,

A. $\frac{1}{4}$ B. $\frac{2}{3}$ C. $\frac{3}{5}$ D. $\frac{4}{5}$

Q12. If $\tan\theta + \cot\theta = 2$ $(0^0 \le \theta \le 90^0)$ then the value of $\tan^{100}\theta - \cot^{111}\theta$ is,

A. 0 B. 1 C. 2 D. -1

Q13. If $\sin\theta + \operatorname{cosec}\theta = 2$ $(0^0 \le \theta \le 90^0)$ then the value of $\sin^{100}\theta - \operatorname{cosec}^{111}\theta$ is,

A. 0 B. 1 C. 2 D. -1

Q14. If $\cos\theta + \sec\theta = 2$ $(0^0 \le \theta \le 90^0)$ then the value of $\cos^{100}\theta - \sec^{111}\theta$ is,

A. 0 B. 1 C. 2 D. -1

Q15. If $\tan\theta + \cot\theta = 2$ $(0^0 \le \theta \le 90^0)$ then the value of $\tan^{10}\theta + \cot^{11}\theta$ is,

A. 0 B. 1 C. 2 D. -1

Q16. If $\tan\theta + \cot\theta = 2$ $(0^0 \le \theta \le 90^0)$ then the value of $\tan\theta + \cot\theta$ is,

A. 0 B. 1 C. 2 D. -1

Q17. If $\tan\theta + \cot\theta = 2$ $(0^0 \le \theta \le 90^0)$ then the value of $\sin\theta + \cos\theta$ is,

A. 0 B. 1 C. √2 D. None

Q18. If $0^0<\theta<90^0$ and $2\sin^2\theta+3\cos\theta=3$ then the value of θ is,

A. 0^0 B. 30^0 C. 60^0 D. A or C

Q19. If $\sin\theta=a/\sqrt{(a^2+b^2)}$ then the value of tanθ will be,

A. $\frac{a}{b}$ B. $\frac{b}{a}$ C. $\frac{a+1}{b+1}$ D. $\frac{ab}{a+b}$

Q20. If $\sin21^0=x/y$ then $\sec21^0-\sin69^0$ is,

A. $x^2/[y\sqrt{(y^2-x^2)}]$. B. $x/[y\sqrt{(y^2-x^2)}]$. C. $xy/[\sqrt{(y^2-x^2)}]$. D. $y/[x\sqrt{(y^2-x^2)}]$.

Q21. If $\sin\theta+\operatorname{cosec}\theta=2$ $(0^0\le\theta\le90^0)$ then the value of $\sin\theta+\operatorname{cosec}\theta$ is,

A. 0 B. 1 C. 2 D. -1

Q22. If $\sin\theta+\cos\theta=2$, then find the value of $\operatorname{cosec}\theta-\sec\theta$:

A. $\frac{1}{3}$ B. $\frac{2}{3}$ C. 3 D. $1\frac{1}{3}$

Q23. The minimum value of $2\sin^2\theta+3\cos^2\theta$ is,

A. 0 B. 1 C. 2 D. 3

Q24. If $(\sec\theta+\tan\theta)/(\sec\theta-\tan\theta)=5/3$ then sinθ is,

A. 0 B. $\frac{1}{2}$ C. $\frac{1}{3}$ D. $\frac{1}{4}$

Q25. If $\tan\theta=3/4$ and θ is acute then, sinθ is equal to,

A. 1/3 B. 3/5 C. 5/7 D. 1

Q26. Find maximum value of $12\sin x + 5\cos x + 8$ is:

A. 10 B. 21 C. 32 D. 45

Q27. If $7\sin\theta=24\cos\theta$, where $0<\theta<\frac{\pi}{2}$, then the value of $14\tan\theta-75\cos\theta-7\sec\theta$ is,

A. 1 B. 2 C. 3 D. 4

Q28. If $(1+\sin A)(1+\sin B)(1+\sin C)=(1-\sin A)(1-\sin B)(1-\sin C)$, then the expression on each side of the equation equals,

A. 1 B. sinA.sinB.sinC C. cosA.cosB.cosC D. tanA.tanB.tanC

Q29. If $\tan\theta=1$, then the value of $(8\sin\theta+5\cos\theta)/(\sin^3\theta-2\cos^3\theta+7\cos\theta)$ is,

A. 1 B. 2 C. 3 D. 4

Q30. Find maximum value of $4\tan x + 3\cot x + 10$ is:

A. 10 B. 15 C. 17 D. 31

Q31. $(\sec\theta-\cos\theta)^2+(\operatorname{cosec}\theta-\sin\theta)^2-(\cot\theta-\tan\theta)^2$ is,

A. 0 B. 1 C. 2 D. -1

Q32. If $\tan2\theta.\tan4\theta=1$, then the value of $\tan3\theta$ is,

A. 0 B. 1 C. $\sqrt3$ D. 2

Q33. If $\tan\theta+\cot\theta=2$ $(0^0\le\theta\le90^0)$ then the value of $\sin\theta+\cos\theta$ is,

A. 0 B. 1 C. $\sqrt2$ D. None

Q34. If $\sin\theta+\operatorname{cosec}\theta=2$ $(0^0\le\theta\le90^0)$ then the value of $\sin^{100}\theta-\operatorname{cosec}^{111}\theta$ is,

A. 0 B. 1 C. 2 D. -1

Q35. If $\frac{\sin\theta+\cos\theta}{\sin\theta-\cos\theta}=\frac{5}{4}$, then the value of $(\tan^2\theta+1)/(\tan^2\theta-1)$ will be,

A. $\frac{40}{41}$ B. $\frac{41}{40}$ C. $\frac{42}{47}$ D. $\frac{47}{42}$

Q36. If $(r\cos\theta-\sqrt{3})^2+(r\sin\theta-1)^2=0$, then the value of $(r\tan\theta+\sec\theta)/(r\sec\theta+\tan\theta)$ is,

A. $\frac{4}{5}$ B. $\sqrt{34}$ C. $\sqrt{54}$ D. 54

Q37. If $a\sin\theta+b\cos\theta=c$, then the value of $a\cos\theta-b\sin\theta$ is,

A. $\sqrt{(a^2+b^2-c^2)}$ B. $\sqrt{(a^2+b^2+c^2)}$ C. $\sqrt{(a^2-b^2-c^2)}$ D. $\sqrt{(a^2-b^2+c^2)}$

Q38. If $y = 36\cos^2x + 16\text{cosec}^2x - 4$ then y_{min} is:

A. 0 B. 11 C. 22 D. 44

Q39. If $\tan(x+y)\tan(x-y) = 1$, then find $\tan(2x/3)$?

A. $\frac{1}{4}$ B. $\frac{1}{\sqrt{3}}$ C. $\frac{1}{\sqrt{5}}$ D. $\frac{3}{4}$

Q40. If $\tan\theta=3/4$ and $0<\theta<\pi/2$ and $25x\sin^2\theta\cos\theta=\tan^2\theta$, then the value of x is,

A. $\frac{1}{4}$ B. $\frac{3}{16}$ C. $\frac{5}{64}$ D. $\frac{7}{256}$

Q41. The minimum value of $\sec^2\theta+\cos^2\theta$ is,

A. 0 B. 1 C. 2 D. 3

Q42. If $y = 9\sin^2x + 16\text{cosec}^2x + 4$ then y_{min} is:

A. 10 B. 19 C. 28 D. 41

Q43. In a right $\triangle ABC$ with right angle at $\angle ABC$, if $AB=2\sqrt{6}$ and $AC-BC=2$ then, secA+tanA is,

A. $\sqrt{6}$ B. $2\sqrt{6}$ C. $3\sqrt{6}$ D. $4\sqrt{6}$

Q44. If $\frac{x}{\sin\theta}=\frac{y}{\cos\theta}$, then $\sin\theta-\cos\theta$ is,

A. $(x-y)/(x+y)$ B. $(x+y)/(x^2+y^2)$ C. $(x-y)/\sqrt{(x^2+y^2)}$ D. $(x-y)/(x^2+y^2)$

Q45. If $\tan\theta-\cot\theta=0$ find the value of $\sin\theta+\cos\theta$.

A. 0 B. 1 C. $\sqrt{2}$ D. $\sqrt{3}$

Q46. If $4\sin\theta + 3\cos\theta = 2$, then find the value of $4\cos\theta - 3\sin\theta$:

A. $\sqrt{21}$ B. 3 C. $\sqrt{3}$ D. 1

Q47. Find maximum value of $24\sec x + 7\text{cosec } x + 12$ is:

A. 10 B. 21 C. 37 D. 50

Q48. The maximum value of $3\sin^2\theta+2\cos^2\theta$ is,

A. 0 B. 1 C. 2 D. 3

Q49. If $\tan\theta+\cot\theta=2$ $(0^0\le\theta\le90^0)$ then the value of $\tan^{100}\theta - \cot^{111}\theta$ is,

A. 0 B. 1 C. 2 D. -1

Q50. If $\tan\theta+\cot\theta=-2$ $(0^0\le\theta\le90^0)$ then the value of $\tan^{101}\theta - \cot^{101}\theta$ is,

A. 0 B. 1 C. -2 D. -1

This chapter contains the topics and questions I discussed and created in our classes or obtained from students as their doubts. All the questions noted, typed, redesigned and rectified by group of volunteers consisting of:

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----------ANSWERS ----------

Q1.B	**Q2.B**	**Q3.B**	**Q4.B**	**Q5.B**	**Q6.B**
Q7.B	**Q8.C**	**Q9.C**	**Q10.C**	**Q11.C**	**Q12.A**
Q13.A	**Q14.A**	**Q15.C**	**Q16.C**	**Q17.C**	**Q18.D**
Q19.A	**Q20.A**	**Q21.C**	**Q22.D**	**Q23.C**	**Q24.D**
Q25.B	**Q26.B**	**Q27.B**	**Q28.C**	**Q29.B**	**Q30.B**
Q31.B	**Q32.B**	**Q33.C**	**Q34.A**	**Q35.B**	**Q36.A**
Q37.A	**Q38.D**	**Q39.B**	**Q40.C**	**Q41.C**	**Q42.C**
Q43.A	**Q44.C**	**Q45.C**	**Q46.A**	**Q47.C**	**Q48.D**
Q49.A	**Q50.A**				

----------ANSWERS WITH SOLUTION----------

Q1.B

Q1 Solution:

Shortcut:

$\cos\theta \times \cos 2\theta \times \cos 4\theta = \frac{1}{4}\cos 3\theta$ [for all values of θ]

Now, $(\cos 20^o \cos 40^o \cos 80^o)\cos 60^o$

$\frac{1}{4}(\cos 3x20) \times \cos 60^o$

$\frac{1}{4}\cos^2 60^o = \frac{1}{4} \times (\frac{1}{2})^2 = 1/16$

Q2.B

Q2 Solution:

Shortcut:

$\sin\theta \times \sin 2\theta \times \sin 4\theta = \frac{1}{4}\sin 3\theta$ [for all values of θ]

Now, $(\sin 10^o \sin 20^o \sin 40^o)\sin 30^o$

$\frac{1}{4}(\sin 3x10) \times \sin 30^o$

$\frac{1}{4}\sin^2 30^o = \frac{1}{4} \times (\frac{1}{2})^2 = 1/16$

Q3.B

Q3.Solution:-

We have:

$\cot 72^0 = \cot(90^0-18^0) = \tan 18^0$,

$\tan 72^0 = \tan(90^0-18^0) = \cot 18^0$

$\sec 68^0 = \sec(90^0-22^0) = \operatorname{cosec} 22^0$.

$\cos 68^0 = \cos(90^0-22^0) = \sin 22^0$.

$\cot 18^0[\cot 72^0 \cos^2 22^0 + 1/(\tan 72^0 \sec^2 68^0)]$

$= \cot 18^0[\tan 18^0 \cos^2 22^0 + \cot 72^0 \cos^2 68^0)]$

$= \cot 18^0[\tan 18^0 \cos^2 22^0 + \tan 18^0 \cos^2 68^0)]$

$= \tan 18^0 \cot 18^0[\cos^2 22^0 + \sin^2 22^0)]$

$= 1.[1] = 1.$

Q4.B

Q4 Solution:

We have,

$\tan(90^0-\theta) = \cot\theta$, where θ is acute.

With this knowledge, we find in the product a matching pair of tan890tan890 for tan10tan10. As
$\tan89^0 = \tan(90^0 - 1^0) = \cot1^0$,
$\tan88^0 = \tan(90^0 - 2^0) = \cot2^0$,
$\tan87^0 = \tan(90^0 - 3^0) = \cot3^0$
.
.
.
.

$\tan46^0 = \tan(90^0 - 44^0) = \cot44^0$
Now sustituting these values in original equation we get
$\tan1^0\tan2^0\tan3^0 \ldots\ldots \tan44^0 \tan45^0 \tan46^0 \ldots\ldots \tan87^0 \tan88^0\tan89^0$
$\tan1^0\tan2^0\tan3^0 \ldots\ldots \tan44^0 \tan45^0 \cot44^0 \ldots\ldots \cot3^0 \cot2^0\cot1^0$
$\tan1^0\cot1^0\tan2^0 \cot2^0\tan3^0\cot3^0 \ldots\ldots \tan44^0 \cot44^0 \tan45^0$
1.1.1.....1.1 [as $\cot45^0 = 1$]

Q5.B
Q5 Solution:
We have:
$\sin\theta = \cos(90^0 - \theta)$
$\sin^2 1^0 + \sin^2 89^0 = \sin^2 1^0 + \sin^2(90^0 - 1) = \sin^2 1^0 + \cos^2 1^0 = 1$
$\sin^2 2^0 + \sin^2 89^0 = \sin^2 2^0 + \sin^2(90^0 - 2) = \sin^2 2^0 + \cos^2 2^0 = 2$
$\sin^2 3^0 + \sin^2 89^0 = \sin^2 3^0 + \sin^2(90^0 - 3) = \sin^2 3^0 + \cos^2 3^0 = 3$

.
.
.
.
.
$\sin^2 44^0 + \sin^2 89^0 = \sin^2 44^0 + \sin^2(90^0 - 44) = \sin^2 44^0 + \cos^2 44^0 = 44$
adding all we get:
$\sin^2 1^0 + \sin^2 3^0 + \sin^2 5^0 + \ldots\ldots + \sin^2 87^0 + \sin^2 89^0 = 1+1+1\ldots\ldots\ldots 22\text{times} = 22$
We are to find:
$\sin^2 1^0 + \sin^2 3^0 + \sin^2 5^0 + \ldots\ldots\ldots\ldots \sin^2 44^0 + \sin^2 45^0 + \sin^2 46^{0\ldots\ldots\ldots} \ldots + \sin^2 87^0 + \sin^2 89^0$
$= \sin^2 1^0 + \sin^2 3^0 + \sin^2 5^0 + \ldots\ldots\ldots\ldots \sin^2 44^0 + \sin^2 46^{0\ldots\ldots\ldots} \ldots + \sin^2 87^0 + \sin^2 89^0 + \sin^2 45^0$
$= 22 + (1/\sqrt{2})^2$
$= 22\frac{1}{2}$

Q6.B
Q6 solution:-
we have $1 = 57.32^0$
And we know
sinx>siny if x>y for acute angles
So
$1 > 1^0$
$\sin1 > \sin1^0$

Q7.B
Q7 Solution:
$\sin^4\theta + \cos^4\theta = (\sin^2\theta + \cos^2\theta)^2 - 2\sin^2\theta\cos^2\theta$
$= 1 - 2\sin^2\theta\cos^2\theta$

The maximum of this expression can only be 1 when, the second term is zero, or when either sinθ or cosθ is 0.

Q8.C
Q8 Solution:
We know $a^2 + 1/a^2$ has minimum value as 2,
So, $\tan^2\theta+\cot^2\theta = \tan^2\theta+1/\tan^2\theta$ has min value as 2

Q9.C
Q9 Solution:
We know $a^2 + 1/a^2$ has minimum value as 2,
So $\cos^2\theta+\sec^2\theta = \cos^2\theta+1/\cos^2\theta$ has min value as 2

Q10.C
Q10 Solution:
We know $a^2 + 1/a^2$ has minimum value as 2, [As A.P. > /=G.P]
So $\sin^2\theta+\text{cosec}^2\theta = \sin^2\theta+1/\sin^2\theta$ has min value as 2

Q11.C
Q11 Solution:
Given:
$\frac{\sin\theta+\cos\theta}{\sin\theta-\cos\theta} = 3$
using componendo and dividendo two we get, $\tan\theta=2$
We are to find $\sin^4\theta-\cos^4\theta=(\sin^2\theta+\cos^2\theta)(\sin^2\theta-\cos^2\theta)=1.(\sin^2\theta-\cos^2\theta)$
Again $\tan\theta=2$, or, $\tan^2\theta=4=\sec^2\theta-1$, or, $\sec^2\theta=5$, or, $\cos^2\theta=1/5 \Rightarrow \sin^2\theta= 1-\cos^2\theta =1-\frac{1}{5}=\frac{4}{5}$
So, $(\sin^2\theta-\cos^2\theta) = \frac{4}{5}-\frac{1}{5}=\frac{3}{5}$

Q12.A
Q12 Solution:
$\tan\theta+\cot\theta=2$

$\tan\theta + \frac{1}{\tan\theta} =2$

Or, $\tan^2\theta-2\tan\theta+1=0$
Or, $(\tan\theta - 1)^2=1$
$\tan\theta=1$, giving $\cot\theta=1$
So, $\tan^{100}\theta - \cot^{111}\theta =1 - 1 = 0$

Q13.A
Q13 Solution:
$\sin\theta+\text{cosec}\theta = 2$
$\sin\theta + \frac{1}{\sin\theta} =2$
Or, $\sin^2\theta-2\sin\theta+1=0$
Or, $(\sin\theta - 1)^2=1$
$\sin\theta=1$, giving $\text{cosec}\theta=1$
So, $\sin^{100}\theta - \text{cosec}^{111}\theta =1 - 1 = 0$

Q14.A
Q14 Solution:
$\cos\theta+\sec\theta=2$

$\cos\theta + \frac{1}{\cos\theta} = 2$

Or, $\cos^2\theta - 2\cos\theta + 1 = 0$

Or, $(\cos\theta - 1)^2 = 1$

$\cos\theta = 1$, giving $\sec\theta = 1$

So, $\cos^{100}\theta - \sec^{111}\theta = 1 - 1 = 0$

Q15.C

Q15 Solution:

$\tan\theta + \cot\theta = 2$

$\tan\theta + \frac{1}{\tan\theta} = 2$

Or, $\tan^2\theta - 2\tan\theta + 1 = 0$

Or, $(\tan\theta - 1)^2 = 1$

$\tan\theta = 1$, giving $\cot\theta = \frac{1}{\tan\theta} = \frac{1}{1} = 1$

So, $\tan^{10}\theta + \cot^{11}\theta = 1 + 1 = 2$

Q16.C

Q16 Solution:

$\tan\theta + \cot\theta = 2$

$\tan\theta + 1/\tan\theta = 2$

Or, $\tan^2\theta - 2\tan\theta + 1 = 0$

Or, $(\tan\theta - 1)^2 = 1$

$\tan\theta = 1$, giving $\cot\theta = 1$

So $\tan\theta + \cot\theta = 1 + 1 = 2$

Q17.C

Q17 Solution:

$\tan\theta + \cot\theta = 2$

$\tan\theta + \frac{1}{\tan\theta} = 2$

Or, $\tan^2\theta - 2\tan\theta + 1 = 0$

Or, $(\tan\theta - 1)^2 = 1$

$\tan\theta = 1$, giving $\theta = 45^0$

So, $\sin\theta + \cos\theta = \sin 45^0 + \cos 45^0 = \frac{1}{\sqrt{2}} + \frac{1}{\sqrt{2}} = \frac{2}{\sqrt{2}} = \sqrt{2}$

Q18.D

Q18 Solution:-

$2(1 - \cos^2\theta) + 3\cos\theta = 3$ [

Or, $2\cos^2\theta - 3\cos\theta + 1 = 0$

Or, $(2\cos\theta - 1)(\cos\theta - 1) = 0$.

⇨ $\cos\theta = ½$ Or $\cos\theta = 1$

⇨ $\theta = 60^0$ Or $\theta = 0^0$

Q19.A

Q19 Solution:

We have, $\cos^2\theta = 1 - \sin^2\theta = 1 - a^2/(a^2 + b^2)$

Or, $\cos^2\theta=(a^2+b^2-a^2)/(a^2+b^2)=b^2/(a^2+b^2)$
Or, $\cos\theta=b/\sqrt{(a^2+b^2)}$
So, $\tan\theta=\sin\theta/\cos\theta=[a/\sqrt{(a^2+b^2)}]/[b/\sqrt{(a^2+b^2)}]=a/b$.

Q20.A
Q20 Solution:
We know: $\sin\theta=\cos(90^0-\theta)$.
So, $\sin21^0=\cos69^0$,
Or, $\sin21^0=\cos(90^0-21^0)=\cos69^0$,
Or, $\sin21^0=\cos69^0=x/y$,
Or, $1-\cos^269^0=\sin^269^0=1-x^2/y^2=(y^2-x^2)/y^2$,
Or, $\sin69^0=\sqrt{(y^2-x^2)}/y$.
$\sec21^0-\sin69^0=\operatorname{cosec}69^0-\sin69^0$
$=1-\sin^269^0/\sin69^0$
$=\cos^269^0/\sin69^0$
$=x^2/y^2\times y/\sqrt{(y^2-x^2)}$
$=x^2/[y\sqrt{(y^2-x^2)}]$.

Q21.C
Q21 Solution:
$\sin\theta+\operatorname{cosec}\theta=2$
$\sin\theta+1/\sin\theta=2$
Or, $\sin^2\theta-2\sin\theta+1=0$
Or, $(\sin\theta-1)^2=1$
$\sin\theta=1$, giving $\operatorname{cosec}\theta=1$
So, $\sin\theta+\operatorname{cosec}\theta=1+1=2$

Q22.D
Q22 Solution:
shortcut: If $\sin\theta+\cos\theta=p$ & $\operatorname{cosec}\theta-\sec\theta=q$
then $P-\frac{1}{p}=\frac{2}{q}$
using above we get:
2-(1/2) = 3/2 = 2/q
q= 4/3 or $\operatorname{cosec}\theta-\sec\theta=4/3$

Q23.C
Q23 Solution:
$2\sin^2\theta+3\cos^2\theta$
$=2\sin^2\theta+2\cos^2\theta+\cos^2\theta$
$=2(\sin^2\theta+\cos^2\theta)+\cos^2\theta$
$=2x1+\cos^2\theta$
$=2+\cos^2\theta$
This expression will be minimum for Minimum value of $\cos^2\theta$ that is 0
=2

Q24.D
Q24 Solution:
Given:

$\frac{\sec\theta+\tan\theta}{\sec\theta-\tan\theta}=\frac{5}{3}$

Using componendo and dividend we get

$\frac{\text{Sec}\,\theta}{\tan\theta}=4$

Or, $\frac{\frac{1}{\cos\theta}}{\frac{\sin\theta}{\cos\theta}}=4$

Or, $\frac{1}{\sin\theta}=4$

Or, $\sin\theta=\frac{1}{4}$.

Q25.B

Q25 Solution:

We have:

$\tan\theta=3/4$

$\cot\theta=4/3$, or, $\cot^2\theta=\text{cosec}^2\theta-1=16/9$,

Or, $\text{cosec}^2\theta=25/9$

Or, $\text{cosec}\theta=5/3$.

Or, $\sin\theta=3/5$

Q26.B

Q26 Solution:

Shortcut:

$y = a\sin x + b\cos x + c$

$y = a\tan x + b\cot x + c$

$y = a\sec x + b\text{cosec}\, x + c$

then, $y_{min} = c - [\sqrt{(a^2+b^2)}]$

$y_{max} = c + [\sqrt{(a^2+b^2)}]$

putting the respective values we get it as 21

Q27.B

Q27.Solution:-

Given:

$7\sin\theta=24\cos\theta$,

Or, $\tan\theta=24/7$,

Or, $\tan^2\theta+1=24^2/7^2+1$,

Or, $\sec^2\theta=576/49+1=625/49$,

Or, $\sec\theta=25/7$, as $0<\theta<\pi/2$, $\sec\theta$ is positive.

So, $\cos\theta=7/25$.

So, $14\tan\theta-75\cos\theta-7\sec\theta$,

$=14\times24/7-75\times7/25-7\times25/7$

$=48-21-25$

$=2$.

Q28.C

Q28 Solution:

We are given $(1+\sin A)(1+\sin B)(1+\sin C)=(1-\sin A)(1-\sin B)(1-\sin C)=k$

So, $(1+\sin A)(1+\sin B)(1+\sin C)=k$ ----------(i) and,

$(1-\sin A)(1-\sin B)(1-\sin C)=k$. ----------(ii)

Multiplying equation (i) and (ii) we get,

$k^2=(1-\sin^2A)(1-\sin^2B)(1-\sin^2C)$
$k^2=\cos^2A.\cos^2B.\cos^2C$
Or, $k=\cos A.\cos B.\cos C$

Q29.B
Q29 Solution:
Given:
$\tan\theta=1$,
Or, $\sin\theta=\cos\theta$.
So, $(8\sin\theta+5\cos\theta)/(\sin^3\theta-2\cos^3\theta+7\cos\theta)=13/(7-\sin^2\theta)$. [putting $\sin\theta=\cos\theta$]
Or, $\cot^2\theta=1$,
Or, $\operatorname{cosec}^2\theta-1=1$,
Or, $\sin^2\theta=1/2$.
Substituting, in $13/(7-\sin^2\theta)$ we get
$=13/(7-1/2)$
$=13/(13/2)$
$=2$

Q30.B
Q30 Solution:
Shortcut:
$y=a\sin x+b\cos x+c$
$y=a\tan x+b\cot x+c$
$y=a\sec x+b\operatorname{cosec} x+c$
then, $y_{min}=c-[\sqrt{(a^2+b^2)}]$
$y_{max}=c+[\sqrt{(a^2+b^2)}]$
So, putting the values we get the answer as $10+[\sqrt{(3^2+4^2)}]=10+5=15$

Q31.B
Q31 Solution:
$(\sec\theta-\cos\theta)^2=\sec^2\theta(1-\cos^2\theta)^2=(\sin^2\theta)^2/\cos^2\theta=\sin^2\theta.\sin^2\theta/\cos^2\theta=\sin^2\theta\tan^2\theta$.
Similarly,
$(\operatorname{cosec}\theta-\sin\theta)^2=\cos^2\theta\cot^2\theta$.
Adding all we get:
$2-\tan^2\theta(1-\sin^2\theta)-\cot^2\theta(1-\cos^2\theta)$
$=2-(\sin^2\theta+\cos^2\theta)$
$=2-1=1$.

Q32.B
Q32 Solution -
$\tan2\theta.\tan4\theta=1$,
Or, $\tan2\theta=1/\tan4\theta=\cot4\theta$.
$\tan2\theta=\tan(90^0-4\theta)$, where θ is acute.
$2\theta=90^0-4\theta$
$6\theta=90^0$
$3\theta=45^0$
So, $\tan3\theta=\tan45^0=1$.

Q33.C
Q33 Solution:
$\tan\theta+\cot\theta=2$
$\tan\theta+1/\tan\theta=2$
Or, $\tan^2\theta-2\tan\theta+1=0$

Or, $(\tan\theta - 1)^2=1$
$\tan\theta=1$, giving $\theta=45^0$
So, $\sin\theta+\cos\theta = \sin45^0+\cos45^0 = 1/\sqrt{2} + 1/\sqrt{2} =2/\sqrt{2}=\sqrt{2}$

Q34.A
Q34 Solution:
$\sin\theta+\operatorname{cosec}\theta=2$
$\sin\theta+1/\sin\theta=2$
Or, $\sin^2\theta-2\sin\theta+1=0$
Or, $(\sin\theta - 1)^2=1$
$\sin\theta=1$, giving $\operatorname{cosec}\theta=1$
So, $\sin^{100}\theta - \operatorname{cosec}^{111}\theta =1 - 1 = 0$

Q35.B
Q35 Solution:
Given:
$\frac{\sin\theta+\cos\theta}{\sin\theta-\cos\theta} = \frac{5}{4}$
Using componendo dividendo we get
$\frac{\sin\theta}{\cos\theta} = \frac{5+4}{5-4} = \frac{9}{1}$
Or, $\tan\theta=9$
So, $\tan^2\theta=81$
So, $(\tan^2\theta+1)/(\tan^2\theta-1)=(81+1)/(81-1)=82/80=41/40$

Q36.A
Q36 Solution:-
$(r\cos\theta-\sqrt{3})=0$,
Or, $r\cos\theta=\sqrt{3}$, ----------(i) and
$(r\sin\theta-1)=0$,
Or, $r\sin\theta=1$. ----------(ii)
$(r\cos\theta)^2 + (r\sin\theta)^2 = \sqrt{3}^2 + 1^2 =3+1=4$
$r^2(\cos^2\theta + \sin^2\theta)=4$, and
$r^2(1)=4$
$r=2$
putting in (i) we get:
$2\cos\theta=\sqrt{3}$
$\cos\theta=\sqrt{3}/2$
$\theta=30^0$.
puting these values in $(r\tan\theta+\sec\theta)/(r\sec\theta+\tan\theta)$ we get it's value as 4/5

Q37.A
Q37 Solution
Given: $a\sin\theta+b\cos\theta=c$ ----------(i)
Let $a\cos\theta-b\sin\theta=k$ ----------(ii)
squaring and adding both the equations we get:
Or, $a^2\sin^2\theta+2ab\sin\theta\cos\theta+b^2\cos^2\theta+ a^2\sin^2\theta-2ab\sin\theta\cos\theta+b^2\cos^2\theta =c^2 + k^2$
Or, $a^2(\sin^2\theta+\cos^2\theta)+b^2(\cos^2\theta +\sin^2\theta)= c^2 + k^2$
Or, $a^2.1+b^2.1-c^2= k^2$
Or, $k^2=(a^2+b^2-c^2)$
Or, $k=\sqrt{(a^2+b^2-c^2)}$

Q38.D
Q38 Solution:
Shortcut:

$y = a^2\sin^2x + b^2\ \text{cosec}2x + c$
$y = a^2\cos^2x + b^2\sec^2x + c$
$y = a^2\tan^2x + b^2\cot^2x + c$
then,
$y_{min} = 2ab + c$
y_{max} = infinite.
For, $y_{min} = 2x\sqrt{36} \times \sqrt{16} - 4$
$= 2x6x4 + 20 = 48 - 4 = 44$

Q39.B

Q39 Solution:

$\tan A \times \tan B = 1$
=> $\tan A = \cot B$,
=> $\tan A = \tan(90^0 - B)$
=> $A = 90^0 - B$
So, $A + B = 90^o$
So, $(x+y)+(x-y) = 90^o$, [putting A =(x+y) and B =(x-y)]
$2x = 90^o$,
$x = 45^o$
$\tan(2x/3) = \tan 30^o = \frac{1}{\sqrt{3}}$

Q40.C

Q40 Solution:

$25x\sin^2\theta\cos\theta = \tan^2\theta$
$25x\sin^2\theta\cos\theta = \sin^2\theta/\cos^2\theta$
$25x = \sec^3\theta$
Now, As given:
$\tan\theta = \frac{3}{4}$,
$\sec^2\theta = 1 + \tan^2\theta = 1 + \frac{9}{16} = \frac{25}{16}$.
⇨ $\sec\theta = \frac{5}{4}$
Substituting we get,
$25x = \sec^3\theta$
Or, $x = \frac{125}{64} \times \frac{1}{25} = \frac{5}{64}$

Q41.C

Q41 Solution:

We know $a^2 + 1/a^2$ has minimum value as 2,
So, $\cos^2\theta + \sec^2\theta = \cos^2\theta + 1/\cos^2\theta$ has min value as 2

Q42.C

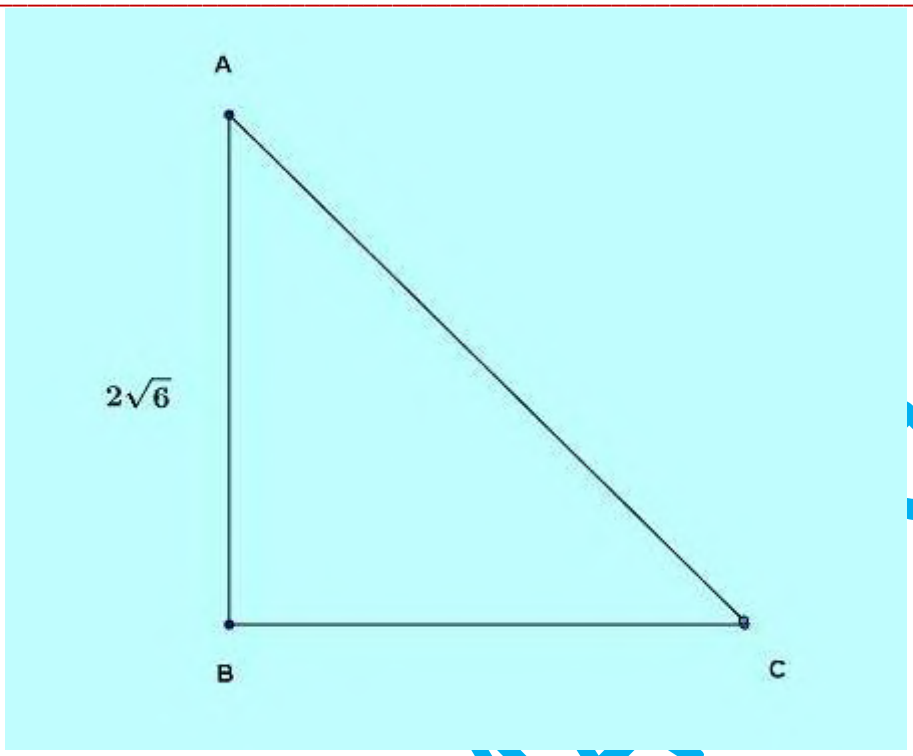
Q42 Solution:

Shortcut:
$y = a^2\sin^2x + b^2\ \text{cosec}2x + c$
$y = a^2\cos^2x + b^2\sec^2x + c$
$y = a^2\tan^2x + b^2\cot^2x + c$
then, $y_{min} = 2ab + c$
y_{max} = infinite.
For given sum,
$y_{min} = 2x\sqrt{9} \times \sqrt{16} + 4$
$= 2x3x4 + 20 = 24 + 4 = 28$

Q43.A

Q43 Solution -

In $\triangle ABC$,



AB=2√6 and,
AC−BC=2.
Multiplying both sides by (AC+BC) we get,
$AC^2-BC^2=2(AC+BC)$,
Or, $AB^2=2(AC+BC)$,
Or, $AC+BC=1/2(2\sqrt{6})^2=12$.
Adding this with the equation of AC−BC=2 we get,
2AC=14,
Or, AC=7.
And subracting,
2BC=10,
Or, BC=5.
So, secA=AC/AB=7/2√6, and
tanA=BC/AB=5/2√6, giving,
secA+tanA=12/2√6=√6.

Q44.C
Q44 Solution:
$x/\sin\theta=y/\cos\theta$
Or, $\cot\theta=y/x$
Or, $\cot^2\theta+1=\text{cosec}^2\theta= 1+y2/x2 = (x^2+y^2)/x^2$
Or, $\sin^2\theta=x^2/(x^2+y^2)$
Or, $\sin\theta=x/\sqrt{(x^2+y^2)}$.
Similarly,
$\cos\theta=y/\sqrt{(x^2+y^2)}$.
So,
$\sin\theta-\cos\theta=(x-y)/\sqrt{(x^2+y^2)}$.

Q45.C
Q45 Solution:
Given: $\tan\theta-\cot\theta=0$

Or, $\tan\theta=\cot\theta$,

Or, $\frac{\sin\theta}{\cos\theta}=\frac{\cos\theta}{\sin\theta}$

Or, $\sin^2\theta=\cos^2\theta$.

Or, $\sin\theta=\cos\theta$

=> $\theta=45^0$.

So, $\sin\theta+\cos\theta=\frac{1}{\sqrt{2}}+\frac{1}{\sqrt{2}}=\frac{2}{\sqrt{2}}=\sqrt{2}$

Q46.A

Q46 Solution:

Shortcut: If a sin θ + b cos θ = m & a cos θ – b sin θ = n
then $a^2 + b^2 = m^2 + n^2$
Let 2 cos θ – 3 sin θ = x
By using above shortcut we get
$4^2 + 3^2 = 2^2 + x^2$
$16 + 9 = 4 + x^2$
$X = \sqrt{21}$

Q47.C

Q47 Solution:

Shortcut:

$y = a\sin x + b\cos x + c$
$y = a\tan x + b\cot x + c$
$y = a\sec x + b\operatorname{cosec} x + c$

then, $y_{min} = c - [\sqrt{(a^2+b^2)}]$
$y_{max} = c + [\sqrt{(a^2+b^2)}]$
putting the respective values we get it as 37

Q48.C

Q48 Solution:

$3\sin^2\theta+2\cos^2\theta$
$=2\sin^2\theta+2\cos^2\theta + \sin^2\theta$
$=2(\sin^2\theta+\cos^2\theta) + \sin^2\theta$
$=2x1 + \sin^2\theta$
$=2 + \sin^2\theta$
This expression will be maximum for maximum value of $\sin^2\theta$ that is 1
=3

Q49.A

Q49 Solution:

$\tan\theta+\cot\theta=2$
$\tan\theta+1/\tan\theta=2$
Or, $\tan^2\theta-2\tan\theta+1=0$
Or, $(\tan\theta - 1)^2=1$
$\tan\theta=1$, giving $\cot\theta=1$
So, $\tan^{100}\theta - \cot^{111}\theta = 1 - 1 = 0$

Q50.A

Q50 Solution:

$\tan\theta+\cot\theta=-2$

$\tan\theta+1/\tan\theta=2$

Or, $\tan^2\theta+2\tan\theta+1=0$

Or, $(\tan\theta + 1)^2=1$

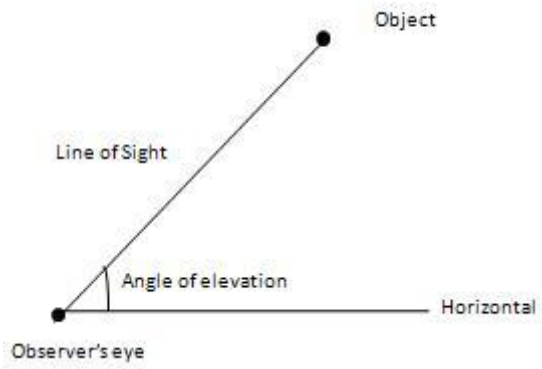
$\tan\theta= -1$, giving $\cot\theta= -1$

So, $\tan^{101}\theta - \cot^{101}\theta = -1 + 1 = 0$

" Be more dedicated to making solid achievements than in running after swift but synthetic happiness." -A.P.J Abdul Kalam

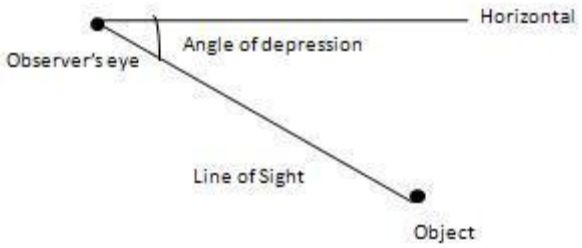
Angle of Elevation:

The angle of elevation of an object as seen by an observer is the angle between the horizontal and the line from the object to the observer's eye (the line of sight).



Angle of Depression:

The angle below horizontal that an observer must look to see an object that is lower than the observer.



Remember these values:

tan 22.5° = √2−1

√2=1.414

√3=1.732

√5=2.236

EXERCISE

Q1. From The top of a 90 m high building, the angles of top and bottom of another building is 30° and 60°. What is the height of another building?

A. 40 m B. 45 m C. 50 m D. 60 m

Q2. A bridge pillar is supported by two rods with ground at 15 m away, at the heights in the ratio 1:9 If the angle made by first rod with ground be equal to the angle made by second rod with first rod be equal what is the actual height of the pole?

A. 25√5 m B. 45 m C. 48 m D. 60√5 m

Q3. The heights of two towers are 90 meters and 45 meters. The line joining their tops make an angle 45^0 with the horizontal then the distance between the two towers is

A. 25 m B. 45 m C. 48 m D. 54 m

Q4. The angle of elevation of the sun, when the length of the shadow of a tree is equal to the height of the tree, is:

A. 30° B. 45° C. 60° D. None

Q5. From a point 375 meters away from the foot of a tower, the top of the tower is observed at an angle of elevation of 45°, then the height (in meters) of the tower is?

A. 125 B. 250 C. 375 D. 495

Q6. From the top of a hill 100 m high, the angles of depression of the top and bottom of a pole are 30° and 60° respectively. What is the height of the pole?

A. 25 m B. 45.33 m C. 66.67 m D. 84 m

Q7. Karan saw that the angle of elevation of the top of a tower is 30°. On moving 20 meters nearer, he observes that angle of elevation is 60°.Then the height of the tower is

A. 5m B. 10√3m C. 15√3m D. 20√3m

Q8. From a point P on a level ground, the angle of elevation of the top tower is 30^0. If the tower is 200 m high, the distance of point P from the foot of the tower is:

A. 50√2 m B. 100√3 m C. 200√3 m D. 400/√3m

Q9. The angle of elevation of a ladder leaning against a wall is 60° and the foot of the ladder is 7.5 m away from the wall. The length of the ladder is:

A. 15/√2m B. 15m C. 15√2m D. 30m

Q10. From the foot and the top of a building of height 230 m, Rajat observes the top of a tower with angles of elevation of b and a respectively. What is the distance between the top of these buildings [if tan(a) = 5/12 and tan(b) = 4/5]

A. 325 m B. 445 m C. 548 m D. 650 m

Q11. A man in a car is moving away from a hill (180 meters high), take 90 seconds to change angle of elevation of the top of the hill from 45° to 60°.The speed of the car is:

A. 1.46 m/sec B. 3 m/sec C. 4.2 m/sec D. 5.56 m/sec

Q12. When the sun's altitude changes from 30° to 60°, the length of the shadow of a tower decreases by 70m. What is the height of the tower?

A. 25 m B. 35√3 m C. 48√3 m D. 54 m

Q13. From top of a tower Ankit is observing a car speeding away from the tower. The car makes the angle of depression of 60° with the man's eye when at a distance of 75 meters from the tower. After 10 seconds the angle of depression becomes 45°. What is the approximate speed of the car?

A. 19.80 kmph B. 21.45 kmph C. 48.8 kmph D. 54 kmph

Q14. Abhilash observes from the top of a 15 metre high tower that it makes an angle of elevation of 60° with the bottom of an electronic pole and angle of elevation of 30° with the top of the same pole. What is the height of the electric pole?

A. 10 m B. 10√3 m C. 18 m D. 24√3 m

Q15. Two men are on opposite sides of a 50m high tower. If their angle of depression from the highest point of the tower as 30° and 45° respectively. Distance between them is:

A. 40(√3+1) m B. 50(√3+1) m C. 50√3 m D. 54 m

Q16. Ankita standing on the top of a building observes two objects. She observes that their angles of depression are 45° and 60° respectively. If the height of the building is 600 m, the distance between the objects will be equal to :

A. 254 m B. 245 m C. 248 m D. 354 m

Q17. The distance between two building is 90 m. The angle of depression trom the top of taller building which is 180 m tall to the top of the second is is 45^0.Then the height of the second is:

A. 30 m B. 60m C. 90 m D. 120 m

Q18. Sukanta standing on the top of a tower observes that a car is moving at a uniform speed coming directly towards it. If it takes 8 minutes for the angle of depression to change from 30° to 45°, in what time will the car reach the tower?

A. 10 min B. 11 min C. 12 min D. 14 min

Q19. Vishesh from the top of a 25 meter high building observes an angle of depression of bottom and top of an electric pole as 45^0 and 30^0 . The height of the electric pole.

A. 25/√3 B. 25 C. 25√3 D. 25((√3-1)/√3)

Q20. Arjun observes that a balloon rises vertically upward at uniform speed. At the end of 2minutes, He notices that elevation of the balloon is 60°. If he is standing at 150 m away from point balloon, what is the speed of the balloon?

A. 2.16m/s B. 4.5 m/s C. 4.8 m/s D. 5.45 m/s

Q21. Tripti is standing in the middle of two towers observes the angles of elevation of top of these two vertical towers as 45° and 60°.Then what is the ratio of the height of the towers?

A. √3:1 B. √3:2 C. 1:√3 D. 3:1

Q22. An aeroplane when 900 m high passes vertically above another aeroplane at an instant when their angles of elevation at same observing point are 60° and 45° respectively. Approximately, how many meters higher is the one than the other?

A. 381 m B. 445 m C. 548 m D. 654 m

Q23. Abhishek flying a kite at 12 noon with and observe that the shadow of kite is just 3m away from him then length of string is:

A. √2m B. 2√2m C. 3√2m D. 4√2m

Q24. I observe that the angle of elevation of the top of a tower is 30°. If I move 40m towards the tower, the angle of elevation of the top of the tower increases by 15°. Then what is my distance from the foot of the tower?

A. 25 m B. 45 m C. 48.8 m D. 54.6 m

Q25. Chandana standing on top of a hill observes that angle of depression of Ruby and Shikha are 45°and 30° while they are moving away from the hill if Ruby and Shikh are 200 m away,Find the height of hill.

A. 100 m B. 100(√3+1) m C. 200 m D. 200(√3+1) m

Q26. The angle of elevation of a supporting rod that supports electric pole is 60º and it is fixed to land at 12.4m away from the pole. The length of the supporting rod is:

A. 20.8 m B. 24.8 m C. 28.5 m D. 34.64 m

Q27. A vertical pole fixed to the ground is divided in the ratio 1:3 by a mark on it with lower part shorter than the upper part. If the two parts subtend equal angles at a place on the ground, 16 m away from the base of the pole, what is the height of the pole?

A. 10√2 B. 20√2 C. 32√2 D. 40√2

Q28. An observer 2 m tall is 10√3 m away from a tower. The angle of elevation from his eye to the top of the tower is 30^0. The height of the tower is:

A. 12m B. 14 m C. 18 m D. 25 m

Q29. Avinash having height of 1.4 m is 10√3 away from a lamp post. he observes that the angle of elevation from his eye to the light of the lamp post is 30°. Then heights of the lampost is:

A. 11.4 m B. 12.2 m C. 13.4 m D. 14.4 m

Q30. Two ships are sailing in the sea on the two sides of a building. The angle of elevation of the top of the building is observed from the ships are 30º and 45º respectively. If the building is 100 m high, the distance between the two ships is:

A. 235 m B. 273 m C. 348 m D. 354 m

Q31. A person, standing exactly midway between two towers, observes the top of the two towers at angle of elevation of 22.5° and 67.5°. What is the ratio of the height of the taller tower to the height of the shorter tower?

A. (3+2√2):1 B. 1: (3+2√2) C. 41:48 D. (3:2√2)

Q32. Annu uses a ladder of 10 m long just to reach the top of a wall and makes an angle of 60° with the wall.Find the distance of the Anuu while she is just starts to walk on ladder.

A. 6.35 m B. 8.65 m C. 12.8 m D. 15.4 m

Q33. Standing on a point P on ground, ruby observes the angle of elevation of the top of a tree as 60°. If the height of tree is 80m, then her distance from tree is:

A. 30√3 B. 40√3 C. 50√3 D. 60√3

Q34. The angles of depression and elevation of the top of a wall 11 m high from top and bottom of a tree are 60° and 30° respectively. What is the height of the tree?

A. 25 m B. 40 m C. 44 m D. 54 m

Q35. From a tower of 80 m high, the angle of depression of a bus is 30°. How far is the bus from the tower?

A. 120 m B. 125.45 m C. 138.4 m D. 154 m

Q36. Uttam and Vikrant standing opposite side of a 60 m high building, observes the angle of elevation of the top as 45° and 60° respectively. What is the distance between them?

A. 50.8 m B. 75.4 m C. 88 m D. 94.6 m

Q37. Two vertical poles are 200 m apart and the height of one is double that of the other. From the middle point of the line joining their feet, an observer finds the angular elevations of their tops to be complementary. Find the heights of the smaller pole.

A. 50 m B. 64.5 m C. 70.5 m D. 72.5 m

Q38. A vertical tower stands on ground and is surmounted by a vertical flagpole of height 18 m. At a point on the ground, the angle of elevation of the bottom and the top of the flagpole are 30° and 60° respectively. What is the height of the tower?

A. 5 m B. 9 m C. 12 m D. 15 m

Q39. Two persons are on either sides of a tower of height 50 m. The persons observers the top of the tower at an angle of elevation of 30° and 60°. If a car crosses these two persons in 10 seconds, what is the speed of the car?

A. 95 m B. 115 m C. 125 m D. NONE

Q40. Laxman standing outside his house, observes that the angles of elevation of the top and bottom of a window are 60° and 45° respectively. If his height of is 180 cm and he is 5 m away from the wall, what is the length of the window?

A. 3.65 m B. 4.45 m C. 5.48 m D. 6.54 m

This chapter contains the topics and questions I discussed and created in our classes or obtained from students as their doubts. All the questions noted, typed, redesigned and rectified by group of volunteers consisting of:

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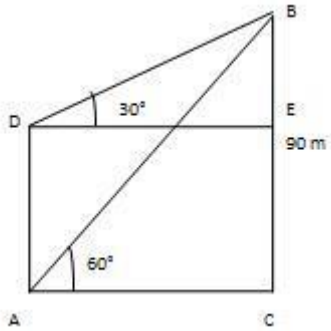
ANSWER

Q1.D	**Q2.D**	**Q3.B**	**Q4.B**	**Q5.C**
Q6.C	**Q7.B**	**Q8.C**	**Q9.A**	**Q10.D**
Q11.A	**Q12.B**	**Q13.A**	**Q14.A**	**Q15.B**
Q16.A	**Q17.C**	**Q18.B**	**Q19.D**	**Q20.A**
Q21.A	**Q22.A**	**Q23.C**	**Q24.D**	**Q25.B**
Q26B	**Q27.C**	**Q28.A**	**Q29.A**	**Q30.B**
Q31.A	**Q32.B**	**Q33.D**	**Q34.C**	**Q35.C**
Q36.D	**Q37.C**	**Q38.B**	**Q39.B**	**Q40.A**

ANSWER AND SOLUTION

Q1.D

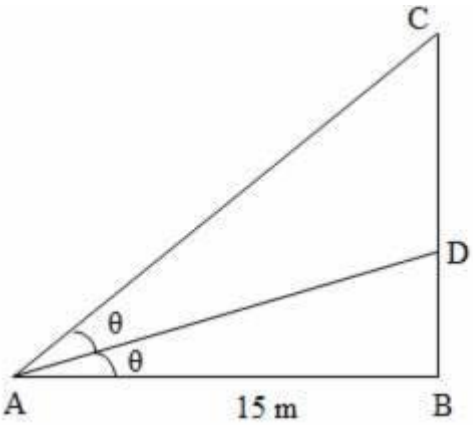
Q1 Solution:-



Let AD be the height of another building and CB be the main building of height 90 m. Draw DE || CA.
Then, ∠BDE=30°, ∠BAC=60°and AB= 90m.
From right △CAB, we have
CA/AB=cost60°=1/√3
=> CA/90=1/√3
⇨ CA=(90x1/√3x √3/√3)
=30 √3m.
∴ DE =CA=30/√3m.
From right angled △DEB, we have
BE/DE= tan30°=1/√3
=> BE/30 √3=1 √3
⇨ BE= (30 √3x1 √3) =30m.
∴ AD=CE= (CB-BE) = (90-30) m=60 m.
So, the tower's stature is 60 m.

Q2.D

Q2 Solution:-



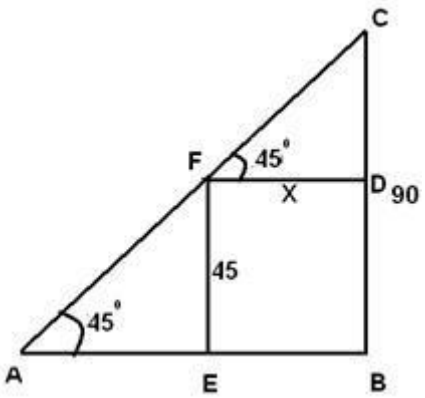
Let BC be the height of pillar and point D is supporting point it such that BD : DC = 1 : 9
And both supporting rods are fixed at A.
ATP:
Given that AB = 15 m
Let the the two parts subtend equal angles at point A such that
∠CAD = ∠BAD = θ
From "Angle Bisector Theorem", we have
BD/DC=AB/AC
=> 1/9=15/AC [∵ BD : DC = 1 : 9 and AB = 15(given)]
=> AC = 15 × 9 m (eq: 1)
From the right angled ΔABC,
$CB=\sqrt{(AC^2-AB^2)}$ (∵ Pythagorean theorem)
$=\sqrt{[(15\times9)^2-15^2]}$ (∵AC=15×9----------(i) and AB=15 m(given)]
$=\sqrt{15^2\times9^2-15^2}=\sqrt{15^2(9^2-1)}=\sqrt{15^2\times80}=\sqrt{(15^2\times16\times5)}=15\times4\times\sqrt{5}=60\sqrt{5}$ m

[In geometry, the **angle bisector theorem** is concerned with the relative lengths of the two segments that a triangle's side is divided into by a line that bisects the opposite angle. It equates their relative

lengths to the relative lengths of the other Two sides of the triangle]

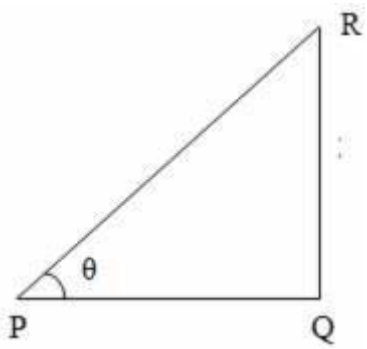
Q3.B

Q3 Solution:-



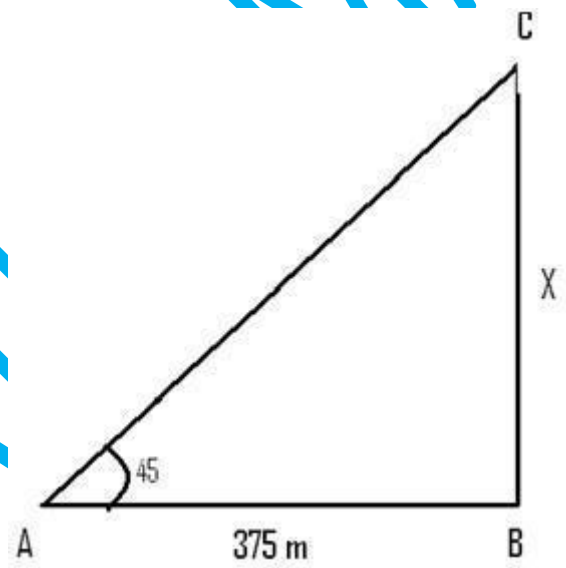
Let the distance between the towers be X
From the right angled triangle CFD
tan(45)= (90-45)/X
=> x=45 meters

Q4.B
Q4 Solution:-



Considering the above diagram let QR be the tree and PQ be its shadow
Then ATP, We have:
QR = PQ
Let QPR = θ
tanθ=QR/PQ=1
=> θ = 45°
i.e., required angle of elevation = 45°

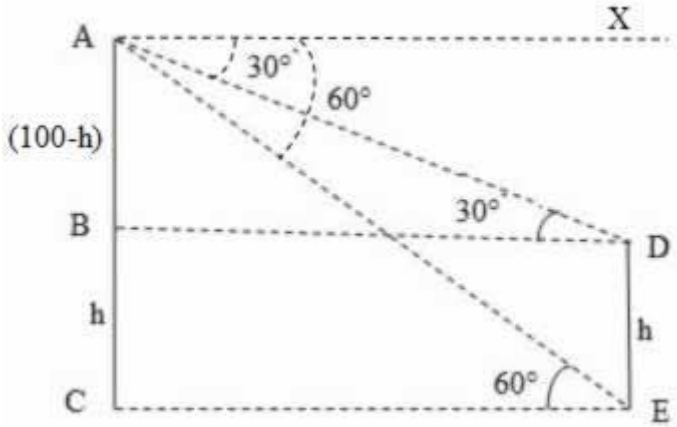
Q5.C
Q5 Solution:-



From the right angled triangle
tan(45°)= X/375
=> X = 375 m

Q6.C

Q6 Solution:-



Consider the diagram shown above. AC be the hill and DE be the pole

Given that AC = 100 m

∠XAD = ∠ADB = 30° (∵ AX BD)

∠XAE = ∠AEC = 60° (∵ AX CE)

Let DE = h

Then, BC = DE = h,

AB = (100-h) (∵ AC=100 and BC = h),

BD = CE

tan60°=AC/CE

=>√3=100/CE=>CE = 100/√3 (1)

tan30°=AB/BD

=>1/√3=(100−h)/BD

=>1√3=(100−h)/(100/√3) (∵ BD = CE and substituted the value of CE from equation 1)

=>(100−h)=1√3×100√3=100/3=33.33

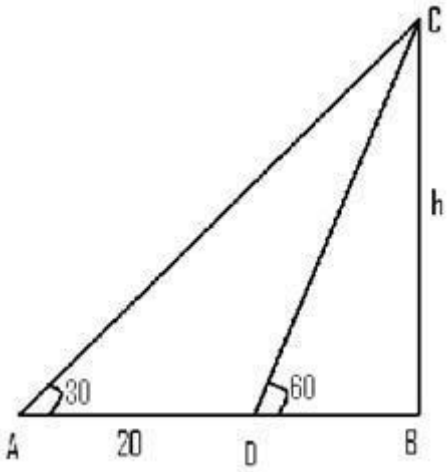
=>h=100−33.33=66.67 m

i.e., the height of the pole = 66.67 m

Q7.B

Q7 Solution:-

Drawing the figure as shown in figure and let h be the height of tower, Let A be his initial position and D be his final position So, AD=20 m



From triangle ABC

$AB/CB = \cot 30^0$

=> $AB/h = \sqrt{3}$

$AB = h\sqrt{3}$

From triangle CBD

$BD/CB = \cot 60^0$

$BD/h = 1/\sqrt{3}$

=> $BD = h/\sqrt{3}$

From figure. We have:

$AB - BD = 20$

$20 = h(\cot 30 - \cot 60)$

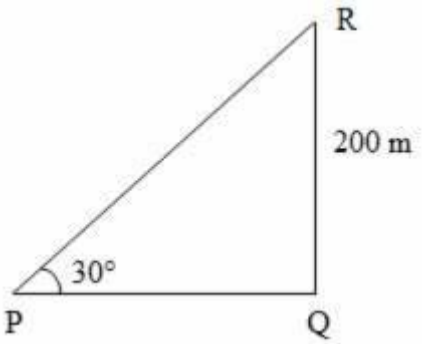
$20 = h(\sqrt{3} - 1/\sqrt{3})$

=> $20\sqrt{3} = h(3-1)$

=> $h = 10\sqrt{3}$ m

Q8.C

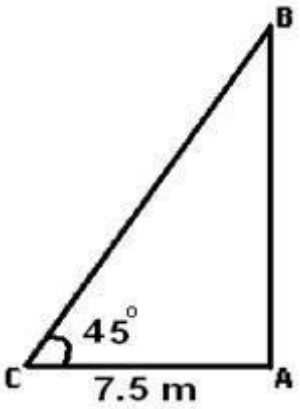
Q8. Solution:-



$\tan 30° = RQ/PQ$

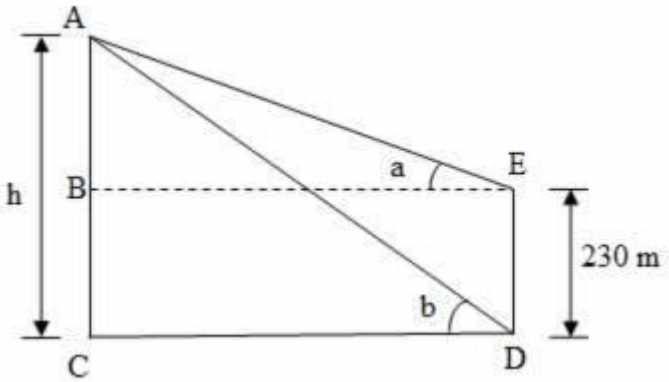
$1\sqrt{3} = 200/PQ = 200\sqrt{3}$

Q9.A
Q9 Solution:-



Let AB be the wall and BC be the ladder.
Then, ∠ACB = 45° and AC = 7.5 m
AC/BC= Cos (45) =1/√2
BC=15/√2

Q10.D
Q10 Solution:-



Let ED be the building and AC be the tower.
Given that ED = 230 m, ∠ADC = b, AEB = a
Also given that tan a = 5/12 and tan b = 4/5
Let AC = h
Required Distance = Distance between the top of these buildings = AE
From the right angled ΔABE,
tan(a)=AB/BE
=> 5/12=(h-230)/BE [∵ tan(a)=5/12(given), AB = (AC-BC) = (AC-ED) = (h-230)]
=> BE =12(h-230)/5 ----------(i)
From the right angled ΔACD,
tan(b)=AC/CD
=> 4/5=h/CD [∵ tan(b) = 4/5(given), AC=h]
=> CD =5h/4 ----------(ii)
From the diagram, BE = CD
=> 12(h-230)/5=5h/4
=> (from equation (i) and equation (ii))

=> 48h−(4×12×230)=25h=>23h=(4×12×230)

=> h=(4×12×230)/23=480 m ----------(iii)

AB = (AC - BC)

= (480 - 230) [∵ Since AC=h=480(from equation (iii)) and BC=ED=230 m(given)]

= 250 m

In the triangle ABE, tan(a) = 5/12. Let's figure out the value of sin(a) now.

Consider a triangle with opposite side = 5 and adjacent side = 12 such that tan(a) = 5/12

hypotenuse =$\sqrt{(5^2+12^2)}$=13

i.e., sin(a) =opposite sidehypotenuse=513

We have seen that sin(a) = 5/13

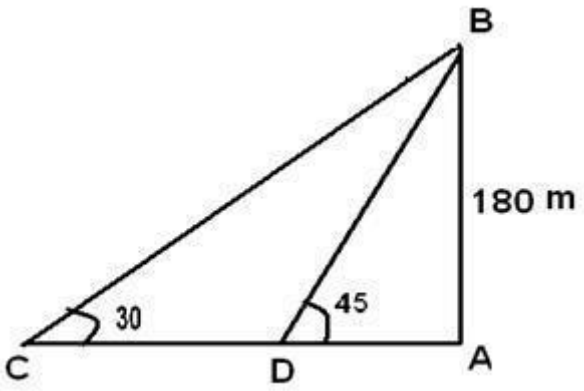
=> AB/AE=5/13

=> AE = AB×13/5=250×13/5=650 m

i.e., Distance between the top of the buildings = 650 m

Q11.A

Solution:-



From right angled triangle ADB,

Tan45=AB/AD =>AB=AD=180

From right angled triangle ACB,

Tan 30=180/(CD+180)

=> CD+180=180√3

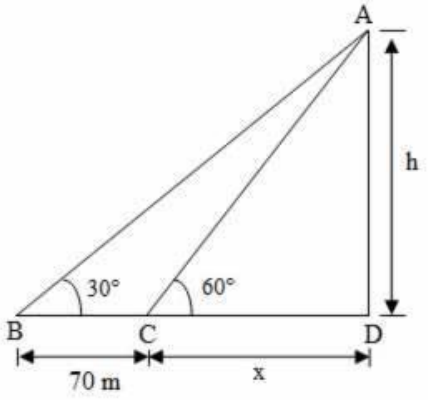
=> CD=180(√3-1)

Speed =Distance/Time=180(√3-1)/90=2(√3-1) =2(1.732 -1)m/sec = 2x0.732=1.46 m/sec

Q12.B

Q12 Solution:-

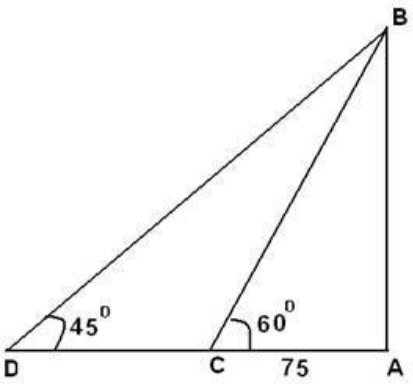
Let AD be the tower, BD be the initial shadow and CD be the final shadow.



Given that BC = 70 m, ABD = 30°, ACD = 60°,
Let CD = x, AD = h
From the right angled ΔCDA,
tan60°=AD/CD
√3=h/x ----------(i)
From the right angled ΔBDA,
tan30°=AD/BD
1/√3=h/(70+x) ----------(ii)
equation (i)equation (ii)
=>√3(1/√3)=(h/x)[h/(70+x)]
=>3=(70+x)/x=>2x=70
=>x=35
Substituting this value of x in equation (i), we have
√3=h/35=>h=35√3

Q13.A

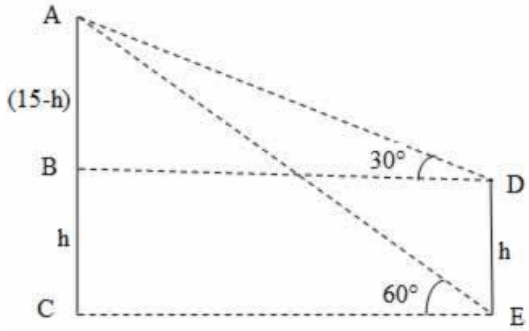
Q13 Solution:-



Let AB be the tower and C and D be the positions of the car.
Distance travelled by car = CD
From the figure 75tan(60)=(75+CD)tan(45)
=> 75√3 = 75+CD
=> CD =(75√3 – 75) =75(√3 – 1)= 55 m
Speed = distance/time=55/10
= 5.5 m/sec=19.8 kmph

Q14.A

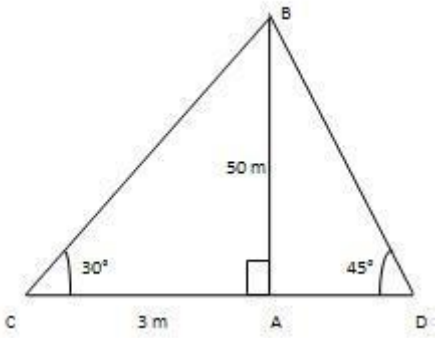
Q14 Solution:-



Consider the diagram shown above. AC be the tower and DE be the pole.
Given that AC = 15 m, ADB = 30°, AEC = 60°
Let DE = h
Then, BC = DE = h,
AB = (15-h) (∵ AC=15 and BC = h),
BD = CE
tan60°=AC/CE
=> √3=15/CE
=> CE = 15/√3 (1) tan30°=ABBD=>1√3=15−h/BD
=> 1√3=(15−h)/(15√3) (∵ BD = CE and substituted the value of CE from equation 1)
=> (15−h)=1/√3×15/√3=15/3=5
=> h=15−5=10 m
i.e., height of the electric pole = 10 m

Q15.B

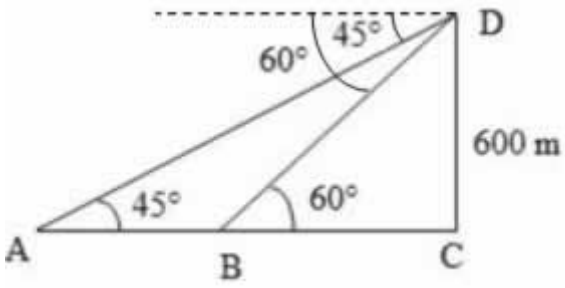
Q15 Solution:-



Let AB be the tower and let C and D be the positions of both man.
At that point ∠ACB=30°,∠ADB= 45°and AB= 50 m
AC/AB = Cot30°=√3 => AC/50 = √3
=>AC=50√3m
AD/AB=cot 45°=1 => AD/50=1
=> AD=50M.
distance between the two men =CD= (AC+AD)
= (50√3+50) m=50(√3+1)

Q16.A

Q16 Solution:-

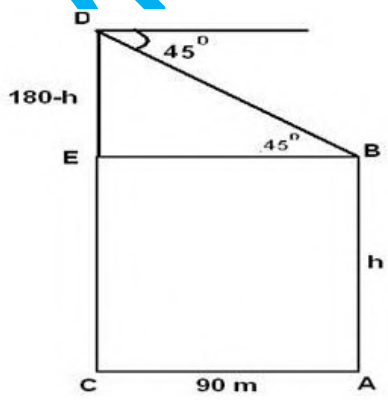


Let DC be the tower and A and B be the objects as shown above.
Given that DC = 600 m , DAC = 45°, DBC = 60°
tan 60°=DC/BC
√3=600/BC
BC= 600/√3 (1)
tan 45°=DC/AC
1=600/AC
AC= 600 (2)
Distance between the objects
= AB = (AC - BC)
=600−600/√3 [∵ from (1) and (2)]
=600(1−1/√3)=600[(√3−1)/√3]=600[(√3−1)/√3)×√3/√3=200(3−√3)=200(3−1.732) ≅254

Q17.C

Q17 Solution:-

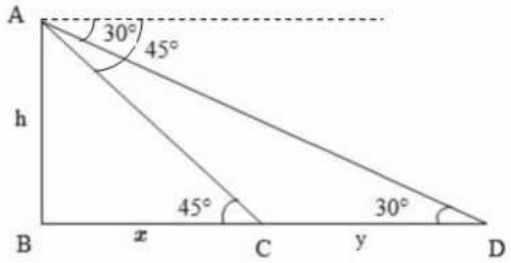
refer the given figure:



AB= CE
let AB be h then CE is h since CD is 180 so ED is 180-h
In triangle BED
=> (180-h)/90 = tan(45)=1
=> 180 - h =90 m
=> h =90 m

Q18.B

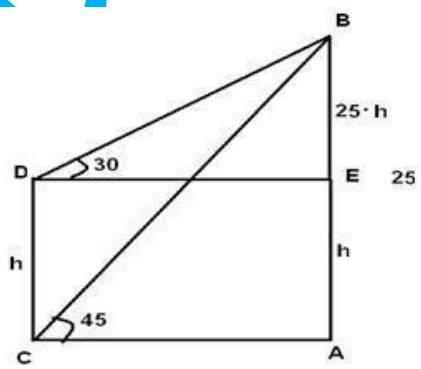
Q18 Solution:-



Consider the diagram shown above. Let AB be the tower. Let D and C be the positions of the car.
Then, ADC = 30° , ACB = 45°
Let AB = h, BC = x, CD = y
tan45°=AB/BC=hx=>1=hx=>h=x (1)
tan30°=AB/BD=AB/(BC + CD)=h/(x+y)
=> 1/√3=h/(x+y)
=> x + y = √3h
=> y = √3h – x
=> y = √3h−h (∵ Substituted the value of x from equation 1)
=> y = h(√3−1)
Given that distance y is covered in 8 minutes.
i.e, distance h(√3−1) is covered in 8 minutes.
Time to travel distance x
= Time to travel distance h (∵ Since x = h as per equation 1).
Let distance h is covered in t minutes.
=> h(√3−1)/h=8/t
=> (√3−1)=8/t
=> t=8/(√3−1)=8/(1.73−1)=8/0.73=800/73 minutes≈11 minutes

Q19.D

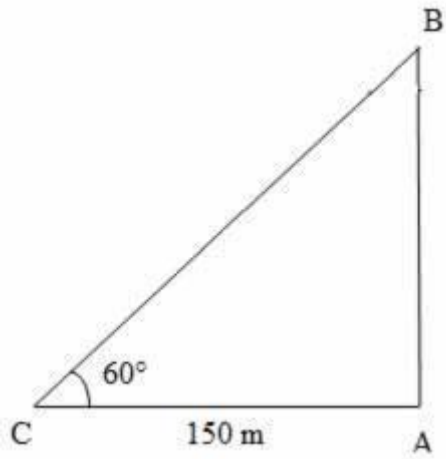
Q19 Solution:-



Let AB be the building with B as top and CD be the electric pole.
From the figure CA = DE
=> 25/(tan(45))=(25-h)/(tan(30))
=> 25tan(30) = [25-h](1) [As $\tan 45^0 = 1$]
=> h=25-25tan(30)= 25(1- tan(30)) = 25((√3-1)/√3)

Q20.A

Q20 Solution:-



Let C be the position of John. Let A be the position at which balloon leaves the earth and B be the position of the balloon after 2 minutes.

Given that CA = 150 m, ∠BCA = 60°

tan60°=BA/CA

√3=BA/150

BA=150√3

i.e, the distance travelled by the balloon =150√3 meters

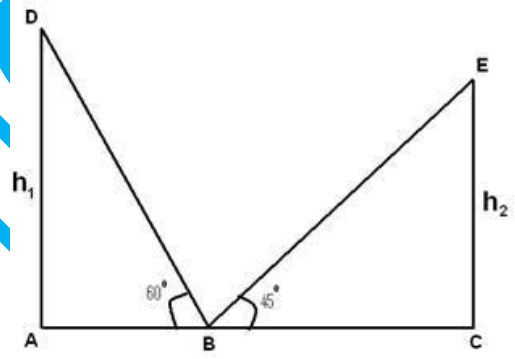
time taken = 2 min = 2 × 60 = 120 seconds

Speed =Distance/Time

=150√3/120=1.25√3=1.25×1.73=2.16 meter/second

Q21.A

Q21 Solution:-



Let h1 and h2 be the heights of two towers as seen in the figure

then ATP:

tan(60)=h1/AB [From the triangle ABD]

=> h1/AB=√3

=> AB=h1/√3

tan(45)=h1/BC [From the triangle BCE]

=> h2=BC=AB [as B is th middle point of AC]

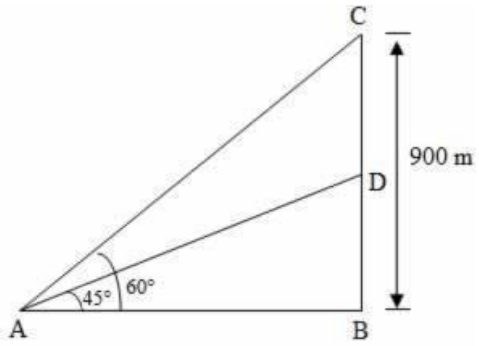
comparing we get

h1/ h2=√3/1

=> h1:h2=√3:1

Q22.A

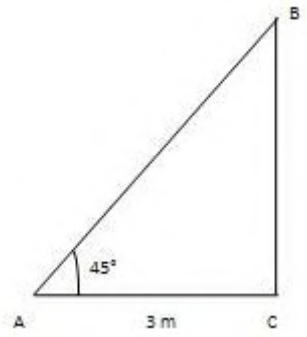
Q22 Solution:-



Let C and D be the position of the aeroplanes.
Given that CB = 900 m, ∠CAB = 60°, ∠DAB = 45°
From the right angled ΔABC,
tan60°=CB/AB
√3=900/AB
AB=900/√3=900×√3/(√3×√3)=900√3/3=300√3
From the right angled ΔABD,
tan45°=DB/AB
1=DB/AB
DB=AB=300√3
Required height
= CD = (CB-DB)
=(900−300√3)=(900−300×1.73)=(900−519)=381 m

Q23.C

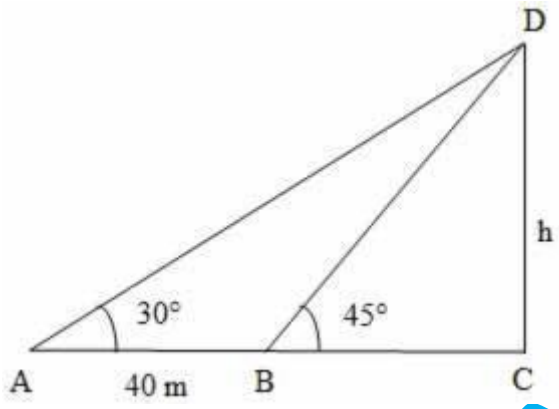
Solution:-



At 12 noon shadow of any object falls just below it
Let AB be the string and BC and let AC be the distance of shadow frm him
Then, ∠CAB=45^0 and AC=3m. Let AB= x Meter.
From right Δ ACB, we have
AB/AC =sec. 45° = √2 => x/3 = √2
X= 3√2m .
∴ Length of the string stool is 3√2m

Q24.D

Q24 Solution:-



Let DC be the tower and A and B be the positions of the observer such that AB = 40 m

We have ∠DAC = 30°, ∠DBC = 45°

Let DC = h

$\tan 30° = DC/AC$

$\Rightarrow 1\sqrt{3} = h/AC$

$\Rightarrow AC = h\sqrt{3}$ ----------(i)

$\tan 45° = DC/BC$

$\Rightarrow 1 = h/BC$

$\Rightarrow BC = h$ ----------(ii)

We know that, AB = (AC - BC)

$\Rightarrow 40 = (AC - BC)$

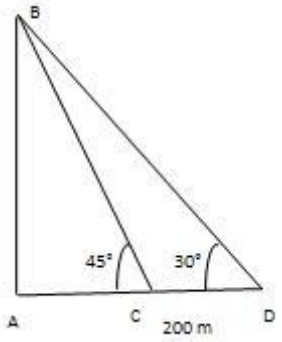
$\Rightarrow 40 = (h\sqrt{3} - h)$ [∵ from (i) and (ii)]

$\Rightarrow 40 = h(\sqrt{3}-1) = 40/(\sqrt{3}-1)\times(\sqrt{3}+1)/(\sqrt{3}+1)$

$= 40(\sqrt{3}+1)/2 = 20(\sqrt{3}+1) = 20(1.73+1) = 20\times 2.73 = 54.6$m

Q25.B

Q25 Solution:-



Let AB be the height of hill and C and D be the positions of Ruby and Shikha

So, ATP:

CD=200m.

∠ABC=45°and ∠ADB=30°. Let height of hill be h

Considering triangle ΔABC

we get $AB/AC = \tan 45° = 1$

$\Rightarrow AB = AC = x$ m.

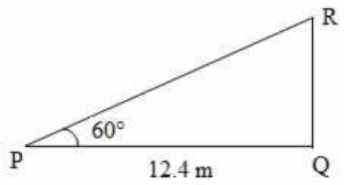
Considering triangle ABD

$AB/AD = \tan 30° = 1/\sqrt{3}$

$h/(h+200) = 1\sqrt{3}$

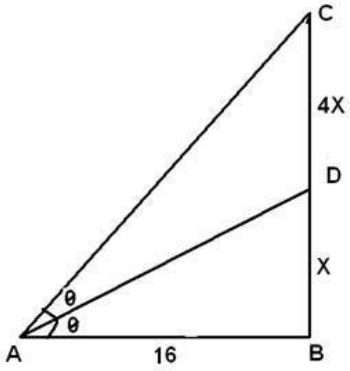
=> $\sqrt{3}h=h+200$
=> $(\sqrt{3}-1)h=200$
=> $h=200/\sqrt{3}-1)x(\sqrt{3}+1/(\sqrt{3}+1)=100(\sqrt{3}+1)$

Q26B
Q26 Solution:-



Consider the diagram shown above where PR be the ladder and RQ be the wall.
$\cos 60° = PQ/PR$
$\frac{1}{2}=12.4/PR$
$PR=2\times12.4=24.8$ m

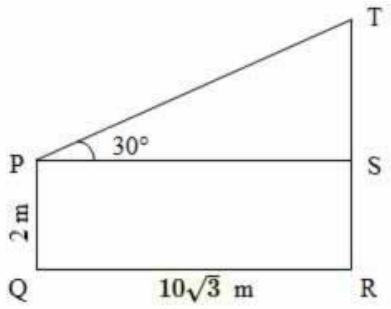
Q27.C
Q27 Solution:-



Let CB be the pole and point D divides it such that BD : DC = 1 : 4 = X:4X
Given that AB = 16 m
Let the the two parts subtend equal angles at point A such that
CAD = BAD = θ
=> $\tan\theta = X/16$ [considering triangle ABD]
=> $X=16\tan\theta$ ---------- (i)
=> $\tan(\theta+\theta)=4X/16$ [considering triangle ΔABC]
=> $16\tan(2\theta)=4X$
=> $16[2\tan(\theta)]/(1-\tan^2\theta)=4X$ ---------- (ii)
From equation (i) and (ii) :
$2X/(1-\tan^2\theta)=4X$ [As $X=16\tan\theta$)
$1/[1-(X/16)^2]=2$
$1-(X/16)^2=1/2$
$X^2=16^2/2$
=> $X^2=128$
=> $X=8\sqrt{2}$ m
=> Height of pole BC = $4X=5X=32\sqrt{2}$ m

Q28.A

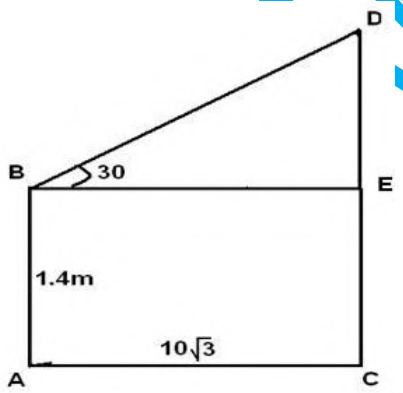
Q28 Solution:-



SR = PQ = 2 m
PS = QR =10√3 m
tan30°=TS/PS
1/√3=TS/10√3=10 m
TR = TS + SR = 10 + 2 = 12 m

Q29.A

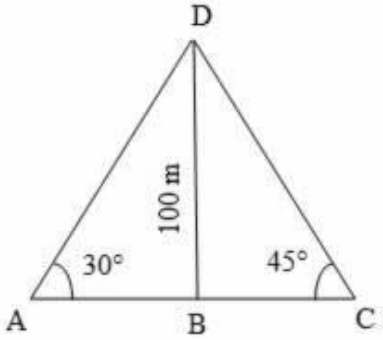
Q29 Solution:-



Let AB be the Avinash and CD be the height of lamp post.
Then, ATP.
CE = AB = 1.4 m,
BE = AC = 10√3 m.
DE/BE=tan (30) =1/√3
DE=10√3/√3=10
CD=CE+DE=1.4+10=11.4 m
So height of lamp post will be 11.4m.

Q30.B

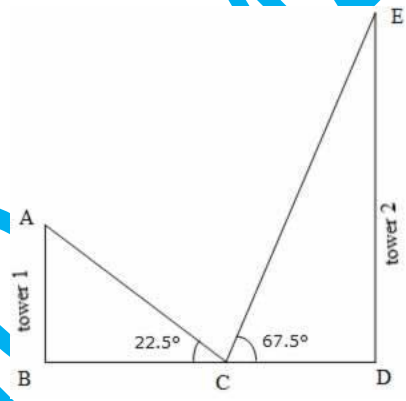
Q30 Solution:-



Let BD be the building and A and C be the positions of the ships.
Then, BD = 100 m, ∠BAD = 30° , ∠BCD = 45°
tan30°=BD/BA=>1√3=100/BA=>BA=100√3
tan45°=BD/BC=>1=100/BC=>BC=100 Distance between the two ships
= AC = BA + BC
=100√3+100=100(√3+1)
= 100(1.73+1) = 273 m

Q31.A

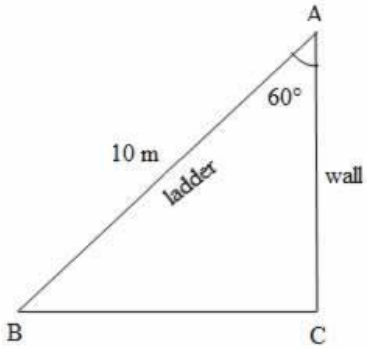
Q31 Solution:-



Let ED be the taller tower and AB be the shorter tower.
Let C be the point of observation.
Given that ACB = 22.5° and DCE = 67.5°
Given that C is the midpoint of BD.
So, BC = CD
From the right angled ΔABC,
tan22.5°=AB/BC ----------(i)
From the right angled ΔCDE,
tan67.5°=ED/CD ----------(ii)
=> tan67.5°/tan22.5°=(ED/CD)(AB/BC)=ED/AB (∵ CD=BC)
=> tan(90°−22.5°)/tan22.5°=ED/AB
=> cot22.5°tan22.5°=ED/AB [∵ tan(90-θ)=cot θ]
=> (1/tan22.5°)/tan22.5°=ED/AB [∵cotθ=1tanθ]
=> ED/AB=1/(tan22.5°)^2=1/(√2−1)^2= (3+2√2)
Required ratio = ED : AB
=(3+2√2):1

Q32.B

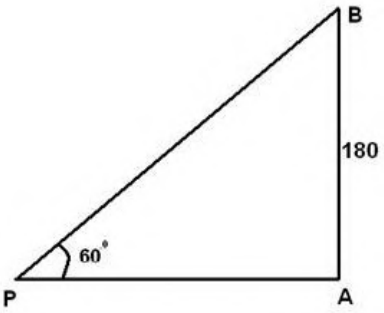
Q32 Solution:-



Let BA be the ladder and AC be the wall as shown above.
Then the distance of the foot of the ladder from the wall = BC
Given that BA = 10 m , BAC = 60°
$\sin 60° = BC/BA$
$\sqrt{3}/2 = BC/10$
$BC = 10 \times \sqrt{3}/2 = 5 \times 1.73 = 8.65$ m

Q33.D

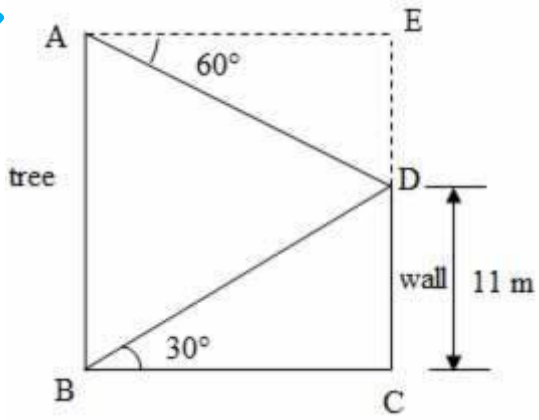
Q33 Solution:-



From $\angle APB = 60°$ and AB = 180 m.
$AB/AP = \tan 60° = \sqrt{3}$
$AP = AB/\sqrt{3} = 180/\sqrt{3} = 60\sqrt{3}$

Q34.C

Q34 Solution:-



Let DC be the wall, AB be the tree.
Given that $\angle DBC = 30°$, $DAE = 60°$, DC = 11 m

We have:

tan 30°=DC/BC

1/√3=11/BC

BC = 11√3 m

AE = BC =11√3 m

Again We have:

tan60°=ED/AE

√3=ED/11√3 [∵ Substituted value of AE from (1)]

ED =11√3×√3=11×3=33

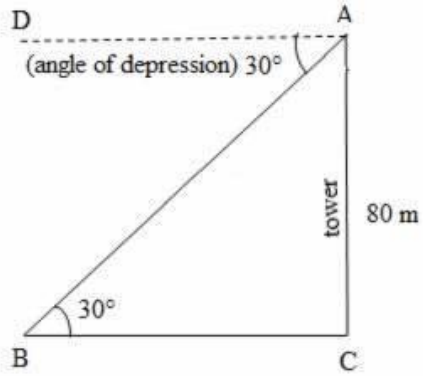
Height of the tree

= AB = EC = (ED + DC)

= (33 + 11) = 44 m

Q35.C

Q35 Solution:-



Let AC be the tower and B be the position of the bus.

Then BC = the distance of the bus from the foot of the tower.

Given that height of the tower, AC = 80 m and the angle of depression, DAB = 30°

ABC = DAB = 30° (because DA BC)

tan30°=AC/BC

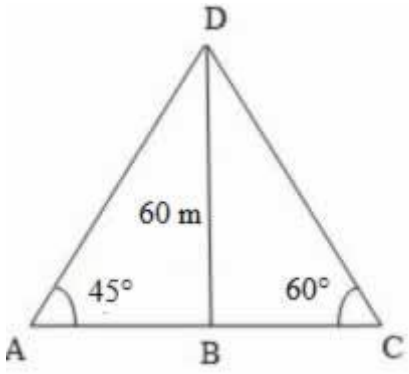
=> tan30°=80/BC

=> BC = 80/tan30°=80/(1√3)=80×1.73=138.4 m i.e.,

So, Distance of the bus from the foot of the tower = 138.4 m

Q36.D

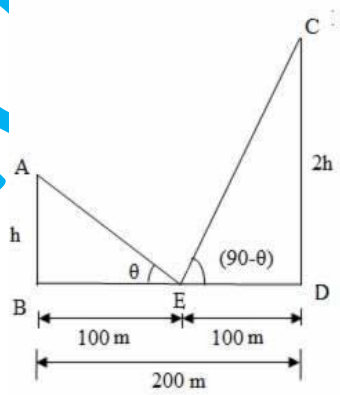
Q36 Solution:-



Let BD be the building and A and C be the two position of Uttam and Vikrant.
Then, BD, the height of the building = 60 m
∠BAD = 45° , ∠BCD = 60°
tan45°=BD/BA
=> 1=60/BA
=> BA=60 m (1)
tan60°=BD/BC
=> √3=60/BC
=> BC=60/√3=60×√3/(√3×√3)=60√3/3=20√3=20×1.73=34.6 m (2)
Distance between the two points A and C
= AC = BA + BC
= 60 + 34.6 [∵ Substituted value of BA and BC from (1) and (2)]
= 94.6 m

Q37.C

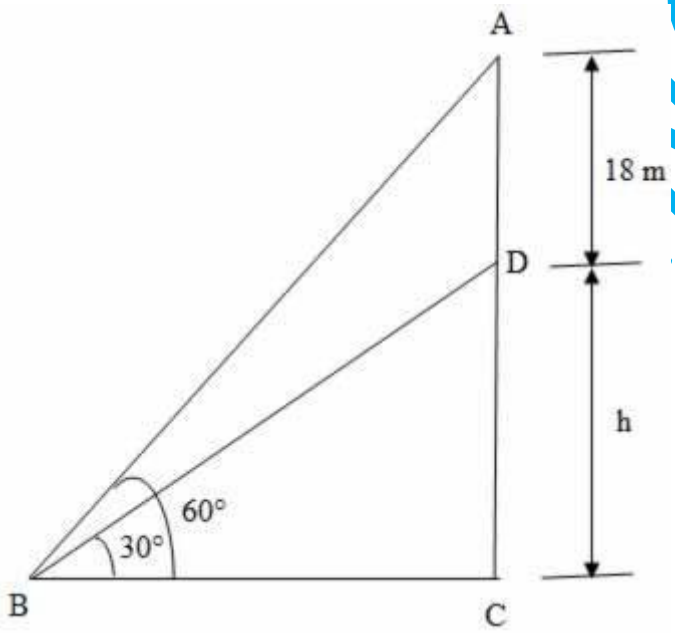
Q37 Solution:-



Let AB and CD be the poles with heights h and 2h respectively.
Given that distance between the poles, BD = 200 m
Let E be the middle point of BD,
∠AEB = θ
∠CED = (90-θ) (∵ given that angular elevations are complementary)
Since E is the middle point of BD, we have BE = ED = 100 m
From the right angled ΔABE,
tanθ=AB/BE
tanθ=h/100
h = 100tanθ ----------(i)
From the right angled ΔEDC,

tan(90−θ)=CD/ED
cotθ=2h/100 [∵tan(90−θ)=cotθ]
2h=100cotθ ----------(ii)
From equation (i) and (ii)
=> $2h^2=100^2$ [∵tanθ×cotθ=tanθ×1tanθ=1]
=> √2h=100
=> h=100√2m=100×√2√2×√2m=50√2m=50×1.41m=70.5m
=> 2h=2×70.5=141
i.e., the height of the poles are 70.5 m and 141 m.

Q38.B
Q38 Solution:-

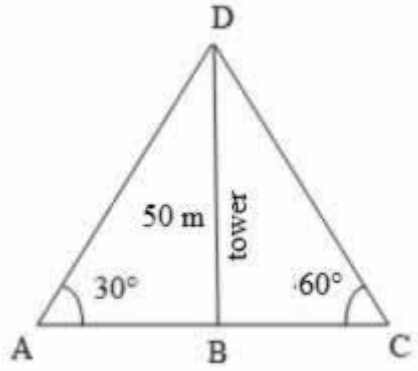


Let DC be the vertical tower and AD be the vertical flagpole. Let B be the point of observation.
Given that AD = 18 m, ABC = 60°, DBC = 30°
Let DC be h.
tan30°=DC/BC
1/√3=h/BC
h=BC/√3 (1)
tan60°=AC/BC
√3=(18+h)/BC
18+h=BC×√3 (2)
(1)/(2) =>h/(18+h)=(BC/√3)(BC×√3)=1/3
=>3h=18+h
=>2h=18=>
h=9 m
i.e., the height of the tower = 9 m

Q39.B

Q39. Solution:-

ATP we get following figure



where BD be the tower and A and C be the positions of the persons.

Given that BD = 50 m, ∠BAD = 30°, ∠BCD = 60°

From the right angled ΔABD,

tan 30° = BD/BA

=> 1/√3=50/BA

=> BA=50√3

From the right angled ΔCBD,

tan 60° = BD/BC

=> √3=50/BC

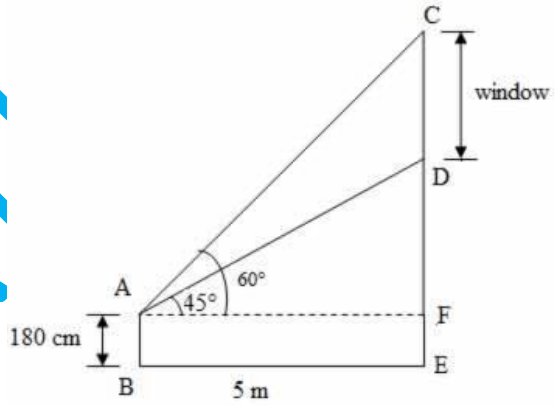
=> BC=50/√3=50×√3/(√3×√3)=50√3/3

So, The distance between the two persons

= AC = BA + BC = 50√3 + 50√3/3 = 50√3(1 + 1/3)= 50√3x4/3=200/√3 = 115 approx

Q40.A

Q40 Solution:-



Let AB be the Laxman and CD be the window

Given that the height of the man, AB = 180 cm, the distance between the man and the wall, BE = 5 m,

DAF = 45° ,∠CAF = 60°

From the diagram, AF = BE = 5 m

From the right angled ΔAFD,

tan45° =DF/AF

=> 1=DF/5

=> DF = 5m

From the right angled ΔAFC,

tan60°=CF/AF

=> √3=CF/5

=> CF=5√3

Length of the window

= CD = (CF - DF)

=5√3−5 [∵ Substituted the value of CF and DF from (1) and (2)]

=5(√3−1)=5(1.73−1)=5×0.73=3.65 m=5(3−1)=5(1.73−1)=5×0.73=3.65 m

"Life is very interesting. In the end, some of your greatest pains become your greatest strengths." —*Drew Barrymore*

TRIANGLE

IMPORTANT FORMULAE:

1. Area of a triangle = 1/2 × Base × Height = 1/2 × b × h

2. Area of a triangle = $\sqrt{s(s-a)(s-b)(s-c)}$

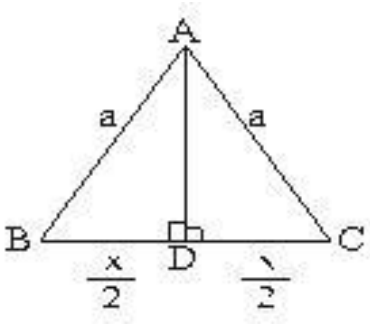
[Where s = $\frac{a+b+c}{2}$ and a, b, c are the corresponding sides of the △]

(1) Right Angled Triangle:

Let be a right angled triangle in which, then

(i) Perimeter = AB + BC + AC
(ii) Area = 1/2 × Base × Height
(iii) AC^2 = $AB^2 + BC^2$ (Pythagoras Theorem)

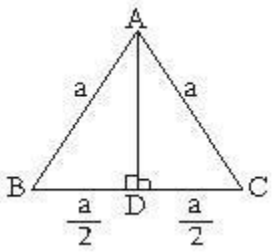
(2) Isosceles Triangle:



Let be an isosceles triangle in which AB = AC = *a* and BC = *x*. Let then,

(i) Perimeter = AB + BC + AC = $2a + x$
(ii) Area = 1/2 × Base × Height

3. Equilateral Triangle:



Let be an equilateral triangle in which

AB = BC = AC = a

(i) Perimeter = 3a

(ii)	Altitude	=
(iii)	Area	=

HERON'S FORMULA:

Heron was born in about 10AD in Alexandria in Egypt. His work on mathematical and physical subjects is so numerous and varied that he is considered to be an encyclopedia writer in these field. His geometrical work deals largely with problems on mensuration.

The formula given by Heron is a famous formula for calculating area of a triangle in terms of its three sides.

Let *a*, *b* and *c* are the sides of the triangle and *s* is semi perimeter i.e. $s = \frac{a + b + c}{2}$

$$\text{Area of triangle} = \sqrt{s(s-a)(s-b)(s-c)}$$

This formula can be used for any triangle to calculate its area and it is very useful where it not possible to find the height of the triangle easily.

Theorem: Two triangles on the same base (or equal bases) and in between the same parallels are equal in area.

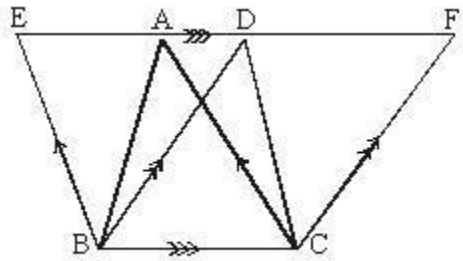


Fig.4

Here, ar(△ABC) = ar(△DBC)

Theorem: The area of a triangle is half the product of its base (or any side) and the corresponding altitude (or height).

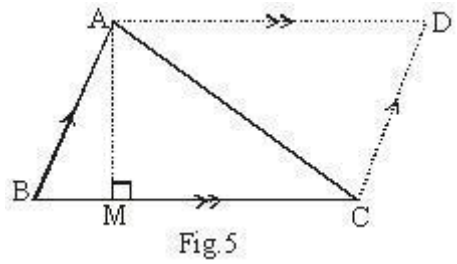
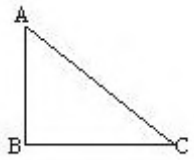


Fig.5

Here, area(ABC) = 1/2 × base × height.

Perimeter and Area of different types of triangles:



----------**EXERCISE**----------

Q1. The ratio of sides of a triangle is 3 : 4 : 5 and it's area is 72 sq. units. Then what will be the area of an equilateral triangle that have perimeter equal to first triangle?

A. 14sq.unit B. 16sq.unit C. 32√3sq.unit D. 48√3sq.unit

Q2. A regular hexagon is formed by cutting the corners of sides of an equilateral triangle of side 6 cm.The area of this hexagon will be,

A. $6\sqrt{6}$ cm^2 B. $8\sqrt{3}$ cm^2 C. $6\sqrt{3}$ cm^2 D. None

Q3. Through each vertex of a triangle, a line parallel to the opposite side is drawn. The ratio of the perimeter of the new triangle thus formed with the original triangle is,

A. 3:1 B. 2:1 C. 3:2 D. None

Q4. From a point in the interior of an equilateral triangle, the perpendicular distances of the sides are, √3 cm, 2√3 cm and 5√3 cm. The perimeter (in cm) of the triangle is,

A. 48 B. 51 C. 57 D. 63

Q5. In two triangles, the ratio of the areas is 4 : 3 and the ratio of their heights is 3 : 4. Find the ratio of their bases.

A. 16 : 9 B. 17 : 9 C. 19 : 9 D. 26 : 9

Q6. If area of an equilateral triangle is A and its height is b, the value of b^2/A is,

A. 1 B. $\sqrt{3}$cm^2 C. $2\sqrt{3}$cm^2 D. None

Q7. The base of a right pyramid is an equilateral triangle of side $10\sqrt{3}$ cm. If the total surface area of the pyramid is $270\sqrt{3}$ sq cm, its height is,

A. 10. B. 11. C. 12. D. 13

Q8. The length of perpendiculars drawn from a point in the interior of an equilateral triangle to the respective sides are p_1, p_2 and p_3. The length of each side of the triangle is then.

A. $(1/\sqrt{3})(p_1+p_2+p_3)$ B. $(2/\sqrt{3})(p_1+p_2+p_3)$
C. $(4/\sqrt{3})(p_1+p_2+p_3)$ D. $(8/\sqrt{3})(p_1+p_2+p_3)$

Q9. What will be the effect on its area of a triangle if it's height is decreased by 40% and it's base is increased by 40%.?

A No change B 8% decrease C 16% decrease D 16%increase

Q10. If the height of an equilateral triangle is √6cm. Then It's area will be:

A $3\sqrt{3}$ sq. cm. B $2\sqrt{3}$ sq. cm. C $2\sqrt{2}$ sq. cm. D $6\sqrt{2}$ sq. cm.

Q11. The lengths of three medians of a triangle are 9 cm, 12 cm and 15 cm. The area (in sq.cm.) of the triangle is,

A. 72 B. 83 C. 94 D. None

Q12. The area of a triangle of side lengths 9 cm, 10 cm and 11 cm (in cm^2) is,

A. $30\sqrt{2}$ B. $30\sqrt{3}$ C. $60\sqrt{2}$ D. $60\sqrt{3}$

Q13. Find the area of a triangle whose sides measure 13 cm, 14 cm and 15 cm.

A. 81 cm^2 B. 84 cm^2 C. 88 cm^2 D. 96 cm^2

Q14. Find the area of a right-angled triangle whose base is 12 cm and hypotenuse is 13cm.

A. 30 cm^2 B. 40 cm^2 C. 50 cm^2 D. 60 cm^2

Q15. The altitude drawn to the base of an isosceles triangle is 8 cm and the perimeter is 32 cm. Find the area of the triangle.BDC

A. 41 cm^2 B. 45 cm^2 C. 54 cm^2 D. 60 cm^2

Q16. Find the length of the altitude of an equilateral triangle of side $3\sqrt{3}$ cm.

A. 1.5cm B. 4.5cm C. 6.9cm D. 9cm.

This chapter contains the topics and questions I discussed and created in our classes or obtained from students as their doubts. All the questions noted, typed, redesigned and rectified by group of volunteers consisting of:

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----------ANSWER----------

Q1.D	**Q2.C**	**Q3.B**	**Q4.A**	**Q5.A**
Q6.B	**Q7.C**	**Q8.B**	**Q9.C**	**Q10.B**
Q11.A	**Q12.A**	**Q13.B**	**Q14.A**	**Q15.D**
Q16.B				

----------ANSWER AND SOLUTIONS----------

Q1.D

Q1 Solution:-

Let the side be 3x:4x:5x. By the amounts it is obvious that the triangle is a right triangle, $(5x)^2=(3x)^2+(4x)^2$.

Its area is then,

$\frac{1}{2}.4.3x^2=72$ square units,

Or, $x^2=12$ square units,

Or, $x=2\sqrt{3}$ unit.

So Perimeter of the triangle $=(3x+4x+5x)=12x=12X2\sqrt{3}=24\sqrt{3}$ unit.

Let the side of required equilateral triangle be a,

Then ATP,

$3a = 24\sqrt{3}$,

Or, $a = 8\sqrt{3}$ unit.

The area of the equilateral triangle is$=\sqrt{3}/4a^2$

So, $A=(\sqrt{3}/4)(8\sqrt{3})^2=(\sqrt{3}/4)X64X3=48\sqrt{3}$ square units.

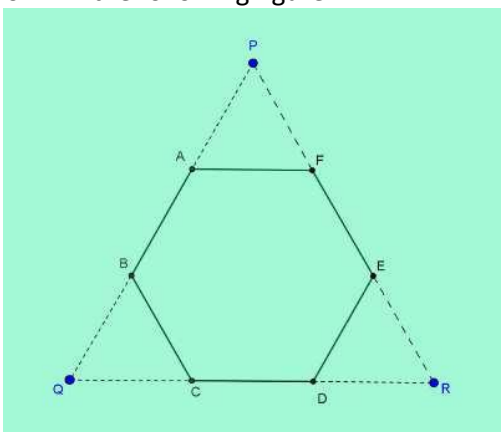
Q2.C

Q2 Solution:-

For given length a, the area of the triangle $= (\sqrt{3}/4).a^2$.

If length of side of larger triangle is 6, then length of side of smaller triangle will be 6/3=2.

The area of the hexagon will be area of the larger triangle minus three times the area of the smaller triangle, As shown in the following figure:



Let area of bigger triangle be A and smaller triangle be A_s and area of hexagon be A_h

So, $A_h = A-3A_s$

$=\sqrt{3}/4.6^2 - 3.(\sqrt{3}/4)2^2$

$=9\sqrt{3} - 3\sqrt{3}$

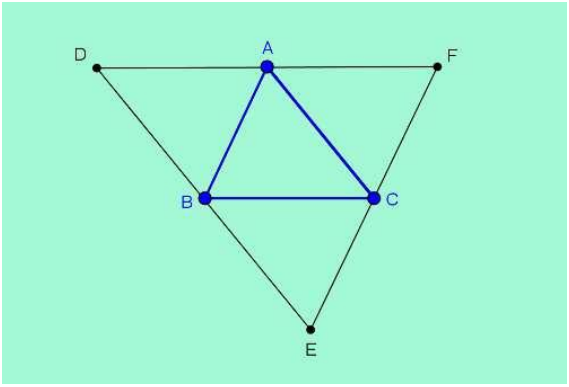
$=6\sqrt{3}$ [As a=6]

Q3.B

Q3 Solution:-

ATP:

AC||BE and AB||CE, ABEC forms a parallelogram where AC=BE and AB=CE.
Similarly, as AC||DB and BC||AD, ADBC forms a second parallelogram
where AC=BDand AD=BC.
Considering the above conditions we can draw a figure as given below.



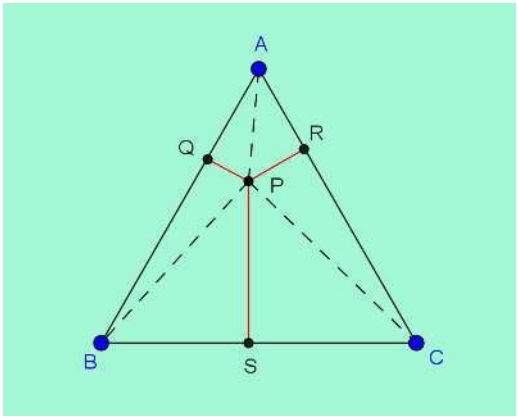
We can conclude from these two condition that B is the mid-point of DE and AC is half of DE. And in same way C is the mid-point of EF and AB is half of EF and A is the mid-point of DF and BC is half of DF In short, each of the three sides of the original triangle is half the length of a corresponding side of the new triangle.
If original triangle has side as 2a , 2b and 2c that is perimeter as = 2a + 2b + 2c = 2(a + b + c)
then new triangle will have side as a , b and c that is perimeter as = (a + b + c)
Thus ratio of perimeter of new triangle to that of original triangle is 2 : 1.

Q4.A

Q4 Solution:-

ATP:

We are given three heights from a single internal point. So we get the three areas and the sum of which will be the area of the whole triangle.
See figure for the problem:-



Let us assume side length of the equilateral triangle as a.
Area of $\triangle ABC$ = Area of $\triangle PBC$ + Area of $\triangle PBA$ + Area of $\triangle PAC$
$=1/2(PS\times BC+PQ\times AB+PR\times AC)$ [As Area of a triangle= (1/2 x Base x Height)]
$=a/2(PS+PQ+PR)$ [As AB = BC = CA = a(let)]
$=a/2\times 8\sqrt{3}$
$=4a\sqrt{3}$.

But again, area of the equilateral triangle = $\sqrt{(3/4)a^2}=4a\sqrt{3}$,

Or, a=16, and so,

Perimeter = 3a = 48.

Q5.A

Q5 Solution:-

Let the bases of the two triangles be x and y and their heights be 3h and 4h respectively.

Then,

((1/2) X x X 3h)/(1/2) X y X 4h) =4/3

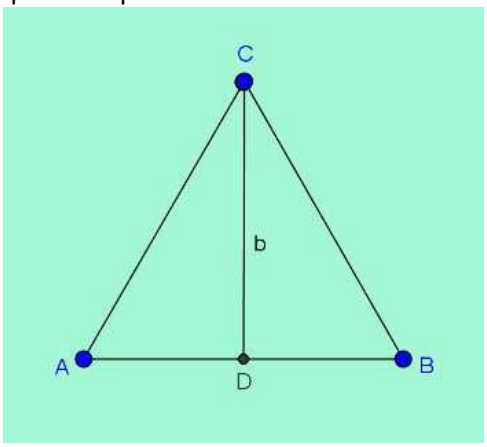
⇨ x/y =(4/3 X 4/3)=16/9

Required ratio = 16 : 9.

Q6.B

Q6. Solution:-

The following figure depicts the problem situation.



If the side length of an equilateral triangle is aa, its height is,

$b^2=a^2-a^2/4=3a^2/4$

And its area is,

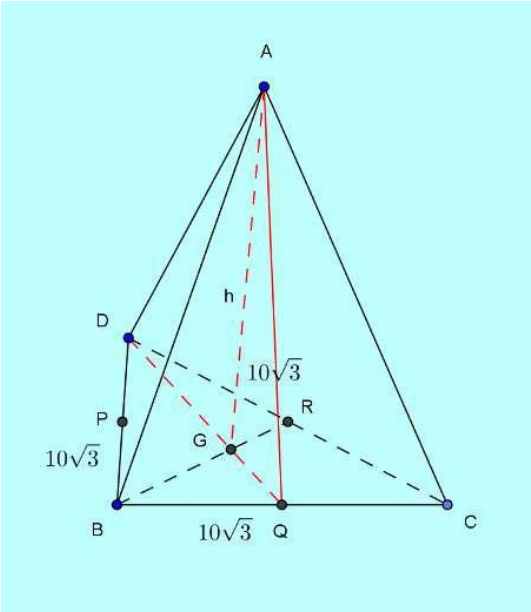
$A=\sqrt{3}a^2/4$,

So desired expression,

$b2/A= (3a^2/4)/(\sqrt{3}a^2/4) = \sqrt{3}$.

Q7.C

Q7 Solution:-



Median langth of the base is,

DQ $=\sqrt{[(10\sqrt{3})^2-(5\sqrt{3})^2]}$

$=\sqrt{(300-75)}$

$=\sqrt{225}$

$=15$

As centroid G divides the median in a 2 : 1 ratio,

$GQ=1/3\times15=5$.

Finally in right $\triangle AGQ$, height of pyramid,

$h=\sqrt{(h_1^2-GQ^2)}$

$=\sqrt{(13^2-5^2)}$

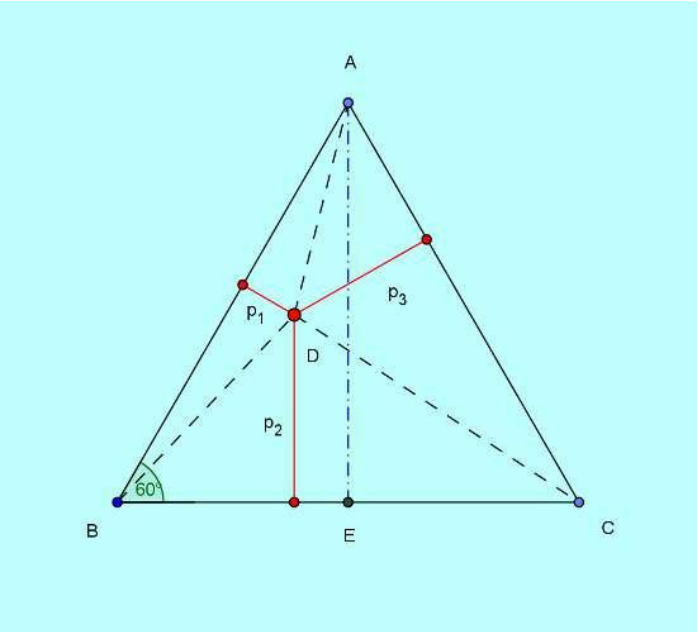
$=\sqrt{(169-25)}$

$=\sqrt{144}$ cm.

$=12$

Q8.B

Q8 Solution:



The perpendicular lengths p1, p2 and p3 are from the internal poind D to sides AB, BC and CA of the equilateral △ABC of side length, say, d.
So sum of areas of the three triangles △DAB, △DBC and △DCA is,
A=1/2d(p1+p2+p3).
Again, the area of the equilateral △ABC is,
$A=\sqrt{3}/4d^2=(1/2)d(p1+p2+p3)$
Or, $d=(2/\sqrt{3})(p1+p2+p3)$.

Q9.C
Q9 Solution:-

Let the height be h and base= b. then, area = (1/2 bh) sq. units.
New height = (60% of h) = (60/100) h= 3h/5,
New base = (140% of b) = (140/100) b= 7b/5
New Area = (1/2 x7b/5 x3h/5) sq. unit= (21/50) bh sq. unit
Decrease in area = [1/2 bh- (21/50) bh] = 4/50 bh.
Decrease % = (4/50 bh x 2/bh x100) % = 16%

Q10.B
Q10 Solution:-

We have area of a triangle = 1/2xbxh [if base and heights are given]
$= (\sqrt{3}/4)\ a^2$ [If side of the equilateral triangle is given]
Let side of the triangle be a cm,
Then,
It's area will be $1/2\ xax\sqrt{6}= (\sqrt{3}/4)\ a^2$
⇒ $a= 1/2\ x\sqrt{6}x\ 4/\sqrt{3}= 2\sqrt{2}$
Area of the triangle = $[(\sqrt{3}/4x\ (2\sqrt{2})\ 2]$ sq. cm. = $(\sqrt{3}/4x8)$ sq. cm.
$= 2\sqrt{3}$sq. cm.

Q11.A

Q11 Solution:-

Shortcut:

Area of any triangle =4/3rd [Area of triangle formed by its median]

Now finding area of triangle formed by the medians of given triangle.

We have:

$A=\sqrt{[s(s-a)(s-b)(s-c)]}$

s=(9+12+15)/2=18

So the area of the triangle of medians is,

Area $=\sqrt{[18(18-9)(18-12)(18-15)]}$

$=\sqrt{[18x9x6x3]}$

$=\sqrt{[18x9x6x3]}$

$=\sqrt{2916}$

=54 sq.cm.

So the area of the original triangle will be 4/3 times of it, that is 4/3x54=72 sq.cm.

Q12.A

Q12 Solution:-

We have:

$Area=\sqrt{[s(s-a)(s-b)(s-c)]}$

ATP, we have

s=(9+10+11)/2=15 and so,

Area $=\sqrt{[15(15-9)(15-10)(15-11)]}$

$=\sqrt{[15x6x5x4]}$

$=\sqrt{1800}$

$=30\sqrt{2}$ cm^2.

Q13.B

Q13 Solution:-

Let a = 13, b = 14 and c = 15. Then, S = (a + b + c)/2 = 21.

(s- a) = 8, (s - b) = 7 and (s - c) = 6.

Area = $\sqrt{[s(s- a) (s - b)(s - c)]} = \sqrt{(21x8x7x6)}$= 84 cm^2.

Q14.A

Q14 Solution:-

Height of the triangle = $\sqrt{[13^2 - 12^2]}$ cm = $\sqrt{(169 – 144)}$= $\sqrt{25}$ cm = 5 cm.

Its area = (1/2)xBasexHeight = ((1/2)x12x5) cm^2 = 30 cm^2.

Q15.D

Q15 Solution:-

Let ABC be the isosceles triangle and AD be the altitude.

Let AB = AC = x. Then, BC = (32 - 2x).

Since, in an isosceles triangle, the altitude bisects the base,

so BD = DC = (16 - x).

In triangle ADC, $AC^2= AD^2 + DC^2 => x^2=8^2+(16-x)^2$

=> 32x = 320

=> x= 10.

BC = (32- 2x) = (32 - 20) cm = 12 cm.

So, required area = ((1/2)xBCx AD) = ((1/2)x12 x10)cm^2 = 60 cm^2.

Q16.B

Q16 Solution:-

Area of the triangle = (√3/4) x (3√3)2 = 27√3. Let the height be h.

Then, (1/2) x 3√3 x h = (27√3/4) X(2/√3) = 4.5 cm.

Fill the brain with high thoughts, highest ideals place them day and night before you and out of that will come great work.

Theorem: Parallelograms on the same base and in between the same parallels are equal in area.

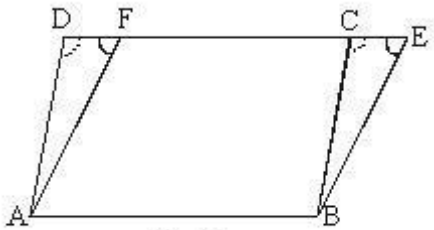


Fig.3

Here, area(ABCD) = area(ABEF)

IMPORTANT FORMULAE:

1. Area of a rectangle = Length × Breadth = $l \times b$
2. Area of a square = $(\text{side})^2 = a^2$
3. Area of a parallelogram = Base × Height = $b \times h$
4. Area of a rhombus = $1/2 \times d_1 \times d_2$

[Where d_1 and d_2 are the lengths of the two diagonals of the rhombus]

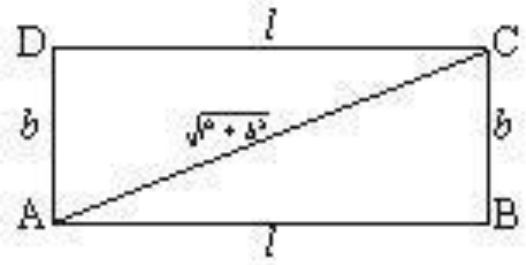
5. Area of a Trapezium = $1/2(a + b) \times h$

[Where a and b are the lengths of opposite parallel lines and h is the distance between the parallel lines]

SOME IMPORTANT FORMULAS RELATED TO PLANE FIGURES

(1) Rectangle

Let ABCD be a rectangle with length *l* and breadth *b*, then



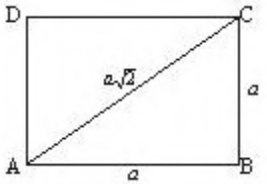
(i) Perimeter = $2(l + b)$

(ii) Area = $l \times b$

(iii) Diagonal = $\sqrt{l^2 + b^2}$

(2) Square

Let ABCD be a square with each side equal to a, then



(i) Perimeter = $4a$

(ii) Area = a^2

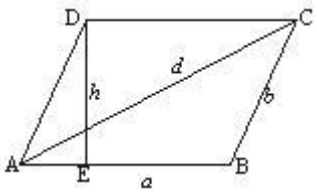
(iii) Diagonal = $\sqrt{Area} = \frac{Perimeter}{4}$

(iv) Area = $(\text{diagonal})^2$

(v) Side of square = $a\sqrt{2}$

(3) Parallelogram

Let a parallelogram ABCD with adjacent sides a and b with diagonal d.



Let and DE = h, then

(i) Perimeter = 2 (sum of adjacent sides) = $2(a + b)$

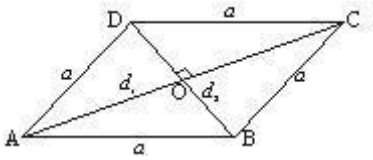
(ii) Area = Base × Height = $a \times h$

(iii) If $s = \frac{a + b + c}{2}$, then

Area of parallelogram = $2\sqrt{s(s-a)(s-b)(s-d)}$

(4) Rhombus

Let ABCD be a rhombus with each side equal to a. Let d_1 and d_2 are diagonals, then



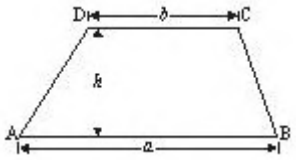
(i) Area = $1/2 \times d_1 \times d_2$

(ii) Perimeter = $\frac{1}{2}\sqrt{d_1^2 + d_1^2}$

(iii) Each side = $\frac{1}{2}\sqrt{d_1^2 + d_1^2}$

(5) Trapezium

Let ABCD be a trapezium in which AB || DC such that



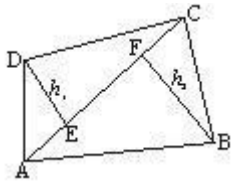
AB = a and CD = b then,

Area of trapezium = 1/2 × (sum of parallel sides) × (distance between them)

= 1/2 (a + b) x h

(6) Quadrilaterals

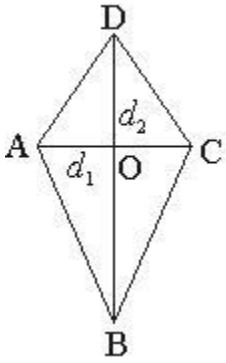
(i) Let ABCD be a quadrilateral in which length of diagonals = AC = d



Let DE ⊥ AC and BF ⊥ ACsuch that DE = h_1 and BF = h_2

So, area of quadrilateral = 1/2 x d x (h_1 + h_2)

(ii) Let ABCD be a kite then diagonals AC and BE are mutually perpendicular.

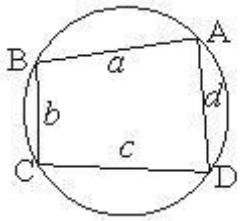


Let AC = d_1 and BD = d_2.

Area of kite = (product of the diagonals)

= 1/2 x d_1 x d_2

(iii) Let ABCD be a cyclic quadrilateral with sides a, b, c and d,



Then, area of cyclic quadrilateral

$= \sqrt{(s-a)(s-b)(s-c)(s-d)}$

Where $s = \frac{a+b+c}{2}$

QUADRILATERAL

----------EXERCISE----------

Q1. The difference between the length and breadth of a rectangle is 33 m. And its perimeter is 134 m, then what will be its area?

A 800 sq. mtr. B 850 sq. mtr. C 900 sq. mtr. D 950 sq. mtr.

Q2. One side of a rectangular field is 15 m and one of its diagonals is 17 m. Find the area of the field.

A. 100 B. 120 C. 190 D. 260

Q3. What is perimeter of a rectangular feild if its area is 37/2 and length of diagonal is √63.

A 20 cm B 16 cm C 15 cm D 10 cm

Q4. A hall is in the form of a rectangle having its sides in the ratio 2: 3. The area of the hall is (1/6) hectares. Find the length and breadth of the hall.

A. 10 B. 20 C. 50 D. 160

Q5. A rectangle chart paper has perimeter as 92 c.m. and diagonally a line of length 34 cm can be sketched on it. Then find it's area.

A 400 sq. cm. B 420 sq. cm. C 480 sq. cm. D 540 sq. cm.

Q6. The length of a rectangle is twice its breadth. If its length is decreased by 5 cm and breadth is increased by 5 cm, the area of the rectangle is increased by 75 sq. cm. Find the length of the rectangle.

A. 10 B. 20 C. 90 D. 160

Q7. The ratio between the length and the breadth of a rectangular park is 2: 1. If a man cycling along the boundary of the park at the speed of 18 km/hr completes one round in 10 minutes, then the area of the park (in sq. m) is:

A 500 sq. mtr. B 5000 sq. mtr. C 50000 sq. mtr. D 500000 sq. mtr.

Q8. If the diagonal of a rectangle is 17 cm long and its perimeter is 46 cm, find the area of the rectangle. .

A. 120 B. 140 C. 190 D. 196

Q9. The diagonals of two squares are in the ratio of 3 : 7. Find the ratio of their areas.

A 3:49 B 9:49 C 9:7 D 81:24

Q10. A rectangular grassy plot 110 m. by 65 m has a gravel path 2.5 m wide all round it on the inside. Find the cost of gravelling the path at 80 paise per sq. metre.

A. 100 B. 400 C. 590 D. 680

Q11. What is the least number of squares tiles required to pave the floor of a room 30 m 34 cm long and 18 m 4 cm broad?

A 814 B 816 C 800 D 712

Q12. If length and perimeter of a rectangle are in the ratio 5 : 16, then its length and breadth will be in the ratio,

A. 5 : 2 B. 5 : 4 C. 7 : 3 D. 5 : 3

Q13. The length of a rectangular plot is 40 meters more than its breadth. If the cost of fencing the plot at 53 per meter is Rs. 10600, what is the length of the plot in meters?

A 100 m B 80 m C 60 m D 55 m

Q14. One side of a rectangular field is 30 m and one of its diagonals is 34 m. Find the area of the field.

A 420 sq. mtr. B 480 sq. mtr. C 300 sq. mtr. D 240 sq. mtr.

Q15. In an equilateral ΔABC of side 10cm, the side BC is trisected at D. The length of AD then (in cm) is,

A. 8√7/3. B. 10√7/3. C. 12√7/3. D. 14√7/3

Q16. A circular wire of radius 42 cm is bent in the form of a rectangle whose sides are in a ratio of 6 : 5. The smaller side of the rectangle is, (take π=22/7)

A. 20 B. 40 C. 60 D. None

Q17. The base of a parallelogram is (x + 2), altitude to the base is (x-6) and the area is (x^2 - 48), then it's area is:

A 52 units B 46 units C 50 units D 42 units

Q18. The length of a rectangle is thrice its breadth. If its length is decreased by 9 cm and breadth is increased by 9 cm, the area of the rectangle is increased by 81 sq. cm. Find the original length of the rectangle.

A 9 cm B 15 cm C 18 cm D 27 cm

Q19. If two squares are similar but not equal and the diagonal of larger square is 8 m. What is the area of smaller square if it area is 1/2 of larger square.

A 4 sq. mtr. B 16 sq. mtr. C 24 sq. mtr. D 32 sq. mtr.

Q20. Find the area of a rhombus having one side as 10 cm and one diagonal 12 cm.

A 96 sq. cm. B 98 sq. cm. C 100 sq. cm. D 104 sq. cm.

Q21. A rectangular plot has an area of 120 square meters and Perimeter of 46m. The it's diagonal is:

A 11 m B 13 m C 15 m D 17 m

Q22. The area of a rectangle is thrice that of a square. The length of the rectangle is 20 cm and the breadth 3/2 times the length of a side of the square. The side of the square (in cm) is,

A. 1m B. 10m C. 100m D. 1000m

Q23. The length of a rectangular plot is increased by 25%.how much breadth should be decreased to keep area same.

A No change B Increase by 25% C Decrease by 20% D Decrease by 25%

Q24. Find the area of a rhombus having perimeter of 40 cm and height of 5 cm:

A. 50 sq.cm. B. 100sq.cm. C. 120sq.cm. D. 1000sq.cm.

Q25. Find the area of a square, If one of it's diagonal be 7.2 m long.

A 22.62 sq. mtr. B 23.72 sq. mtr. C 24.82 sq. mtr. D 25.92 sq. mtr.

Q26. The sum of the length, breadth and height of a rectangular parallelepiped is 24 cm and it's diagonal is 15 cm. long Then it's total surface area will be:

A. 321 sq.cm.. B. 331 sq.cm.. C. 341 sq.cm.. D. 351 sq.cm..

Q27. The difference between two parallel sides of a trapezium is 4 cm. perpendicular distance between them is 19 cm. If the area of the trapezium is 475 find the lengths of the smaller sideof parallel sides.

A. 19cm. B. 23cm. C. 27cm. D. 36cm.

Q28. Find the area of a rhombus one side of which measures 20 cm and one diagonal 24 cm.

A. 184 sq.cm. B. 254 sq.cm. C. 324 sq.cm. D. 384 sq.cm.

Q29. If one diagonal of a rhombus is twice of other and it has an area of 144sq. cm.then its longer diagonal will be:

A 6 cm B 12 cm C 24 cm D 36 cm

Q30. The base of a parallelogram is twice its height. If the area of the parallelogram is 72 sq. cm, find its height.

A. 1cm. B. 4cm. C. 6cm. D. 16cm.

Q31. The base of a triangular field is three times its altitude. If the cost of cultivating the field at Rs. 24.68 per hectare be Rs. 333.18, find its base and height.

A. 100m B. 300m C. 459m D. 576m.

Q32. A room has length and breadth in the ratio of 3 : 1 . The cost of carpeting the floor at Rs. 5 per sq. m is Rs. 270 and the cost of colouring the four walls at Rs. 10 per m^2 is Rs. 1720. If a door and 2 windows have total area of 8 sq. m, find the height of the room.

A. 1m B. 4m C. 6m D. 16m

Q33. How many tiles of dimension 12cm x 5cm are required to fit in a rectangular region of dimension 144cm x 100cm:

A. 160 B. 240 C. 320 D. 450

Q34. If the length of a certain rectangle is decreased by 4 cm and the width is increased by 3 cm, a square with the same area as the original rectangle would result. Find the perimeter of the original rectangle.

A. 5 cm. B. 25 cm. C. 50 cm. D. 75 cm.

Q35. If in △ABC, D and E are the two points on the sides AB and AC respectively so that DE || BC and AD/BD=2/3, then (The area of trapezium DECB)/(The area of △ABC) will be equal to,

A. 21/25 B. 22/29 C. 23/29 D. None

Q36. If each side of a square is increased by 25%, find the percentage change in its area.

A. 16.25%. B. 25.25%. C. 56.25%. D. 64.25%.

Q37. Find the area of a square, one of whose diagonals is 3.8 m long.

A. 7.22 B. 17.22 C. 27.22 D. 37.22

Q38. ABCD is a parallelogram. P and Q are the mid-points of sides BC and CD respectively. If the area of the △ABC is 12 sq.cm., the area of △APQ is,

A. 9 sq.cm. B. 12 sq.cm. C. 20 sq.cm. D. None

Q39. At each corner of a triangular field of side lengths 26m, 28m and 30m, a cow is tethered by a rope of length 7m. The area ungrazed by the cows is,

A. 69 sq m B. 77 sq m C. 79 sq m D. NONE

Q40. The length, breadth and height of a room are in the ratio 3:2:1. If the breadth and height are halved while the length is doubled, then the total area of the four walls of the room will be:

A. remains the same. B. decrease by 13.64%
C. decrease by 15% D. decrease by 30%

Q41. The external length, breadth and height of a closed box are 10 cm, 9 cm and 7 cm respectively. The total inner surface area of the box is 262 sq. cm. Find the thickness of walls of box.

A. 4 cm B. 7 cm C. 10cm D. None

Q42. The difference in areas of two squares is 32 sq cm. Find the length of the larger square if it is 2 cm longer than the other.

A. 7 B. 9 C. 10 D. 11

Q43. If each side of a square is increased by 16%, find the percentage change in its area.

A 14.50% B 24.54% C 34.56%. D 44.58%

Q44. The perimeter of an equilateral Δ is $72\sqrt{3}$ meters.Find its height.

A. 63 metres B. 55 metres C. 40 metres D. 36 metres

Q45. The perimeters of two squares are 80 cm and 64 cm. Find the perimeter of a third square which has an area equal to the difference of the areas of the First two squares.

A 36 cm B 48 cm C 54 cm D 64cm

Q46. A round shaped park has a boundary of 440 m. There is a 7m wide path inside the boundary. The area of the path is:

A 2918sq. mtr. B 2921 sq. mtr. C 2924 sq. mtr. D 2926 sq. mtr.

Q47. A rectangle has length of 15cm and area of 150sq. cm. If it's area is to be expanded to 4/3 times without expanding its breadth then it's new perimeter will be:

A 50 cm B 60 cm C 70 cm D 80 cm

Q48. If a rectangle has diagonal of 17cm long and its perimeter is 46cm, Then find it's area:

A 100 sq. cm. B 110 sq. cm. C 120 sq. cm. D none of these

Q49. The area of rhombus is 300 sq. cm. If the length of one of it's diagonals be 20 cm. Then the length of the other diagonal will be:

A 30 cm B 32 cm C 40 cm D 45 cm

Q50. The perimeters of two squares are 40 cm and 32 cm. Find the perimeter of a third square whose area is equal to the difference of the areas of the two squares. (S.S.C. 2003)

A. 21 B. 24 C. 29 D. 36

Q51. If the diagonals of a rhombus are 20 cm and 10 cm, what will be its perimeter?

A. $20\sqrt{5}$ cm B. $25\sqrt{5}$ cm C. $30\sqrt{5}$ cm D. $40\sqrt{5}$ cm

Q52. The difference between two parallel sides of a trapezium is 8 cm. And perpendicular distance between them is 38 cm. If the area of the trapezium is 950 sq.cm. Then find the lengths of the smaller side of parallel sides.

A. 20 cm B. 21 cm C. 24 cm D. 27 cm

Q53. The sides of a square is equal to sides of an equilateral triangle. Then ratio of their areas will be:

A 2:1 B $2:\sqrt{3}$ C 4:3 D $4:\sqrt{3}$

This chapter contains the topics and questions I discussed and created in our classes or obtained from students as their doubts. All the questions noted, typed, redesigned and rectified by group of volunteers consisting of:

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QUADRILATERAL

----------ANSWER----------

Q1.B	**Q2.B**	**Q3.A**	**Q4.C**	**Q5. C**
Q6.B	**Q7.D**	**Q8.A**	**Q9.B**	**Q10.D**
Q11.A	**Q12.D**	**Q13. A**	**Q14.B**	**Q15.B**
Q16.C	**Q17.A**	**Q18.A**	**Q19.B**	**Q20.A**
Q21.D	**Q22.B**	**Q23.C**	**Q24.A**	**Q25.D**
Q26.D	**Q27.C**	**Q28.D**	**Q29.C**	**Q30.C**
Q31.B	**Q32.C**	**Q33.B**	**Q34.C**	**Q35.A**
Q36.C	**Q37.A**	**Q38.A**	**Q39.B**	**Q40.D**
Q41.B	**Q42.B**	**Q43.C**	**Q44.D**	**Q45.B**
Q46.D	**Q47.B**	**Q48.C**	**Q49.A**	**Q50.B**
Q51.A	**Q52. B**	**Q53.D**		

----------ANSWER WITH SOLUTION----------

Q1.B

Q1 Solution:-

We have: (l - b) = 33 and 2(l + b) = 134 or (l + b) = 67.

Solving the two equations, we get: l = 50 and b = 17.

∴ Area = (l x b) = (50 x 17) sq. mtr. =850 sq. mtr..

Q2.B

Q2 Solution:-

Other side = $\sqrt{[(17)^2 - (15)^2)]} = \sqrt{(289 - 225)} = \sqrt{(64)} = 8$ m.

Area = (15 x 8) m^2 = 120 m^2.

Q3.A

Q3 Solution:-

ATP:

$l^2 + b^2 = (\sqrt{(63)})^2 = 63$

Also, lb = 37/2.

$(l + b)^2 = (l^2 + b^2) + 2lb = 63 + 37 = 100$

⇒ (l + b) = 10.

∴ Perimeter = 2(l + b) = 20 cm.

Q4.C

Q4 Solution:-

Let length = 2x metres and breadth = 3x metre.

Now, area = (1/6)x 1000 m^2 = 5000/3m^2

So, 2x x 3x = 5000/3 <=> x2 = 2500/9 <=> x = 50/3

So Length = 2x = (100/3) m = 33(1/3) m and Breadth = 3x = 3(50/3) m = 50m.

Q5. C

Q5. Solution:-

Let length = X and breadth = Y. Then,

2 (X + Y) = 92

OR, X + Y = 46 AND $X^2 + Y^2 = (34)^2 = 1156$.

Now, $(X + Y)^2 = (46)^2$

⇔ $(X^2 + Y^2) + 2XY = 2116$ ⇔ 1156 + 2XY = 2116

⇒ XY=480

∴ Area = XY = 480 sq. cm..

Q6.B

Q6 Solution:-

Let breadth = x. Then, length = 2x. Then,

(2x - 5) (x + 5) - 2x x x = 75 <=> 5x - 25 = 75 <=> x = 20.

∴ Length of the rectangle = 20 cm.

Q7.D

Q7 Solution:-

Perimeter = Distance covered in 10 min. =18000/60 x 10=3000 m

Let length = 4X meters and breadth = X meters.

Then, 2(2X +1X) = 3000 or X = 500.

Length = 1000 m and Breadth = 500 m.

∴ Area = (1000 x 500) sq. mtr. = 500000 sq. mtr..

Q8.A

Q8 Solution:-

Let length = x and breadth = y. Then,

2 (x + y) = 46 or x + y = 23 and $x^2 + y^2$ = (17) 2 = 289.

Now, $(x + y)^2 = (23)^2$ <=> $(x^2 + y^2) + 2xy = 529$ <=> 289 + 2xy = 529 => xy=120

Area = xy = 120 sq.cm..

Q9.B

Q9 Solution:-

Let the diagonals of the squares be 3K and 7K respectively.

Ratio of their areas = $(1/2)x(3K)^2 :(1/2)x(7K)^2 = 9K^2 : 49K^2 = 9: 49$.

[As Area of a Square = $\frac{1}{2}(\text{diagonal})^2$]

Q10.D

Q10 Solution:-

Area of the plot = (110 x 65) m2 = 7150 m2

Area of the plot excluding the path = [(110 - 5) x (65 - 5)] m2 = 6300 m2.

Area of the path = (7150 - 6300) m2 = 850 m2.

Cost of gravelling the path = Rs.850 x (80/100)= Rs. 680

Q11.A

Q11 Solution:-

Length of largest tile = H.C.F. of 3034 cm and 1804 cm = 82 cm.

Area of each tile = (82 x 82) sq. cm..

Required number of tiles 3034x1804/82x82 = 37x22=814.

Q12.D

Q12 Solution:-

Let the actual length and perimeter be 5x and 16x respectively.

ATP:

2(5x + k) = 16x.

5x + k =8x

k=16x−10x=6x So length and breadth ratio is, 10x:6x=5:3.

Q13. A

Q13 Solution:-

Let breadth = X meters. Then, length = (X+ 40) meters.

Perimeter = 10600/53 =200 m

∴ 2[(X + 40) + X] = 200

=> 2X + 40 = 100

=> 2X = 120

=> X = 60.

So, length = x + 40 = 100 m.

Q14.B

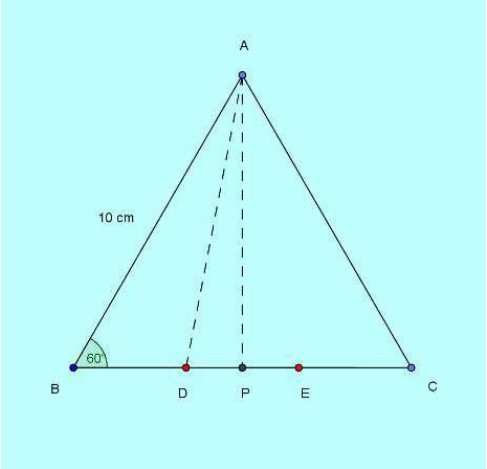
Q14 Solution:-

By pythogerous theorem Other side = $\sqrt{((34)^2 - (30)^2)} = 16$

⇒ Area = (30 x 16) sq. mtr. = 480 sq. mtr.

Q15.B

Q15 Solution:-



As D trisects BC of length 2 cm, BD=DE=EC=10/3 cm where E also is the second trisecting point on BC.

Also as median AP is the perpendicular bisector of side BC, it bisects section DE so that,

DP=10/6=5/3.

Median length of the equilateral △ABC is,

AP=√[100−25]= √75=5√3.

Finally then in right △APD,

AD=√[DP^2+AP^2]=√[25/9+75]=√(700/9) =10√7/3.

Q16.C

Q16 Solution:-

The perimeter of the circle will form the perimeter of the rectangle which will comprise of twice sum of length and breadth.

The perimeter of the circle, that is, the rectangle is,

P=2πr=2×22/7×42=12×22 cm.

Let us assume the actual length and breadth of the rectangle be, 6x6x and 5x5x using ratio concepts.

So perimeter will be,

P=2(6x+5x)=22x=12×22.

So x=12.

The smaller side or breadth is then =5x=60 cm.

Q17.A

Q17 Solution:-

Area of a parallelogram, A = bh
(where b is the base and h is the height of the parallelogram)
⇒ $(x^2 – 48) = (x-6)(x + 3)$
⇒ $x^2 – 48 = x^2 -3x - 18$
⇒ $x=10$
⇒ Actual Area = $10^2-48=52$ units

Q18.A

Q18 Solution:-

Let breadth = K. Then, length = 3K.
Then, $(3K\ 9)(K + 9) = 3K \times K + 81$
⇒ $3K^2+27K-9K-81=3K^2+81$
$18K=162$
⇒ $K=9$ cm
∴ Length of the rectangle = 9 cm

Q19.B

Q19 Solution:-

Area is larger square $=1/2 \times 8^2 =32$
⇒ Area is smaller square=32/2=16 sq. mtr.

Q20.A

Q20 Solution:-

Let other diagonal = 2x cm.
Since diagonals of a rhombus bisect each other at right angles,
we have: $(10)^2 = (6)^2 + (x)^2$
⇒ $x = \sqrt{((10)^2 - (6)^2)} = \sqrt{64} = 8$ cm.
So, other diagonal = 16 cm.
∴ Area of rhombus = (1/2) x (Product of diagonals)
= ((1/2) x 12 x 16) sq. cm. = 96 sq. cm.

Q21.D

Q21 Solution:-

Let l be the length and b be the breadth of floor.
So, ATP:
lxb=120 ----------(i) and
2(l+b)= 46
⇒ (l+b)=23 ----------(ii)
$(l-b)^2 = (l+b)^2 -4lb = (23)^2-4x120$
$= 529-480 =49 \Rightarrow l-b= 7$
On solving L+b= 23, L-b= 7 we get: L= 15, b=8
Diagonal = $[\sqrt{(15)^2+ (8)^2}] = [\sqrt{(225+64)}] = \sqrt{289} =17$

Q22.B

Q22 Solution:-

Let A_r be the area and l be the length of the rectangle, A_s be the areA and a be the side of square
So, ATP:

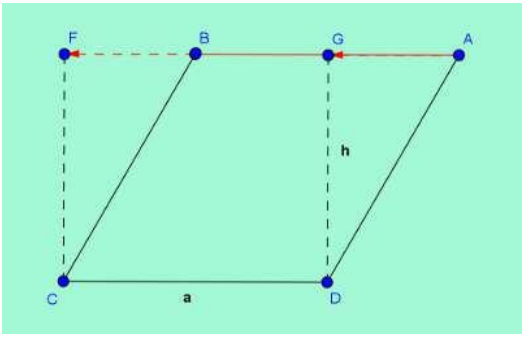
A_r=20×breadth=20×3a/2, where a is length of a side of the square,
=30a=3A_s
⇨ A_s = 10a.
So, A_s=10a=a^2, by condition.
Or, a=10.

Q23.C
Q23 Solution:-

Let the length be l meter and breadth be b mtr.
Then, its area = (lb) sq. mtr.
New length = (125/100xl) m = (5l/4) m. let the new breadth be z meters.
Then, lb = 5l/4xz ⇒z= 4/5 b
Decrease in width = (b-4/5b) = b/5 mtr.
Decrease % in width = (b/5x1/bx100) % = 20%

Q24.A
Q24 Solution:-

We know the length of all sides of a rhombus is equal in length,
For a given rhombus, its area = base × height = a × h.
So, length of its side = 40/4=10 cm.
If you push the rhombus from right to left holding its corner A and keeping its base CD fixed, it adjusts its shape to the rectangle shape of CDGF without losing or adding any area.
As shown in the figure:



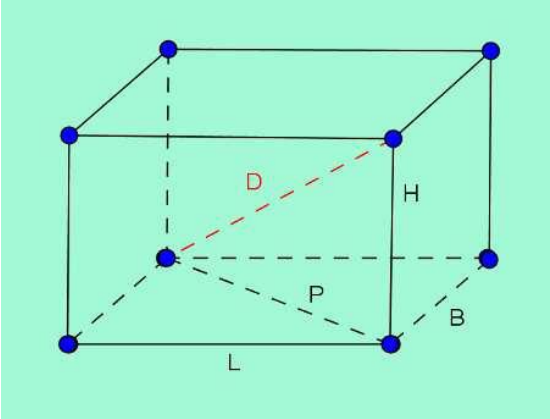
Here the area of the triangles ΔAGD and ΔBFC will remain same.
As area of the rectangle = a × h, we get the area of the rhombus as = base × height.
So, area of the rhombus in our problem = side length × height = 50 cm.

Q25.D
Q25 Solution:-

Area of the square = 1/2(diagonal)^2= 1/2x7.22≡ 7.2x7.2/2=25.92 sq. mtr.

Q26.D
Q26 Solution:-

The following is the figure corresponding to the problem.



Let the length, breadth and height be, L, B and H. The base diagonal,
$P^2=L^2+B^2$.
Again, Main diagonal,
$D^2=P^2+H^2$
$=L^2+B^2+H^2=225$.
Given L+B+H=24 cm.
Knowing that the total surface area is, 2(LB+BH+HL) using the square of three term sum expression,
$(L+B+H)^2$
$=L^2+B^2+H^2+2(LB+BH+HL)$,
we have total surface area as,
2(LB+BH+HL)
$=(L+B+H)^2-(L^2+B^2+H^2)$
$=24^2-225$
=576−225
=351 sq.cm..

Q27.C
Q27 Solution:-

Let the two parallel sides of the trapezium be a cm and b em.
Then, a - b = 4
And, (1/2) x (a + b) x 19 = 475
⇨ (a + b) =((475 x 2)/19)
⇨ a + b = 50
Solving (i) and (ii), we get: a = 27, b = 23.
So, the two parallel sides are 27 cm and 23 cm.

Q28.D
Q28 Solution:-

Let other diagonal = 2x cm.
Since diagonals of a rhombus bisect each other at right angles, we have:
$20^2 = 12^2 + (x)^2$
⇨ $x = \sqrt{(20^2 - 12^2)} = \sqrt{(400-144)} = \sqrt{256} = 16$ cm.
So, other diagonal = 32 cm.
Area of rhombus = (1/2) x (Product of diagonals) = ((1/2)x 24 x 32) sq.cm. = 384 sq.cm.

Q29.C
Q29 Solution:-

Let one diagonal be d cm. then, another diagonal = 2d cm

∴ 1/2 x dx2d= 144
⇒ d^2 =144
⇒ d= 12
Length of the diagonals is 12cm, 24 cm
So, Longer diagonal will be 24 cm.

Q30.C
Q30 Solution:-
Let the height of the parallelogram be x. cm. Then, base = (2x) cm.
2x X x =72
⇨ $2x^2 = 72$
⇨ $x^2=36$
⇨ x=6
So, height of the parallelogram = 6 cm.

Q31.B
Q31 Solution:-
Area of the field = Total cost/rate = (333.18/25.6)hectares = 13.5 hectares
=> (13.5 k 10000) m^2 = 135000 m^2.
Let altitude = k metres and base = 3k metres.
Then, (1/2)x 3k x k = 135000
=> k^2= 90000
=> k = 300.
Base = 900 m and Altitude = 300 m.

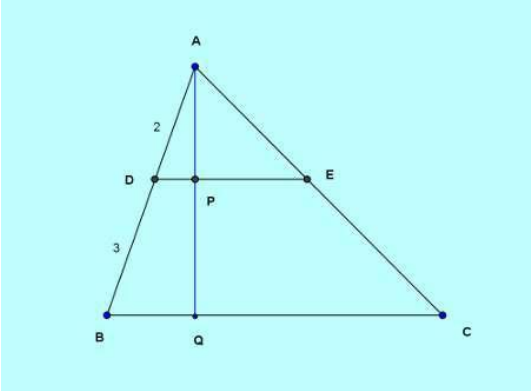
Q32.C
Q32 Solution:-
Let breadth = k metres, length = 3k metres, height = H metres.
Area of the floor=$\frac{\text{Total cost of carpeting}}{\text{Rate sq.mtr}} = \frac{270}{5}$ m^2=54m^2.
kx (3k/2) = 54
=> k^2 = (54x2/3) = 36
=> k = 6.
So, breadth = 6 m and length =(3/2)x6 = 9 m.
Now, coloured area = (1720/10)m^2 = 172 m^2.
Area of 1 door and 2 windows = 8m^2.
Total area of 4 walls = (172 + 8)m^2 = 180 m^2
2x(9+ 6)x H = 180 <=> H = 180/30 = 6 m.

Q33.B
Q33 Solution:-
Total area of the region=100×144=14400 sq. cm.
Area of one tile =12×5=60 sq. cm.
Number of tiles required=14400/60=240
So, 240 tiles are required.

Q34.C
Q34 Solution:-
Let x and y be the length and breadth of the rectangle respectively.
Then, x - 4 = y + 3 or x - y = 7 ----(i)
Area of the rectangle =xy; Area of the square = (x - 4) (y + 3)
(x - 4) (y + 3) =xy
=> 3x - 4y = 12 ----(ii)
Solving (i) and (ii), we get x = 16 and y = 9.

Perimeter of the rectangle = 2 (x + y) = [2 (16 + 9)] cm = 50 cm.

Q35.A
Q35 Solution:-



(The area of trapezium DECB)/(The area of △ABC)
=(Area of △ABC−Area of △ADE)/(Area of △ABC)
=(1/2BC×AQ−1/2DE×AP)/(1/2BC×AQ) =(1−DE/BC)×(AP/AQ)=1−2^2/5^2=1−4/25=21/25

Q36.C
Q36 Solution:-

Let each side of the square be a. Then, area = a^2.
New side =(125a/100) =(5a/4). New area = $(5a/4)^2$ =($25a^2$)/16.
Increase in area = ($(25a^2)/16$)-a^2 =($9a^2$)/16.
Increase% = [($(9a^2)/16$)x($1/a^2$)x100] % = 56.25%.

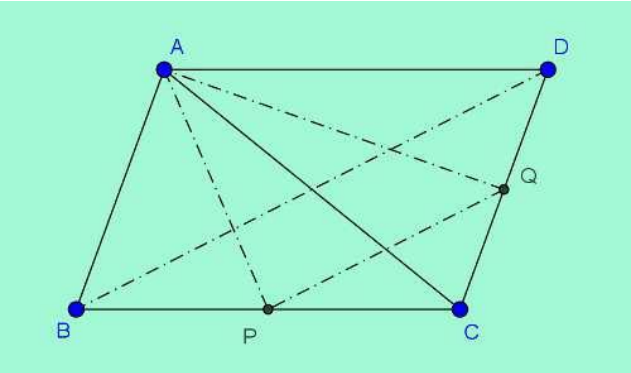
Q37.A
Q37 Solution:-

Area of the square = (1/2)x $(\text{diagonal})^2$ = [(1/2)x3.8x3.8]m^2 = 7.22 m^2.

Q38.A

Q38 Solution:-

ATP we constructed the following figure:



P is the mid point of BC, So, it divides the ∆ABC into two equal parts (As height is same, base is half of larger base), that is,

Area of ∆APC=6 sq.cm.. [1/2 of area of ∆ABC]

Similarly, area of ∆AQC =6 sq.cm.. [half of area of ∆ACD]

So area of quadrilateral APCQ=12 sq.cm..

Now we only have to find the area of ∆PCQ and subtract it from this area of the quadrilateral to get the area of ∆APQ.

The other diagonal BD also divides the area of the parallelogram into two equal parts and so, area of the ∆BCD=12 sq.cm..

Again BD||PQ and P and Q are the midpoints of the other two sides BC and CD of the ∆BCD. So these two triangles ∆PCQ and ∆BCD are similar and each side including the height of the smaller triangle is half its corresponding side and the height of the larger triangle.

This makes the area of the ∆PCQ=1/4th of the area of ∆BCD=3 sq.cm..

Finally then, the area of ∆APQ=12−3=9 sq.cm..

Q39.B

Q39 Solution:-

Shortcut:

In this type of sums when arcs are formed of length l at corners of a triangle of area A

Then simply use:

Grazed part = $\pi l^2/2$

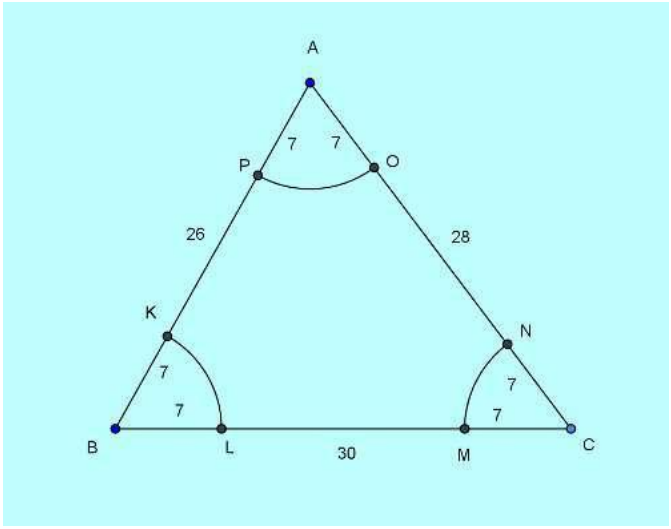
Ungrazed part = A - $\pi l^2/2$

In case of quadrilateral with area A simply use:

Grazed part = πl^2

Ungrazed part = A - πl^2

Refer to the figure:



Area of triangle when length of three sides are given is,

A=√s[(s−a)(s−b)(s−c)], where s=semi-perimeter of the triangles=semi-perimeter of the triangle, and a, b and c are the side lengths.

Here, s=1/2×(26+28+30)=42m.

So the area of the triangle is,

A=√(42×16×14×12)=336 sq m.

So, using

Grazed part = $\pi l^2/2$ =77 sq.cm.

Ungrazed part = A - $\pi l^2/2$ =336 -77 =259 sq.cm.

Q40.D

Q40 Solution:-

Let the original length, breadth and height of the room be 3k, 2k and k respectively.

So, the new length, breadth and height are 6k, k and k/2 respectively.

Area of four walls = (2 × length × height) + (2 × breadth × height)

Original area of four walls=$(2\times3k\times k)+(2\times2k\times k)=6k^2+4k^2=10k^2$

New area of four walls=$(2\times6k\times k/2)+(2\times k\times k/2)=6k^2+k^2=7k^2$

So, Area of walls decreases by=$[(10k^2-7k^2)/10k^2]\times100=(3k^2)/10k^2\times100=30\%$

Q41.B

Q41 Solution:-

Let the thikness of box be t cm.

Then the inner dimensions will be (10−2t),(9−2t) and (7−2t).

So, the inner surface area will be=$2\times[(10-2t)(9-2t)+(10-2t)(7-2t)+(9-2t)(7-2t)] = 262$

Solving we get t=7.

Q42.B

Q42 Solution:-

If the lengths of the two line sides are a cm and b cm, the difference in areas of the two squares is, $a^2-b^2=(a+b)(a-b)=32$, where a is the longer line side.

As $a-b=2$, we have,

$2(a+b)=32$,

Or, $a+b=16$.

Adding this result with the equation of $a-b=2$,

$2a=18$,

Or, $a=9$ cm.

Q43.C

Q43 Solution:-

Let each side of the square be X. Then, area = X^2.

New side $=(116X/100)=(29X/25)$. New area = $(29X/25)^2$

Increase in area = $(29X/25)^2 - X^2 = 841/625X^2 - X^2 = 216/625X^2$

⇒ Increase% = $[(216/625X^2 x 1/(X^2))100]$ % = 34.56%.

Q44.D

Q44 Solution:-

Let one side of the Δ be =a

Perimeter of equilateral $\Delta=3a$

⇒ $3a=72\sqrt{3}$

⇒ $a=24\sqrt{3}$

Height =AC by pythagoras theorem

$AC^2=a^2-(a/2)^2$

$AC^2=a^2\times[1-(1/2)^2]$

$AC^2=a^2\times[1-1/4]$

$AC^2=a^2\times3/4$

Now, putting, $a=24\sqrt{3}$

⇒ $AC^2=24^2\times3\times3/4$

⇒ $AC=24\times3/2$

AC=36 cm

Q45.B

Q45 Solution:-

Side of first square = (80/4) = 20 cm;

Side of second square = (64/4)cm = 16 cm.

Area of third square = [(20)2 (16)2] sq. cm.

= (400 - 256) sq. cm. = 144 sq. cm..

Side of third square = √144 cm = 12 cm.

Required perimeter = (12 x 4) cm = 48 cm.

Q46.D

Q46 Solution:-

Let the radius of the park be r

Then, ATP;

$2\pi R=440$

=> $2x22/7xR=440$

=> $R=(440x\ 7/44)=70$ m

Outer radius = 70m, inner radius = (70-7) =63 m

Required area = $\pi[(70)^2-(63)^2]$ sq. mtr.

= 22/7 x(70+63) (70-63) sq. mtr.
= (22x133) sq. mtr., = 2926sq. mtr.

Q47.B
Q47 Solution:-

Length = 15cm, area = 150sq. cm..
Breadth = 150/15 cm = 10cm
Since it is to be expanded to 4/3rd the new area will be 150x4/3 = 200 sq unit
So, New length = 200/10 cm = 20cm
So, New perimeter = 2(l + b) = 2(20+10) cm = 60 cm

Q48.C
Q48 Solution:-

2(l+b)= 46 ⇒(L+b)=23
√ (a^2+b^2) = 17 ⇒ (L^2+b^2) =289
⇒ (L^2+b^2) = (L+b) ^{2}-2Lb
⇒ 289 = $(23)^2$-2Lb ⇒ 2Lb= 529-289=240
⇒ Lb=120
∴ Area =120 sq. cm.

Q49.A
Q49 Solution:-

We know the area of diagonals is 1/2 x (product of diagonals)
Let the other diagonal be X
So, 300 = 1/2 x X x 20
⇒ X=30 cm.

Q50.B

Q50 Solution:-

Side of first square = (40/4) = 10 cm;
Side of second square = (32/4)cm = 8 cm.
Area of third square = [(10) 2 - (8) 2] sq.cm. = (100 - 64) sq.cm. = 36 sq.cm..
Side of third square = (36)(1/2) cm = 6 cm.
Required perimeter = (6 x 4) cm = 24 cm.

Q51.A

Q51 Solution:-

Shortcut:
If two diagonals of a rhombus is given as d_1 and d_2 then it's Perimeter $=2\sqrt{(d_1^2+d_2^2)}$
So, It's Perimeter $=2\sqrt{(20^2+10^2)} = 20\sqrt{5}$ cm

Q52. B

Q52 Solution:-

Let the two parallel sides of the trapezium be X cm and Y cm.
Then, X - Y = 8
And, (1/2) x (X+ Y) x 38 = 950 [area of trapezium =1/2(x+y).d]
⇒ (X +Y) = ((950 x 2)/38)
⇒ X + Y = 50
Solving (i) and (ii), we get: X = 29, Y = 21.
So, the two parallel sides are 29 cm and 21 cm.

Q53.D

Q53 Solution:-

Let, side of square = side of equilateral triangle = x
Ratio of their areas = $x^2 : \sqrt{3}x^2/4 = 4:\sqrt{3}$

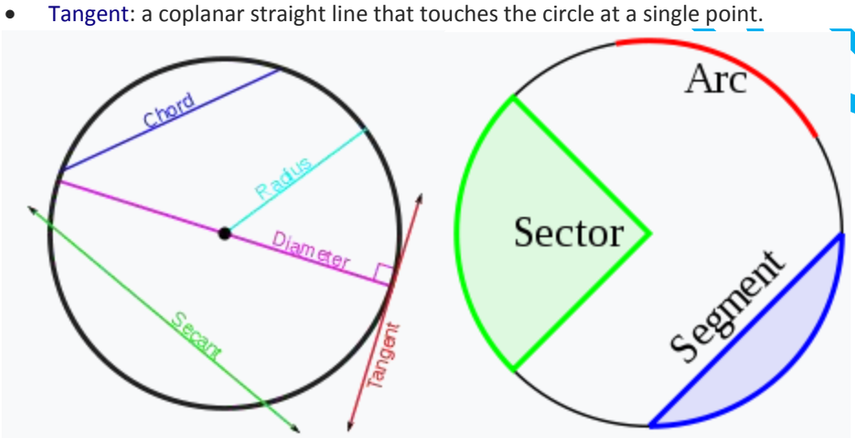
"Strength does not come from winning. Your struggles develop your strengths. When you go through hardships and decide not to surrender, that is strength."

CIRCLE

A **circle** is a simple closed shape in Euclidean geometry. It is the set of all points in a plane that are at a given distance from a given point, the centre; equivalently it is the curve traced out by a point that moves so that its distance from a given point is constant. The distance between any of the points and the centre is called the radius.

SOME DEFINITIONS:

- Arc: any connected part of the circle.
- Centre: the point equidistant from the points on the circle.
- Chord: a line segment whose endpoints lie on the circle.
- Circumference: the length of one circuit along the circle, or the distance around the circle.
- Diameter: a line segment whose endpoints lie on the circle and which passes through the centre; or the length of such a line segment, which is the largest distance between any two points on the circle. It is a special case of a chord, namely the longest chord, and it is twice the radius.
- Radius: a line segment joining the centre of the circle to any point on the circle itself; or the length of such a segment, which is half a diameter.
- Sector: a region bounded by two radii and an arc lying between the radii.
- Segment: a region, not containing the centre, bounded by a chord and an arc lying between the chord's endpoints.
- Secant: an extended chord, a coplanar straight line cutting the circle at two points.
- Semicircle: an arc that extends from one of a diameter's endpoints to the other. In non-technical common usage it may mean the diameter, arc, and its interior, a two dimensional region, that is technically called a half-disc. A half-disc is a special case of a segment, namely the largest one.
- Tangent: a coplanar straight line that touches the circle at a single point.



Chord, secant, tangent, radius, and diameter Arc, sector, and segment

FORMULA REATED TO CIRCLE:

Diameter = 2 x radius of circle

Circumference of Circle = **PI x diameter** = 2 PI x radius
where **PI** = π **= 3.141592...**

Area of Circle:

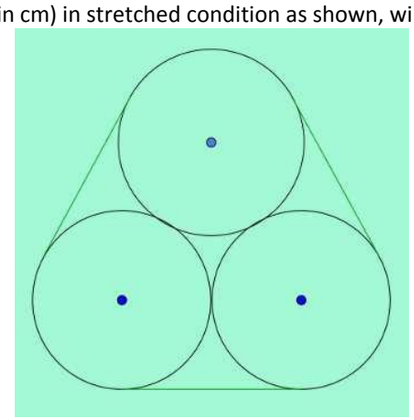
area = PI r^2

Length of a Circular Arc: (with central angle θ)
if the angle θ is in degrees, then length = θ x (PI/180) x r
if the angle θ is in radians, then length = r x θ

Area of Circle Sector: (with central angle θ)
if the angle θ is in degrees, then area = (θ/360)x PI r^2
if the angle θ is in radians, then area = ((θ/(2PI))x PI r^2

----------EXERCISE----------

Q1. Three circles of radius 5 cm each are bound together by a rubber band as shown in the given figure, Then length of the rubber band (in cm) in stretched condition as shown, will be:



A. 30+10π. B. 20+10π. C. 30+20π. D. None

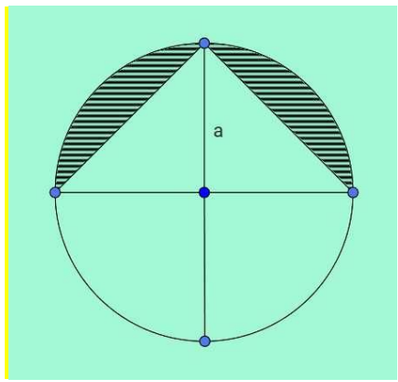
Q2. Three circles of radius 5.5 cm, 4.5 cm and 3.5 cm touch each other externally. The perimeter of the triangle formed by joining the centres of the circles (in cm) is,

A. 0 B. 18 C. 27 D. None

Q3. The maximum area of a circle that can be drawn inside a square of side 14cm is:

A 84 sq. cm. B 154 sq. cm. C 204 sq. cm. D 176 sq. cm.

Q4. Find the area of the shaded region given in figure where the radius of the circle is a:



A. $a^2(\pi/2-1)$ B. $a^2(\pi^2-1)$ C. $a^2(\pi/3-1)$ D. None

Q5. Three circles of radius a, b and c touch each other externally. The area of the triangle formed by the three centres is,

A. $\sqrt{[(a+b+c)abc]}$ B. $\sqrt{(a^2+b^2+c^2)}$ C. $\sqrt{abc/2}$ D. None

Q6. A circle having radius 5.25 cm. Find the area of major sector formed by it's chord AB that makes an angle of 60°at centre.

A. 168 sq. cm. B. 100 sq. cm. C. 74.61 sq. cm. D. 70 sq. cm.

Q7. The circumference of a circle is 11 cm. The area of a sector of the circle subtending an angle of 60^0 at centre is:

A. 71/48 B. 73/48 C. 77/48 D. None

Q8. If the difference between the areas of the circumcircle and incircle of an equilateral triangle is 44 cm^2, then the area of the triangle (in cm^2, take π=22/7), is,

A. $11\sqrt{3}cm^2$ B. $14\sqrt{3}cm^2$ C. $22\sqrt{3}cm^2$ D. None

Q9. When a wire is bent in the form of a square it has an area of 484 sq cm. What will be the area when the same wire is bent in the form of a circle?

A. 576sq cm B. 616sq cm C. 676sq cm D. 1000m

Q10. Ratio between area and circumference of a circle with radius 99 cm is:
A. 99:1 B. 99:2 C. 99:4 D. 99:8

Q11. If the perimeter of a circle, a square and an equilateral triangle are same and their areas are C, S and T respectively which of the following is true?
A. C>S>T B. C>S=T C. C=S>T D. C=S=T

Q12. If arcs of same length in two circles subtend angles 60^0 and 75^0 at their centre, the ratio of their radius will be:
A. 5 : 4 B. 7 : 4 C. 9 : 4 . D. 11 : 4

Q13. Two circles with centres A and B and radius 2cm touch each other externally at C. A third circle with centre at C and radius 2cm meets the other two at D and E on the same side of the line AB joining the two centres. Then the area of the quadrilateral ABED will be:
A. 2√3 sq cm B. 3√3 sq cm C. 4√3 sq cm D. None

Q14. There are five concentric squares. If the area of the circle inside the smallest square is 77 square units and the distance between the corresponding corners of consecutive squares is 1.5 units, find the difference in the areas of the outermost and innermost square.
A. 1254 Sq.units B. 1008 Sq.units C. 877 Sq.units D. 240 Sq.units

Q15. When increasing the radius of a circle by 1 cm the area of a circle increases by 22 sq.cm. Then what is the diameter of the circle.
A. 1 B. 2 C. 4 D. 6

Q16. Find the ratio of the areas of the incircle and circumcircle of a square.
A. 1 : 2 B. 1 : 3 C. 1 : 4 D. 1 : 5

Q17. If the radius of a circle is decreased by 50%, find the percentage decrease in its area.
A. 25% B. 45% C. 75% D. 95%

Q18. The inner circumference of a circular race track, 14 m wide, is 440 m. Find radius of the outer circle.
A. 51m B. 54m C. 69m D. 84m

Q19. Two concentric circles form a ring. The inner and outer circumferences of ring are (352/7) m and (518/7) m respectively. Find the width of the ring.
A. 1m B. 4m C. 9m D. 16m

Q20. A sector of 120^0, cut out from a circle, has an area of (66/7) sq. cm. Find the radius of the circle.
A. 1cm B. 3cm C. 9cm D. 16cm

Q21. ABC is an equilateral triangle of side 2cm. With A, B, C as centre and radius 1 cm three arcs are drawn. The area of the region within the triangle bounded by the three arcs is,
A. (√3−π/2) sq cm. B. (√3−π/3) sq cm. C. (√3−π/4) sq cm. D. NONE

Q22. A wheel makes 2000 revolutions in covering a distance of 44 km. Find the radius of the wheel.
A 12 m B 14 m C 13 m D 15 m

Q23. Two equal maximum sized circular plates are cut-off from a circular paper-sheet of circumference 352 cm. The circumference of each circular plate is,
A. 100 B. 176 C. 221 D. None

Q24. The area of a circular field is 6.7914 hectares. Find the cost of fencing it at the rate of Rs. 2.20 Per meter.
A Rs. 20328 B Rs. 10528 C Rs. 20444 D Rs. 24562

Q25. A wheel makes 1000 revolutions in covering a distance of 88 km. Find the radius of the wheel.
A. 1m B. 4m C. 9m D. 14m

Q26. The diameter of the driving wheel of a bus is 140 em. How many revolution, per minute must the wheel make in order to maintain a speed of 66 kmph ?
A. 250 B. 400 C. 900 D. 1600

Q27. The area of a circular field is 13.86 hectares. Find the cost of fencing it at the rate of Rs. 4.40 per metre.
A. Rs. 4808 B. Rs. 5808 C. Rs. 6808 D. Rs. 7808

Q28. Four equal sized maximum circular plates are cut off from a square paper sheet of area 784 sq. cm. The circumference of each plate is:

A. 22 cm B. 44 cm C. 66 cm D. 88 cm

Q29. The radius of the front wheel of an engine is x cm and that of rear wheel is y cm. To cover the same distance, find the number of times the rear wheel will revolve when the front wheel revolves n times.

A. n/xy times B. nx/y times C. ny/x times D. C=S=T

Q30. The diameter of a circular wheel is 7m. How many revolutions will it make in travelling 22km?

A. 10. B. 100 C. 1000 D. 10000

This chapter contains the topics and questions I discussed and created in our classes or obtained from students as their doubts. All the questions noted, typed, redesigned and rectified by group of volunteers consisting of:

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----------ANSWERS----------

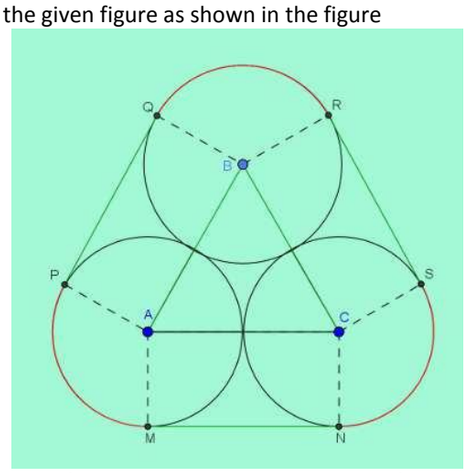
Q1.A	**Q2.C**	**Q3.B**	**Q4.A**	**Q5.A**
Q6.C	**Q7.C**	**Q8.B**	**Q9.B**	**Q10.B**
Q11.A	**Q12.A**	**Q13.B**	**Q14.D**	**Q15.D**
Q16.A	**Q17.C**	**Q18.D**	**Q19.B**	**Q20.B**
Q21.A	**Q22.B**	**Q23.B**	**Q24.A**	**Q25.D**
Q26.A	**Q27.B**	**Q28.B**	**Q29.B**	**Q30.C**

----------ANSWERS AND SOLUTION----------

Q1.A

Q1 Solution:-

Let us construct the given figure as shown in the figure

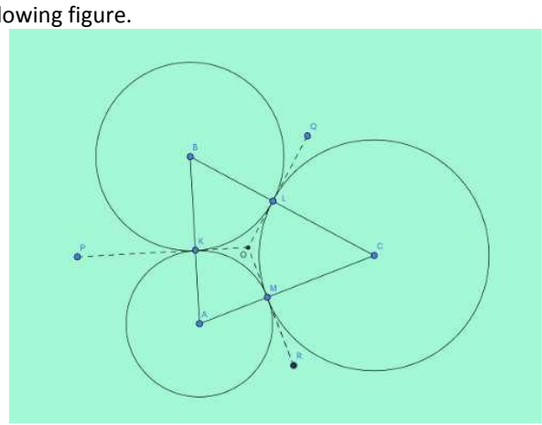


We can see that the total length of the rubber band will comprise of three pairs of,
length of tangent section between a pair of circles coloured green, say, PQ
length of sector of one circle held by the angle between two perpendiculars to the tangents coloured red, say, QR.As PQ is a tangent to the two circles each of equal diameter 10cm, ABQP form a rectangle and PQ=AB=10cm.
Being perpendiculars to the common tangent PQ, the sides AP||BQ and also being radius of same length 5 cm, AP=BQ. So AB||PQ and AB=PQ forming rectangle ABQP.
There are three such tangent sections in the total length, that total up to 30 cm.
Three sides of $\triangle ABC$ being equal, it is an equilateral triangle and $\angle ABC=60^0$. So,
$\angle QBR=360^0-2\times90^0-60^0=120^0$, which is one third of 3600 and so the arc length QR is one-third of perimeter of one circle, that is $13\times10\pi$. Three such arcs total up to 10π.
So total length of the rubber band is, $30+10\pi$.

Q2.C

Q2 Solution:-

ATP:
We construct The following figure.



So any two perpendiculars from two centres to the same tangent will actually be one single line forming one side of the triangle that will comprise of one part radius of one circle and second part radius of second circle. The same is true for the other two sides of the triangles.
Side AB=AK+KB
$=r_1+r_2$
=3.5+4.5

=8 cm,
Side AC=AM+MC
$=r_1+r_3$
=3.5+5.5
=9 cm, and
Side CB=CL+LB
$=r_3+r_2$
=5.5+4.5
=10 cm, that is,
a total of 10+9+8=27 cm.

Q3.B

Q3 Solution:-

seeing the figure we can conclude that:

2r = side of square

----------2r----------

---------14 cm ----------

Radius of the circle =14/2 =7 cm
Area of the circle = $(22/7x7^2)$ sq. cm.= 154 sq. cm.

Q4.A

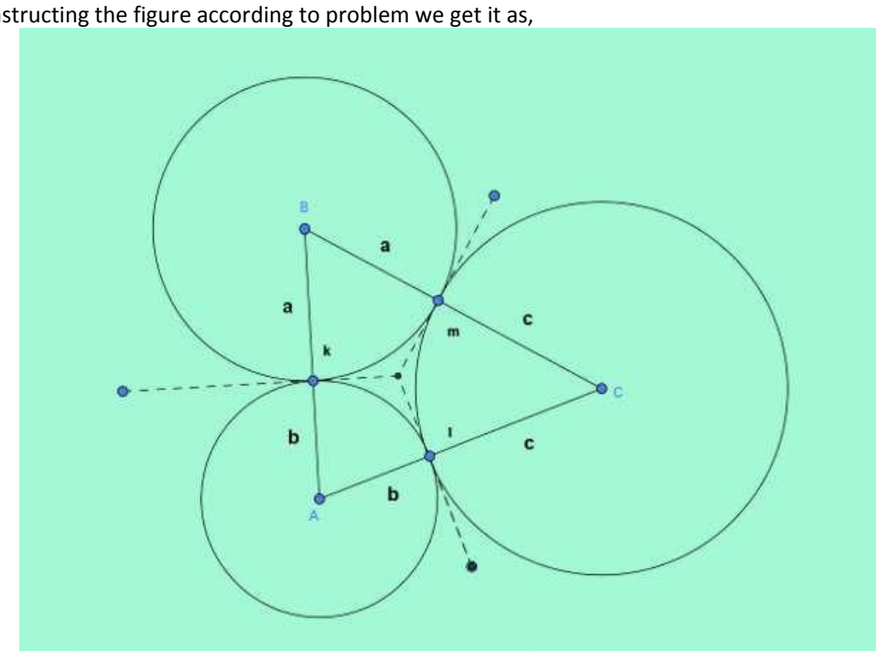
Q4 Solution:-

The triangle formed by the horizontal diameter is a right triangle (as all diameters subtend a 900 angle at the periphery) with two inclined sides equal and the vertical radius as the perpendicular bisector of the base.
Area of this triangle = a^2.
Area of the semi-circle = $\pi a^2/2$.
So, area of the shaded region = $1/2\pi a^2 - a^2 = a^2(\pi/2-1)$

Q5.A

Q5 Solution:-

Constructing the figure according to problem we get it as,



Seeing the figure we can conclude that, the three sides of the triangle are,
k=a+b
l=b+c, and

m=c+a.
The half perimeter of the triangle is then,
s=(k+l+m)/2=a+b+c.
Using Herone's farmulae we get the area as..
A=√[s(s−x)(s−y)(s−z)] where x, y and z are the three side lengths.
putting values we get area as: A=√[(a+b+c)abc].

Q6.C

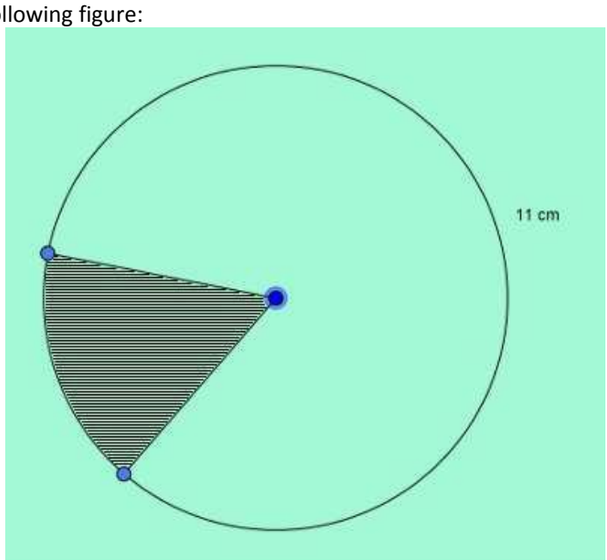
Q6 Solution:-

Clearly The given triangle will be an equilateral triangle
Area of circle = $\pi\times(5.25)^2$ = 86.54
Area of the minor sector
$=60^0/360^0\times\pi\times(5.25)^2$=14.4375 sq. cm.
Area of the triangle =$3\sqrt{4}\times5.25^2$=11.93 sq. cm.
Area of the major sector = Area of the circle - Area of the minor sector
=86.54 sq. cm.− 11.93 sq. cm.=74.61 sq. cm.

Q7.C

Q7 Solution:-.

Considering the following figure:



The circumference is,
2πr=11, where r is radius
Or, 2×22r=7×11
Or, r=7/4 cm
Area subtended by 60^0 sector is one-sixth of the total area (As 60^0 is one-sixth of 360^0 the whole angle covering the circle).
So area of the sector = 1/6×22/7×49/16=77/48 cm^2.

Q8.B

Q8. Solution:-

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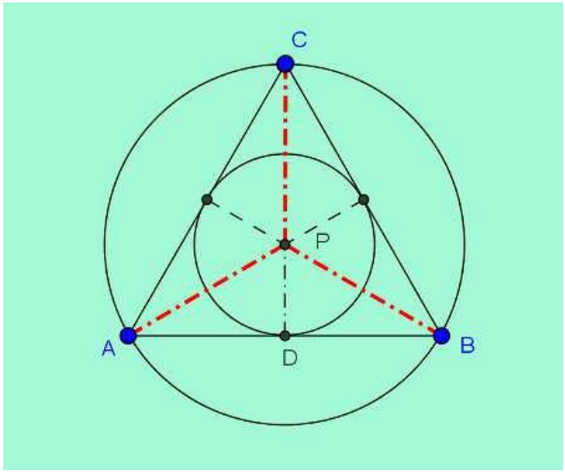


The circumcentre and incentre of the equilateral triangle is the same point P and the perpendicular bisector CD and the other two such bisectors from vertices A and B intersect at P which in this case is also the centroid and CD is a median.

Let's assume side length of the triangle be a.

So, $CD=\sqrt{[a^2-(1/2a)^2]}=\sqrt{3}/2a$.

CD being the median, PD is one-third of CD, that is,

$PD=1/(2\sqrt{3})a$

Similarly, CP is two-third of CD, that is,

$CP=a/\sqrt{3}$.

So, difference in the areas of the circles,

$Ac-Ai=\pi(CP^2-PD^2)$

$=\pi a^2(1/3-1/12)$

$=1/4\pi a^2$

$=44$

Or, $a^2=56$

The area of the equilateral triangle with side length a is,

$At=\sqrt{3}/4a^2$

$=\sqrt{3}/4x56=14\sqrt{3}cm^2$.

Q9.B

Q9. Solution:-

Let the side of the square is a cm,

$a^2=484=22^2$

So, $a=22$ cm.

Periphery of the square is then = $4\times22=88$ cm.

This peripheral length of the wire will then enclose a circular area.

So, if the radius of the circular area is rr cm,

$2\pi r=88$,

Or, $r=14$ cm.

The area of the circular area is then,

$A=\pi r2=22/7\times14^2=616$sq cm.

Q10.B

Q10 Solution:-

Area of a circle= πR^2 ----------(i)

Circumference = $2\pi R$----------(ii)

Ratio between (i) and (ii) is $\pi R^2 : 2\pi R = R:2$

Putting R=99 we get 99:2

Q11.A

Q11 Solution:-

As the perimeters are equal, we have,

$2\pi r=4a=3d$,

This gives,

$d=4/3a$,

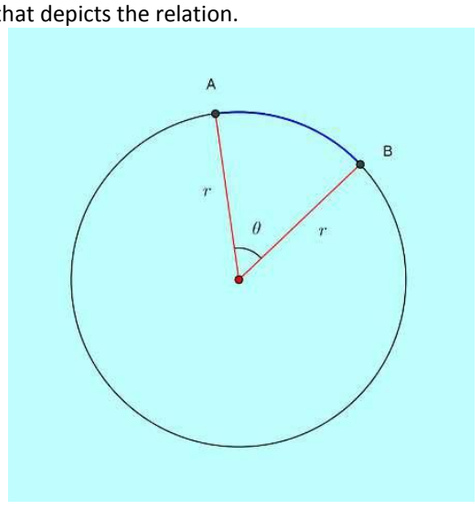
$a=1/2\pi r$, and

$d=2/3\pi r$.

We will now use these relationships in comparing the areas. The areas of the circle, square and the equilateral triangle are,
$C=\pi r^2$,
$S=a^2$, and
$T=\sqrt{3}/4d^2$.
Comparison of C and S
$S=(\pi/4)\pi.r^2=x.C$, where $x=\pi/4=3.1472/4<1$ as $\pi=3.1472$.
So,
C>S.
Comparison of C and T
$T=\sqrt{3}/4d^2$
$=\sqrt{3}/4.(4/9)\pi\pi r^2$
$=\pi/(3\sqrt{3}).C=y.C$ where $y=\pi/(3\sqrt{3})-\sqrt{=3.14723\times1.7=3.14725.1<1/y=\pi33=3.1472/(3\times1.732)=3.1453/5.1<1}$
So C>T.
Comparison of S and T
As S=(3.1472/4)C, and
T=(3.1572/5.1)C,
S>T, as the denominator of T is greater than that of S.
Finally then the required relationship is,
C>S>T.

Q12.A
Q12 Solution:-

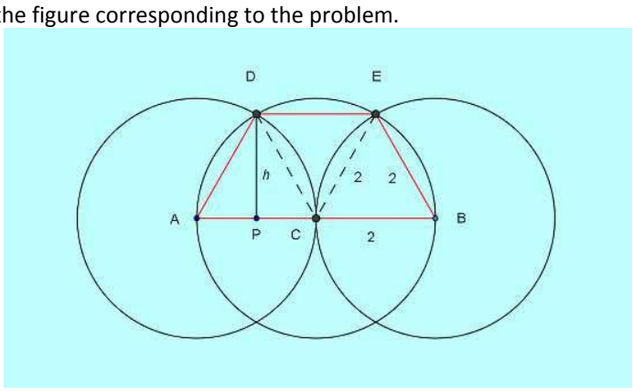
By definition, in a circle of radius rr the length of an arc AB subtending an angle θ at the centre is,
Arclength of AB=rθ, where θ is in radians.
The following is the figure that depicts the relation.



So for same arc length in two circles of radius r1 and r2,
$r_1\theta_1=r_2\theta_2$,
Or, $r_1:r_2=\theta_2:\theta_1=750:600=5:4$.
As the angles are in a ratio, the ratio of angles in radians will be same as ratio of angles in degrees.

Q13.B
Q13 Solution:-

The following is the figure corresponding to the problem.



Being radius of three circles of length 2cm each,
AD=AC=CD, and
BC=BE=CE.
So both △ACD and △CBE are equilateral triangles of side length 2cm. Also,

∠ACD=∠BCE=60^0, so that,
∠DCE=600.
In isosceles △DCE then, vertex angle is 600 and two sides,
CD=CE=2cm which makes this triangle also equilateral.
Finally then the quadrilateral ABED consists of three equilateral triangles of side length 2cm.
Area of each equilateral triangle is,
At=1/2X2√(2^2−1^2)= √3 sq cm.
So the required area of the quadrilateral ABED=3√3 sq cm.

Q14.D

Q14 Solution:-

Here we see that diameter of the circle is equal to the side of the innermost square that is,
πr^2=77
22/7r^2=77
r^2=77.7/22
r^2=49/2
r=7/√2
r=3.5√2
2r=7√2
Then the diagonal of the square is 14 sq.units.
Which means the diagonal of the fifth sqaure would be 14+12 units = 26.
Which means the side of the fifth square would be 26/√2=13√2
So, the area of the fifth sqaure =(13√2)^2=338 sq.units.
Area of the first square =98 sq.units.
So, the difference would be 338−98=240 sq.units.

Q15.D

Q15 Solution:-

Let r be the original radius then it's area will be πr^2],
Then after increasing 1 cm it will be (r + 1) cm it's area will be $\pi(r+1)^2$
Now, ATP:
$\pi(r+1)^2 - \pi r^2 = 22$
Or, 22=π[$(r+1)^2$−r^2],
Or, 2r+1=7,
Or, r=3 cm.
So, Diameter is 2xr=6 cm.

Q16.A

Q16 Solution:-

Let the side of the square be x. Then, its diagonal = x√2.
Radius of incircle = (x/2)
Radius of circum circle= x√2/2 =x/√2
Required ratio = $\pi r^2/4 : \pi r^2/2 = (1/4) : 1/2) = 1 : 2$.

Q17.C

Q17 Solution:-

Let original radius = R. New radius =(50/100) R = (R/2)
Original area=$(R)^2$= and new area= $((R/2))^2$= $\pi R^2/4$
Decrease in area =(3π R^2)/4 X (1/πR^2) X 100) % = 75%

Q18.D

Q18 Solution:-

Let inner radius be r metres. Then, 2πr = 440
⇨ r = (440 x (7/44))= 70 m.
Radius of outer circle = (70 + 14) m = 84 m.

Q19.B

Q19 Solution:-

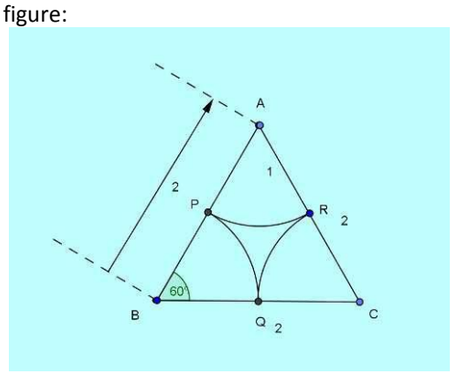
Let the inner and outer radii be r and R metres.
Then 2πr = (352/7)
⇨ r =((352/7) X (7/22) X (1/2))=8m.
2πR=(528/7)
⇨ R=((528/7) X (7/22) X (1/2))= 12m.
So, Width of the ring = (R - r) = (12 - 8) m = 4 m.

Q20.B

Q20. Solution:-

Let the radius of the circle be r cm. Then,
ATP
$(120/360)\pi r^2=(66/7)$
⇨ $(22/7) X (r) 2 X(120/360)= (66/7)$
$r^2=((66/7) X (7/22) X 3)$
⇨ r=3.
So, radius = 3 cm.

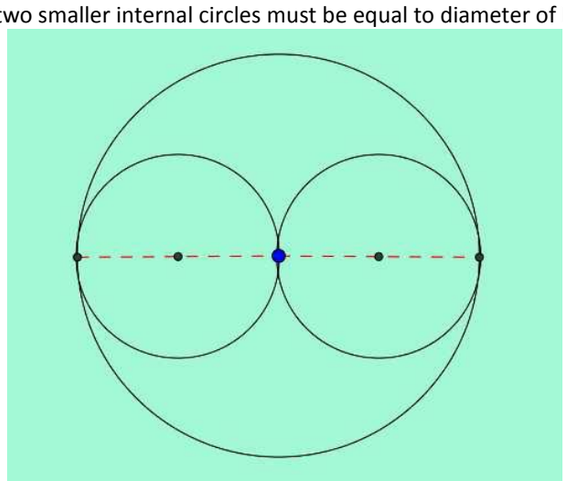
Q21.A
Q21 Solution:-
Considering the following figure:



The required area is,
Area of the triangle−Area covered by the three arcs
Area of the equilateral triangle with side length 2cm is= $1/2\times2\times\sqrt{(2^2-1^2)}= \sqrt{3}$ sq cm
Area of the circle covering 3600 and radius 1cm $=\pi 1^2$ sq cm=. π sq cm
So area of arc covering 600 and with 1 cm radius =π/6 sq cm.
Total area of the three such arcs is then =π/2 sq cm.
So the required area is = (√3−π/2) sq cm.

Q22.B
Q22 Solution:-
Distance covered in one revolution = ((44 X 2000)/1000) = 88m.
⇒ $2\pi R = 88$
⇒ $2 \times (22/7) \times R = 88$
∴ $R = 88 \times (7/44) = 14$ m.

Q23.B
Q23 Solution:-
To cut two equal and maximum sized circles out of the large circle as shown in the figure, the sum of the diameters of the by the two smaller internal circles must be equal to diameter of larger circle.



As the perimeter of a circle with diameter d, is P=2πr, the perimeter of each of the smaller circular paper plate with half the diameter of the larger circular paper will be half the perimeter of the larger circular paper, which in this case will be,
=352/2=176 cm.

Q24.A
Q24 Solution:-
Area = (6.7914 x 10000) sq. mtr.= 67914 sq. mtr..
$\pi R^2= 67914$
⇒ $(R)^2 = (67914 \times (7/22)) \Leftrightarrow R = 147$ m.

Circumference = 2 π R = (2 x (22/7) x 147) m = 924 m.
Cost of fencing = Rs. (9240 x 2.20) = Rs. 20328.

Q25.D

Q25 Solution:-

Distance covered in one revolution =((88 X 1000)/1000)= 88m.
2πR = 88
⇨ 2 x (22/7) x R = 88
⇨ R = 88 x (7/44) = 14 m.

Q26.A

Q26 Solution:-

Distance to be covered in 1 min. = (66 X1000)/(60) m = 1100 m.
Circumference of the wheel = (2 x (22/7) x 0.70) m = 4.4 m.
Number of revolutions per min. =(1100/4.4) = 250.

Q27.B

Q27 Solution:-

Area = (13.86 x 10000)m^2= 138600m^2.
πR^2= 138600
⇨ $(R)^2$ = (138600 x (7/22))
⇨ R = 210 m.
Circumference = 2πR = (2 x (22/7) x 210) m = 1320 m.
Cost of fencing = Rs.(1320 x 4.40) = Rs. 5808.

Q28.B

Q28 Solution:-

Consider the diagram given below:
Side of square paper =√784 cm =28 cm
Radius of each circular plate =14×28cm =7 cm
Circuference of each circular plate=2×22/7×7=44 cm

Q29.B

Q29 Solution:-

The distance travelled by each wheel would be number of revolutions times the perimeter of the wheel.
As the distance travelled is same, we have,
n×2π×x=m×2π×y, where mm is the number of revolutions of the rear wheel. So,
m=nx/y times.

Q30.C

Q30 Solution:-

For each complete revolution of the wheel, the distance covered is equal to the perimeter of the wheel
Perimeter=2π×72=22 m
So to cover a distance of 22 km or 22000 m, Number of revolution will be 22000/22 = 1000 revolutions needed.

A minute's success pays the failure of years. -Robert Browning

SURFACE AREA AND VOLUME

SOLID:

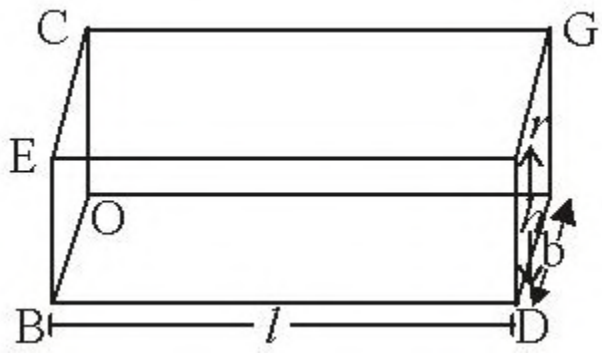
A physical body which occupies some space is called a solid. It has three dimensions in space called length, breadth and height.

Example: a brick, a table, a ball ,an antenna etc.

VOLUME:

The space occupied by a solid body is called its volume. Cubic centimeters (cm^3) and cubic meters (m^3) are the common units of volume.

Cuboid or Rectangular Parallelepiped: It is a solid with six rectangular faces.



If length, breadth and height of a cuboid are *l*, *b* and *h* respectively then,

(i) Volume of cuboid = $l \times b \times h$

= area of base × height cu. units

(ii) Total surface area of

cuboid = $2(lb + bh + hl)$ sq. units

(iii) Curved surface area of cuboid or surface

Area of 4 walls = $2(l + b) \times h$ sq. units

(iv) Diagonal of cuboid = $\sqrt{l^2 + b^2 + h^2}$ units

(v) Height of cuboid = $\frac{\text{volume}}{\text{base area}}$ units

(vi) Area of base = $\frac{\text{volume}}{\text{height}}$ sq. units

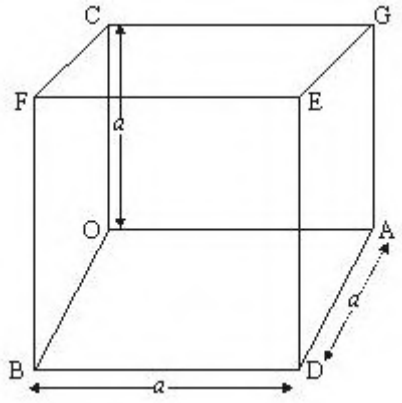
(vii) Surface area of cuboid, in which top face is open = $lb + 2(bh + hl)$ sq. units

(viii) Diagonals of faces of cuboid = $\sqrt{l^2+b^2}, \sqrt{b^2+h^2}, \sqrt{h^2+l^2}$ units

(ix) Perimeter of the cuboid = $4(l + b + h)$ units

CUBE

Cube is a rectangular solid. It has six faces in which every face is a square. Let each edge of a cube measures 'a' then



(i) Volume of a cube = a^3 cu. units

(ii) Total surface area of cube = $6a^2$ sq. units

(iii) Curved surface area of cube = $4a^2$ sq. units

(iv) Diagonal of cube = $a\sqrt{3}$ units

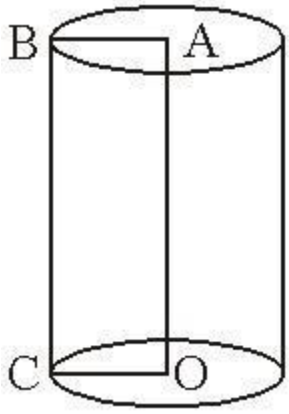
(v) Edge of cube = $(\text{volume})^{1/3}$ units

(vi) Diagonal of face of the cube = $a\sqrt{2}$ units

(vii) Perimeter of the cube = 12 a units

RIGHT CIRCULAR CYLINDER:

A solid generated by the revolution of a rectangle about one of its sides is called a right circular cylinder. In given figure OA is called the axis of the cylinder.



Let OA = height of the cylinder = h and AB = OC = radius of the base of the cylinder = r

then we have

(i) Area of the base of a right circular cylinder = πr^2 sq. units

(ii) Area of the curved surface of a right circular cylinder

= Circumference of the base × Height

= $2\pi rh$ sq. units

(iii) Total surface area of a right circular cylinder

= Area of curved surface + 2 × Base area

= $(2\pi rh + 2\pi r^2)$ sq. units

= $2\pi r\,(r + h)$sq. units

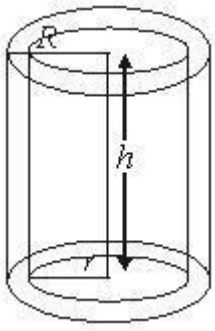
(iv) Volume of a right circular cylinder = Area of base × height

= (πr^2) x h cu. units

= $\pi r^2 h$ cu. units

HOLLOW CYLINDER:

A hollow cylinder is a solid bounded by two coaxial cylinders of the same height and different radii.
If *R* and *r* be the external and internal radii of a hollow cylinder and *h* be its height, then



(i) Each base surface area = $\pi(R^2 - r^2)$ sq. units

(ii) Curved surface area = (External surface area) + (Internal surface area)

= $2\pi Rh + 2\pi rh$

= $2\pi h (R + r)$

(iii) Total surface area = (External surface area) + (Internal surface area) + 2 (base area)

= $2\pi Rh + 2\pi rh + 2\pi(R^2 - r^2)$

= $2\pi h(R + r) + 2\pi (R + r) (R - r)$

= $2\pi(R + r)(h + R - r)$ sq. Units

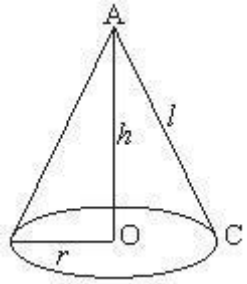
(iv) Volume of the material = Exterior volume – interior volume

= $\pi R^2h - \pi r^2h$

= $\pi h (R^2 - r^2)$

RIGHT CIRCULAR CONE:

If a right angled triangle is revolved about one of the sides containing a right angle, the solid So, formed is called a right circular cone.



A right circular cone can be also defined as a solid generated by revolving a line segment which passes through a fixed point and which makes a constant angle with a fixed line. In given figure we have, the fixed point A is called vertex of the cone and the fixed line AO is called the axis of the cone.

The base of a right circular cone is in circular shape such that the line joining vertex to the center of the circle is perpendicular to the base.

The length of the line segment joining the vertex to any point on the circular edge of the base is called the slant height of the cone.

Let Height of the cone = OA = h

Radius of the base of the cone = OB = r

And slant height of the cone = OC = l

Then we have

(i) Slant height = l = $\sqrt{r^2 + h^2}$ units

(ii) Area of base = $\pi r^2 h$ sq. units

(iii) Volume = 1/3 × (Area of base) × Height

= $1/3\ \pi r^2 h$ cu units

(iv) Curved surface area = $\pi r l$ sq. units

(v) Total surface area = Area of circular base + curved surface area

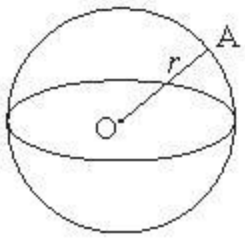
= $(\pi r^2 + \pi r l)$ sq. units

= $\pi r (r + l)$ sq. units

Note: (i) If the base of a cone is not circular or if the line joining the vertex to the centre of the base is not perpendicular to the base then the cone is not right circular cone.

(ii) If a circle is revolved about its one of the diameter, then the solid formed is a sphere. A sphere can be described as a set of all those points in space, which are equidistant from a fixed point.

The fixed point is called the centre of the sphere and the constant distance between the centre and any point on the sphere is called radius of the sphere.



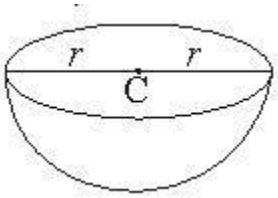
Let the radius of the sphere be r, then

(i) Volume of the sphere = $4/3\ \pi r^3$ cu. units

(ii) Surface area of the sphere = $4\pi r^2$ sq.units

HEMISPHERE:

A plane passing through the centre of a sphere divides the sphere into two equal parts. Each part is called a hemisphere.



Let the radius of the hemisphere be *r*, then

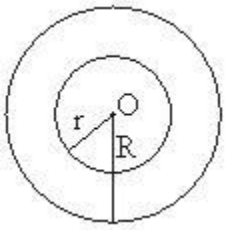
(i) Volume of the hemisphere = $2/3\ \pi r^3$ cu. units

(ii) Curved surface area = $2\pi r^2$ sq. units

(iii) Total surface area = $3\pi r^2$ sq. units

SPHERICAL SHELL:

The difference of two solid concentric spheres is called a spherical shell.



Let the outer radius and inner radius of a spherical shell are *R* and *r* respectively, then

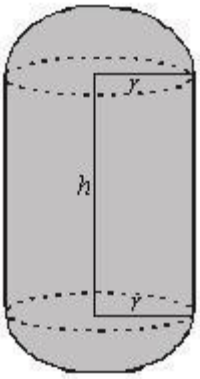
(i) Volume of spherical shell = $4/3\pi\ (R^3 - r^3)$ cub. Units

(ii) External surface area = $4\pi R^2$ sq. units

(iii) Internal surface area = $4\pi r^2$sq. units

SURACE AREA OF COMBINATION OF SOLIDS:

I. Total surface area of the solid given in figure = Curved surface area of one hemisphere



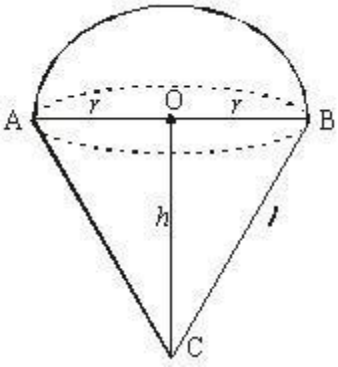
+ Curved surface area of right circular cylinder
+ Curved surface area of other hemisphere

$= 2\pi r^2 + 2\pi rh + 2\pi r^2$

$= 4\pi r^2 + 2\pi rh$

$= 2\pi r\,(2r + h)$

II. Total surface area of the solid [like toy / top (lattu)] (given in figure)



= Curved surface area of hemisphere + curved surface area of cone

$= 2\pi r^2 + \pi rl$

$= \pi r\,(2r + l)$

SURFACE AREA AND VOLUME

----------EXERCISE----------

Q1. A cone and sphere have the same radius of 12 cm. Find the height of the cone if they have equal volume.

A. 18 cm B. 24 cm C. 36 cm D. 48 cm

Q2. Water flows into a tank which is 200 m long and 150 m wide, through a pipe of cross-section (0.3m x 0.2m) at 20 kmph. In what time will the water level be 8?

A 100 hrs B 150 hrs C 175 hrs D 200 hrs

Q3. A cone and a hemisphere have equal bases and equal volumes. Find the ratio of height cone and radius of hemisphere.

A. 1:2 B. 2:1 C. 3:2 D. 3:4

Q4. A bar made up of copper is 9m long, 40 cm wide and 20 cm in thickness. If 1 cubic meter of iron weighs 50 kg. What is the weight of the bar?

A. 56 kg B. 48 kg C. 36 kg D. 27 kg

Q5. The height of a cone is 30cm. A small plane parallel to its base cuts a small cone at the top of it.If it's volume is 1/27th of the volume of the cone, what is the height of the smaller cone?

A. 10cm. B. 12cm. C. 15cm. D. 20cm.

Q6. An open rectangular water tank having 4m length and 3m breadth has capacity of 24 cubic metre. Its expense of painting the internal and external surfaces at Rs 10 per cubic metre is:

A. Rs 400 B. Rs. 500 C. Rs. 600 D. Rs. 800

Q7. If the radius of the base of a cylinder and a cone are in the ratio √3:√2 and their heights are in the ratio of √2:√3. Then their volumes will be in the ratio of:

A. √3/√2 B. 3√3/√2 C. 5√3/√2 D. 11:10

Q8. The measurement of the base of a tube shaped drum is 35dm and its height is 24 dm. It is full of milk. How many of packs each of size 25cm ×22cm× 35 cm can be packed from the drum?

A. 120 B. 600 C. 1020 D. 1200

Q9. A solid cone of height 9cm and diameter of its base 18cm is cut out from a wooden solid sphere of radius 9cm. The percentage of wood wasted is:

A. 25%. B. 50%. C. 75%. D. 11:10

Q10. A pit 6m long, 3m wide and 2.5 m are delved in a corner of a field that is of rectangular field of length 20m and Width 14m. and the earth taken out of the pit is spread uniformly on the remaining part of the field. The level of field will rise by:

A. 17.18 cm B 18.28 cm C 19.38 cm D 20.48 cm

Q11. If a metallic cone of base radius 30cm and height 45cm is melted and recast into metallic spheres of radius 5cm find the maximum number of spheres that can be made,

A. 3 B. 9 C. 27 D. 81

Q12. If the height of a cylinder is increased by 15% and the radius of the base is decreased by 10%, then by what percent will its bended surface region change?

A. 3.5 % diminish B. 3.5% increase C. 5% diminish D. 5% expansion

Q13. The height of a right prism with a square base is 15cm. If the total surface area of the prism is 608 sq cm its volume (in cubic cm.) is,

A. 960. B. 1039. C. 1156. D. 1279.

Q14. A water tank has length of 15m and breadth of 6m. Then amount of water required to raise the water level by 1 m is:

A. 90 ltr. B. 70 kiloliter C. 80 kiloliter D. 90 kiloliter

Q15. The largest sphere that can be carved out of a cube of side 7cm has a volume (in cubic cm),

A. 109.67. B. 139.67. C. 156.67. D. 179.67.

Q16. A spherical ball of copper of volume 0.88 m^3 is melted and reformed into small rods of length 7m and cross sectional radius of 1cm. What will be the number of such rods?

A. 100 B. 200 C. 300 D. 400

Q17. If a right circular cone is separated into solids of volumes V_1, V_2 and V_3 by two planes parallel to the base, which also trisect the altitude then V1:V2:V3 is,

A. 1 : 8 : 19 B. 1 : 7 : 19 C. 1 : 9 : 19 D. 1 : 15 : 19

Q18. The volume of a sphere is 4851 cm^3. Its curved surface area is:

A. 1386 cm^2 B. 1396 cm^2 C. 1486 cm^2 D. 1486 cm^2

Q19. Thebase of a right prism is a quadrilateral ABCD. If AB=9 cm, BC=14 cm, CD=13 cm, DA=12 cm and $\angle DAB=90^0$ and the volume of the prism be 2070 cubic mtr. then the area of the lateral surface of the prism is,

A. 120 B. 720 C. 930 D. None

Q20. A triangle with side lengths 3 cm, 4 cm and 5 cm is rotated about the side 3 cm to form a cone. The volume of the cone formed by it is:

A. 16π cubic cm B. 32π cubic cm C. 64π cubic cm D. None

Q21. A solid wooden toy is in the shape of a right circular cone mounted on a hemisphere. If the radius of the hemisphere is 4.2 cm and the total height of the toy is 10.2 cm, find the volume of the wooden toy.

A. 104.22 cu.cm. B. 162.08 cu.cm. C. 427.56 cu.cm. D. 266.11 cu.cm.

Q22. The total surface range of a cubical box is 600 cm^2. The length of longest rod that can be placed in it:

A. 5√2 cm B. 10√3 cm C. 15√3 cm D. 20√2 cm

Q23. A bakery makes cake in shape of a sector of a circle of radius 10 cm with angle 24◦ at centre and constant thickness 3 cm. Find the volume of raw materials used in making it considering there is no wastage of materials whilke making it.

A. 51.18 cu.cm. B. 62.83 cu.cm. C. 64 cu.cm. D. 68.27 cu.cm.

Q24. A wooden box measures 20cm by 12cm by 10cm. If thickness of it's wall is 1cm. Volume of the wood required to make the box (in cubic cm) is,

A. 519. B. 526. C. 556. D. 576.

Q25. An area of a square km of land had a rainfall of 2cm. If 50% of these rainwater were collected in a pond having length 50m and breadth 20m base, what would be increase in water level in the pond?

A. 1m B. 10m C. 100m D. 1000m

Q26. Water is flowing through a pipe of cross sectional radius of 10 cm at the rate of 3 km per hour into a cylinder of radius 5 m and height 2 m. In what time will the cylinder be filled?

A. 1/3hr B. 2/3hr C. 3/4hr D. 5/3hr

Q27. If the length of each side of a regular tetrahedron is 12cm, then it's volume will be:
A. 104√2 cubic cm B. 124√2 cubic cm C. 144√2 cubic cm D. NONE

Q28. If the surface area of three adjacent surfaces of a cuboid are, p, q and r. Then it's volume will be:
A. √pqr B. √2pqr C. √3pqr D. NONE

Q29. The radius of a cylinder is 10cm and height is 4cm. Find the length adding which either to radius or to height will increase the same volume:
A. 5 B. 10 C. 20 D. 40

Q30. What part of a rectangular shape pond 8 m long, 16.5 m broad and 4 m deep can be filled from the water of a cylindrical tank of diameter 4 m and length 56 m.?
A. 1/7 B. 4/9 C. 2/9 D. 3/11

This chapter contains the topics and questions I discussed and created in our classes or obtained from students as their doubts. All the questions noted, typed, redesigned and rectified by group of volunteers consisting of:

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----------ANSWER----------

Q1.D	**Q2.D**	**Q3.B**	**Q4. C**	**Q5.A**
Q6.D	**Q7.B**	**Q8.D**	**Q9.C**	**Q10.A**
Q11.D	**Q12.B**	**Q13.A**	**Q14.D**	**Q15.D**
Q16.D	**Q17.B**	**Q18.A**	**Q19.B**	**Q20.A**
Q21.D	**Q22.B**	**Q23.B**	**Q24.A**	**Q25.B**
Q26.D	**Q27.C**	**Q28.A**	**Q29.A**	**Q30.C**

----------ANSWER WITH SOLUTION----------

Q1.D

Q1 Solution:-

Let the height of the cone be h
Then the Volume of the cone=$(1/3)\times\pi\times12^2\times h=48\pi h$ cu.cm.
Volume of the sphere=$(4/3)\times\pi\times r^3=(4/3)\pi(12)^3=2304$ cu.cm..
Since the volumes are equal we have:
$48\pi h=2304\pi$
Solving we get $h=2304\pi/48\pi h = 48$ cm

Q2.D

Q2 Solution:-

Volume of water collected in the tank in 11 hour
⇒ $0.3\times0.2\times20\times1000=1200$ m cubic
If after T hours, the water is at height of 8m,
$1200t=200\times150\times8$
⇒ t = 200 Hours.

Q3.B

Q3 Solution:-

Volume of the cone=$\pi r^2h/3$
=Volume of a hemisphere =$2\pi r^3/3$
⇒ Height of a hemisphere = Radius of its base
From the above formula, we can see that h:r=2:1

Q4. C

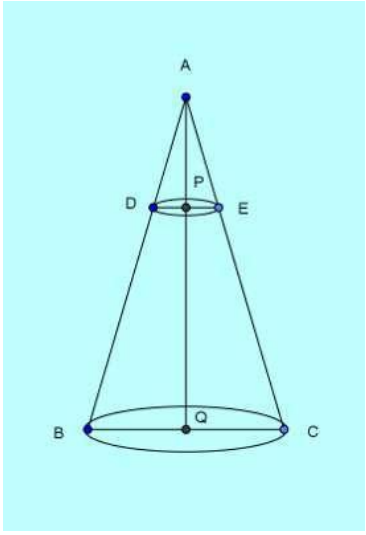
Q4 Solution:-

Volume of bar = $(9\times40/100\times20/100)m3= 18/25m^3$ [As 1 cm=1/100 m]
Weight of the bar = $(18/25\times50)$ kg = 36 kg [As 1 cm^3 weighs 50kg]

Q5.A

Q5 Solution:-

ATP we draw the following figure:



The similarity of the triangles results in equal ratios of corresponding sides so that,
PE/QC=AP/AQ
Volumes of the two cones are,
$V_{small}=1/3\pi PE^2\times AP$, and
$V_{large}=1/3\pi QC^2\times AQ$, where PE and QC are the radius and AP and AQ are the heights.
So the ratio of two volumes is,
$V_{small}/V_{large}=(PE^2\times AP)/(QC^2\times AQ)=1/27$
Or, $(AP/AQ)^3=1/27=(1/3)^3$
So,, AP/AQ=1/3.
As AQ=30cm, AP=10cm and,

Q6.D

Q6 Solution:-

Let the depth of the tank be k meters.
Then, ATP
$4\times3\times k = 24 \Rightarrow k = 2m$
Area of the surface to be painted
$= 2\times [\{2\times(L+b)\times h\} + (L\times b)\}]$ [twice of one surface]
$= 2\times[2\times(4+3)\times2+ (4\times3)]\ m^2 = 80m^2$
Cost of painting = (80×10) = 800 Rs.

Q7.B

Q7 Solution:-

Let r1 and r2 be the radius and h1 and h2 be the heights of the cylinder and the cone.
So,$r_1/r_2=\sqrt3/\sqrt2$, and$h_1/h_2=\sqrt2/\sqrt3$.
Volume of cylinder is$=\pi r_1^2h_1$.
Volume of the cone is$=1/3\pi r_2^2h_2$
So ratio of volumes of the cylinder and the cone is $V_{cylinder}/V_{cone}=3r_1^2/r_2^2\times h_1/h_2=3\times3^2\times\sqrt2/\sqrt3$
$=3x3^2x\sqrt2/\sqrt3=3\sqrt3/\sqrt2$.

Q8.D

Q8 Solution:-

Given: r= 35/2 dm=(35/2×10)cm= 175 cm , h=24 dm = 240cm
Volume of drum = $(22/7\times175\times175\times240)\ cm^3=(22\times25\times175\times240)\ cm^3$

Volume of a tin = (25×22×35) cm^3
Number of tin = (22×25×175×240)/(25×22×35) = 1200

Q9.C
Q9 Solution:-

The volume of the sphere is,
$V_s=4/3\pi r^3$, where r is the radius of the sphere
$=4/3\pi\times9^3$= cubic cm.
The volume of the cone is=$1/3\Pi r^2h$, where R is the radius of the circular base, and h is the height
$=1/3\pi9^2\times9$ cubic cm, which is one-fourth of the volume of the sphere.
So the wood wasted is three-fourth or 75% of the volume of the sphere.

Q10.A
Q10 Solution:-

Volume of earth dug out = (6×3×5/2) m^3=45 m^3
Area of the remaining field =[(20×14)-(6×3)]m^2= (280-18)m^2=262m^2
Let the level of the field raised be h cm. Then,
262×h/100= 45 ⇒ h= (45×100)/262 cm =17.18 cm

Q11.D
Q11 Solution:-

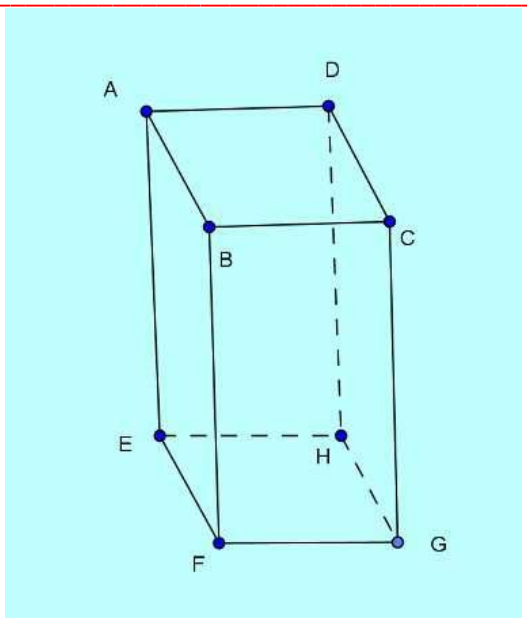
Volume of the cone = $1/3\pi\times30^2\times45=900\times15\pi$
Volume of a single sphere is = $4/3\pi\times5^3=500\pi/3$
So the required number of spheres is,
$N=V_{cone}/V_{sphere}=900\times15\times3/500=81$.

Q12.B
Q12 Solution:-

Let the original radius =r and height = h
Then curved surface area = 2πrh
New height = 115% of h = (115/100×h) = 23h/20
New radius = 90% of r = (90/100×r) = 9r/10
New curved surface area = (2π×9r/10×23h/20) = 207πrh/100
Increase = (207πrh/100-2 πrh) = 7 πrh/100
Increase %= (7 πrh/100×1/2 πrh×100) %= 3.5%

Q13.A
Q13 Solution:-

Consider the following figure:

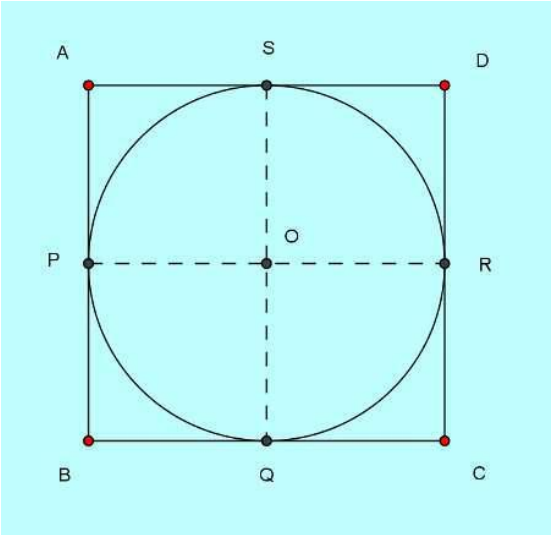


Let x be the side of square base
So total surface area of this prism = $2x^2+4\times15x$,
So, ATP:
Or, $x^2+30x-304=0$,
Or, $(x-8)(x+38)=0$.
So, $x=8$. [ignoring negative value of d]
So the volume of the right prism = $8^2\times15=960$ cubic cubic cm.

Q14.D
Q14 Solution:-
Let the initial depth be x meters. Then,
Quantity Of water taken out = $[(15\times6\times x)- \{15\times6\times(x-1)\}]m3$
$=[90x-(90x-90)]m^3 = 90m^3 = 90$ kiloliters.

Q15.D

Q15 Solution:-



The largest sphere that can be carved out of a cube will have then its radius as half the side length of the cube. In this case then the radius of the sphere is 7/2cm.

Volume of the sphere = $4/3\pi(7/2)^3 = 4/3\times22/7\times7^3/8 = 4/3X22X7^2/811\times49/3 = 539/3 = 179.67$

Q16.D

Q16 Solution:-

For each rod, r = 1 cm = 1/100 m and h= 7m

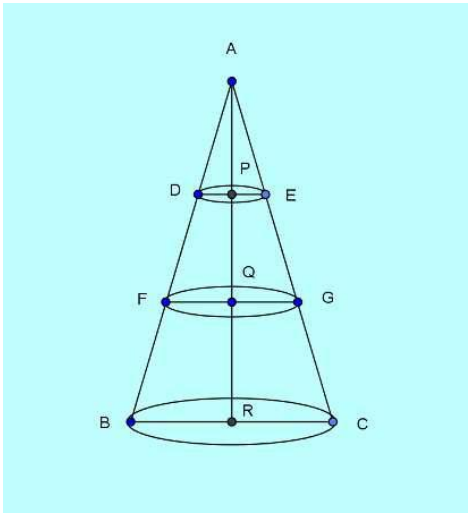
Volume of 1 rod = πr^2h = $(22/7\times 1/100 \times 1/100 \times 7)\ m^3 = 11/5000\ m^3$

No. of rods= volume of slabs/volume of rods=$(88/100\times 5000/11) = 400$

Q17.B

Q17 Solution:-

Consider the following figure:



The volume of a cone is,

$V=1/3\pi r^2h$, where r is the base radius and hh is the height.

So the ratio of the volumes of the three cones is,

$V_{1c}:V_{2c}:V_{3c}=(4/3\pi PE^2.AP):(4/3\pi QG^2.AQ):(4/3\pi RC^2.AR)= (1/3)^3:(2/3)^3:1=1:8:27$, a total of 36 parts.

Finally then the required ratio of the three parts,
$V_1:V_2:V_3=(V_{1c}):(V_{2c}-V_{1c}):(V_{3c}-V_{2c})=1:(8-1):(27-8)=1:7:19$.

Q18.A

Q18 Solution:-

ATP:-

$4/3\pi r^3 = 4851 \Rightarrow 4/3\times22/7\times r^3 = 4851$

$\Rightarrow$ $r^3 = (4851\times21/88) = (441\times21)/8 = (21/2)3$

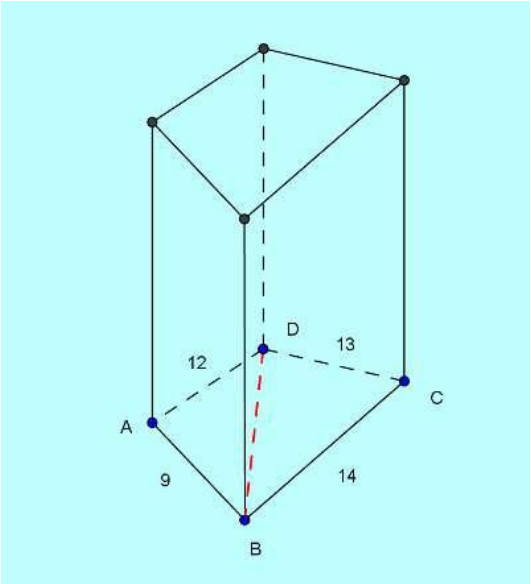
$\Rightarrow$ $r = 21/2$

Curved surface area $= 4\pi r^2 = (4\times22/7\times21/2\times21/2)\ cm^2 = 1386\ cm^2$

Q19.B

Q19 Solution:-

Consider the following figure:



ATP: AB=9 cm, BC=14 cm, CD=13cm and DA=12 cm. And $\angle DAB=90^0$.

So the Area of $\Delta DAB=1/2\times9\times12=54cm^2$

In ΔDBC. $DB=\sqrt{(12^2+9^2)}=\sqrt{(144+81)}=\sqrt{225}=15$ cm.

For ΔDBC,

$s=(13+14+15)/2$ cm.

So the area of $\Delta DBC = \sqrt{[21(21-13)(21-14)(21-15)]}=84cm^2$.

So, the area of the base quadrilateral is,

$A_{base}=54+84=138\ cm^2$.

And the volume of the prism =Area of Base×Height=138H=2070

Or, H=2070/138=15 cm.

Then the lateral surface area of the prism =Base perimeter×Height=(9+14+13+12)×15=48×15=720 cm^2

Q20.A

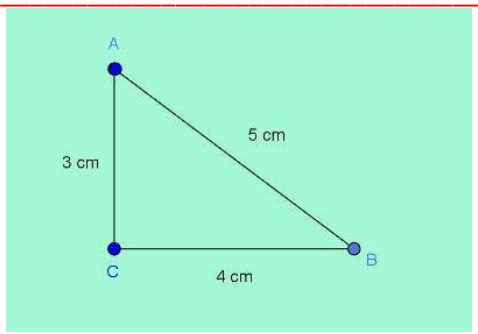
Q20 Solution:-

Clearly the triangle having sides as 3cm, 4cm and 5cm is a right angled triangle.

The height of this right angled triangle is the side 3 cm and hypotenuse is 5 cm.

we know $p^2 + b^2 = h^2$ putting the values we get base as 4 cm.

consider the following figure:



Base forms the radius of the cone, so r=4 cm.
With its height, h=3 cm the volume of the cone is,
$V=1/3\pi r^2h=1/3\pi\times4^2\times3=16\pi$ cubic cm.

Q21.D

Q21 Solution:-

Volume of the cone is given by=$\frac{1}{3}\pi r^2h$
Here r=4.2 cm, h=10.2−r=6 cm
So, the volume of the cone
=$\frac{1}{3}\pi(4.2)^2\times6$=110.88 cu.cm.
Volume of the hemisphere=$\frac{2}{3}\pi r^3$=155.23
Total volume=110.88+155.232=266.112

Q22.B

Q22 Solution:-

Clearly longest rod cn be placed from corner to corner,
So,ATP:
$6a^2=600$
⇒ $a^2=100\Rightarrow a=10$
Diagonal = $\sqrt{3}a=10\sqrt{3}$

Q23.B

Q23. Solution:-

The area of the top face of the wedge is the area of a sector of radius 10 cm and angle 20^0
Area=$24^0/360^0\times\pi\times10^2$
=20π/3=20x22/(7x3)=20.94 sq. cm.
The volume of the wedge
=Area×3=20π=62.83 cu.cm.

Q24.A

Q24. Solution:-

We will get the volume of wood subtracting inner volume of the from The outer volume
The inner dimension of box = 19cm by 11cm by 9cm.
So the volume of the wood=20×12×10−19×11×9=2400−1881=519 cubic cm.

Q25.B

Q25 Solution:-

The volume of the water due to 2cm rainfall over an area of 1 square km of land is,
V=0.02×1000×1000=20000 cubic metre.
50% of this volume is, 10000 cubic metre.
As base area of the pool collecting this volume of water is, 500×20=2000 m^2, the water in the pool will rise by,h=10000/1000=10 m.

Q26.D

Q26 Solution:-

Cross-section area of pipe is,=π(10/100) sq. m.

Volume of water flowing through this cross-section area in 1 hour at the speed of 3 km per hour is, =3000×0.01π=30π cubic metre.

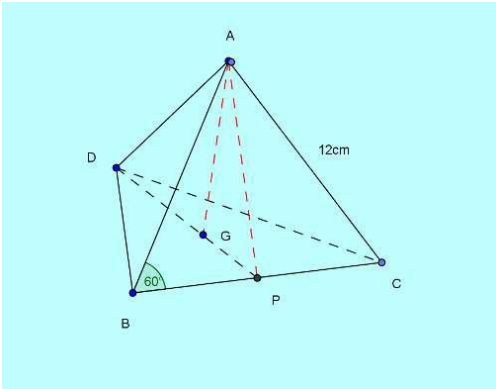
Volume of cylindar is=$\pi\times5^2\times2=50\pi$ cubic mtr..

So the time required for the cylinder to be filled by the pipe is=50π/30π=5/3 hr.

Q27.C

Q27 Solution:-

Refer the following figure:



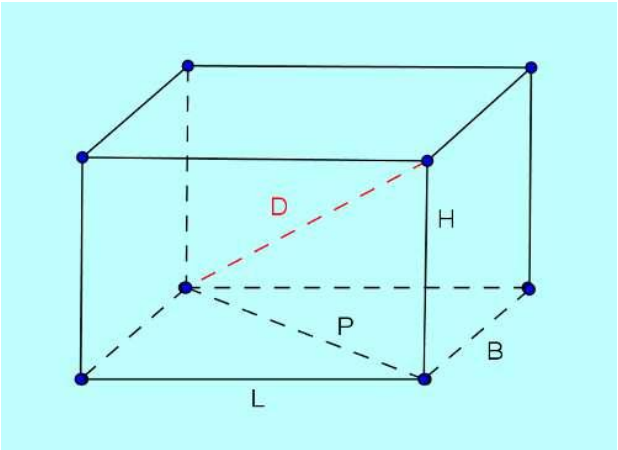
The perpendicular from vertex to base side of the base face △BCD△BCD is the median length,

Volume of tetrahedron = $\frac{\sqrt{2}}{12}a^3 = \frac{\sqrt{2}}{12}12^3$ = 144√2 cubic cm.

Q28.A

Q28 Solution:-

The corresponding figure is as below.



The area of the cuboid face with side lengths L and B is, p=LB.

The area of the cuboid face with side lengths L and H is, q=LH.

The area of the cuboid face with side lengths B and H is, r=BH.

Multiplying the three we have,

$pqr=L^2\times B^2\times H^2$.

So the volume of the cuboid is,

V=LBH=√pqr.

Q29.A

Q29 Solution:-

Increasing the radius of base by x cm, the change will be,

$\pi(10+x)^2 4-\pi 10^2 4=\pi(20x+x^2)4$ ----------(I)

Similarly the change in area by increasing height by x cm will be,

$\pi 10^2(4+x)-\pi 10^2.4=\pi 100x$ ----------(II)

Equating the equation (i) and (ii) we get,

$\pi(20x+x^2)4=\pi 100x$

Or, $4x^2=20x$

Or, $x=5$ [As $x\neq 0$]

Q30.C

Q30 Solution:-

The volume of the cuboid ditch is,

$V_{ditch}=48\times 16.5\times 4=48\times 66$ cubic metre.

The volume of the earth dug from the tunnel is,

$V_{tunnel}=\pi\times 2^2\times 56=88\times 8$ cubic metre.

The part of ditch filled by this amount of earth is the ratio of the two volumes,

$V_{tunnel}/V_{ditch}=(88\times 8)/(48\times 66)=2/9$.

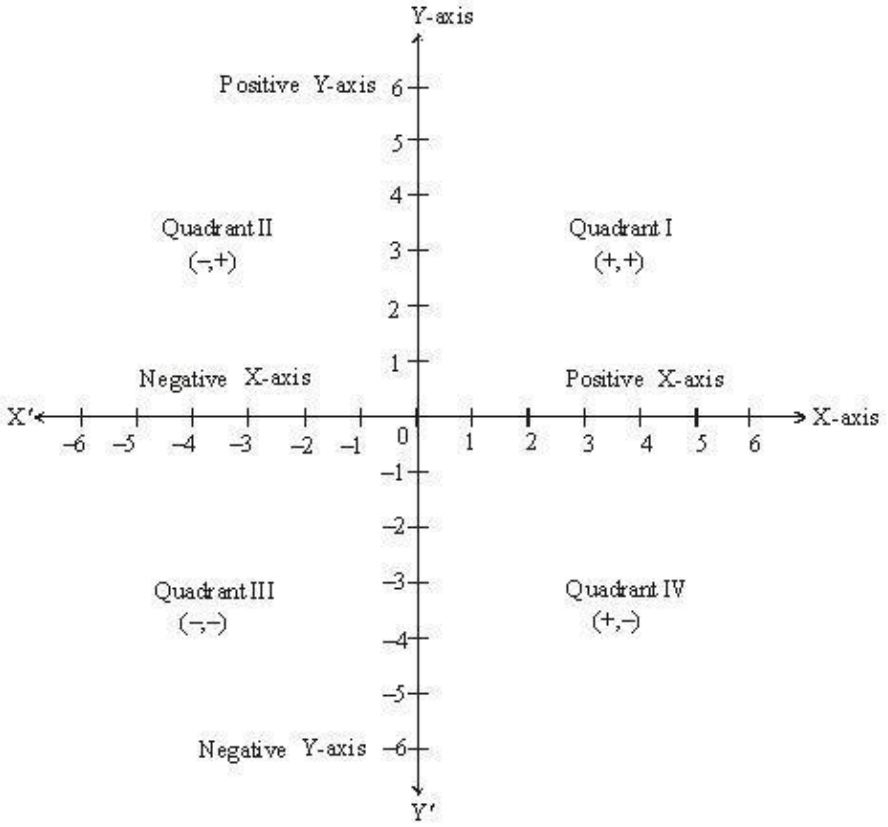
"There are two primary choices in life: to accept conditions as they exist, or accept the responsibility for changing them."

CO-ORDINATE GEOMETRY:

It is a branch of Mathematics in which geometric problems are solved through algebra by using the coordinate system. So it is known as coordinate geometry.

CARTESIAN SYSTEM:

X'X and Y'Y two number lines are taken such that X'X is horizontal and Y'Y is vertical and they are crossing each other at their zeroes or origins. The horizontal line X'X is called X-axis and the vertical line Y'Y is called Y-axis. The point on which X'X and Y'Y intersect each other is called origin and is denoted by O. The positive numbers lie on the directions OX and OY are called the positive directions of the x-axis and y-axis, respectively. Similarly, OX' and OY' are called the negative directions of the X-axis and the Y-axis, respectively.



The axes divide the plane into four parts and each part is called quadrant. In anticlockwise they are called quadrant-I quadrant-II, quadrant-III and quadrant-IV. So,, the plane consists of the axes and these quadrants. So, this plane is called Cartesian plane, or the coordinate plane or the XY-plane. The axes are called the coordinate axes.

X-COORDINATE:

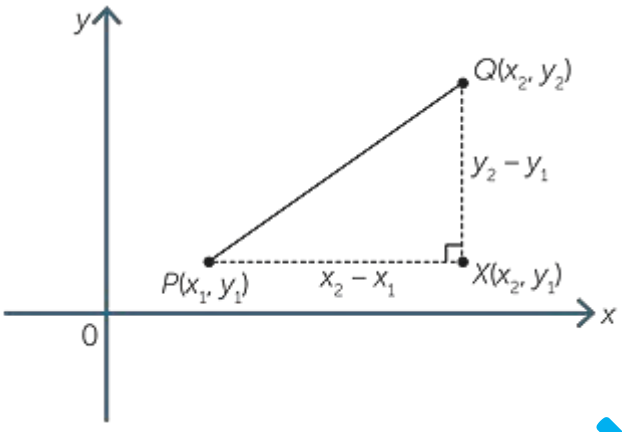
The X-coordinate of a point is its perpendicular distance from Y-axis measured along the X-axis. The X-coordinate is also calld the abscissa.

Y-COORDINATE:

The Y-coordinate of a point is its perpendicular distance from X-axis. The Y-coordinate is also called ordinate.

Distance Formula:

We can obtain a formula for the length of any interval. Suppose that $P(x_1, y_1)$ and $Q(x_2, y_2)$ are two points.



Form the right-angled triangle PQX, where X is the point (x_2, y_1),
$PX = x_2 - x_1$ or $x_1 - x_2$ and $QX = y_2 - y_1$ or $y_1 - y_2$
depending on the positions of P and Q.
By Pythagoras' theorem:
$PQ^2 = PX^2 + QX^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2$

So, $PQ = QP = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

Note that $(x_2 - x_1)^2$ is the same as $(x_1 - x_1)^2$ and So, it doesn't matter whether we go from P to Q or from Q to P – the result is the same.

So, the distance between two points' $p(x_1, y_1)$ and $Q(x_2, y_2)$ is given by

$$PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

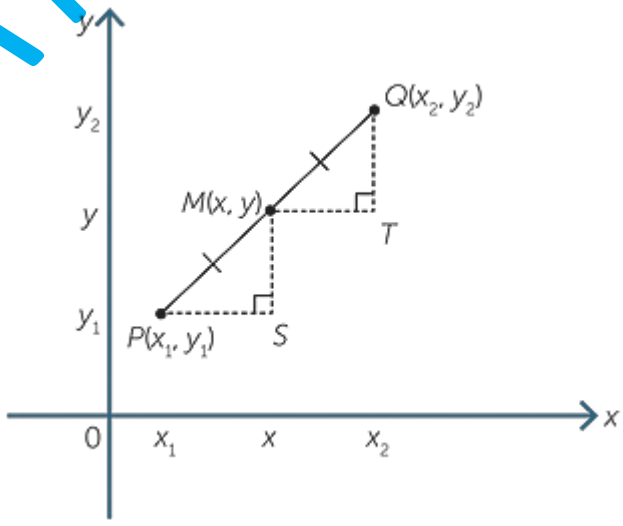
SECTION FORMULA:

The coordinates of point P which divide the straight line joining two points (x_1, y_1) and (x_2, y_2) internally in the ratio $m_1 : m_2$ are,

$$\left[\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2}\right]$$

COORDINATES OF THE MID-POINT:

We can find a formula for the midpoint of any interval. Suppose that $P(x_1, y_1)$ and $Q(x_2, y_2)$are two points and let M(x, y) be the midpoint.



Triangles PMS and MQT are congruent triangles (AAS), and so PS = MT and MS = QT.
So, the x-coordinate of M is the average of x_1 and x_2, and y-coordinate of M is the average of y_1 and y_2.
So,

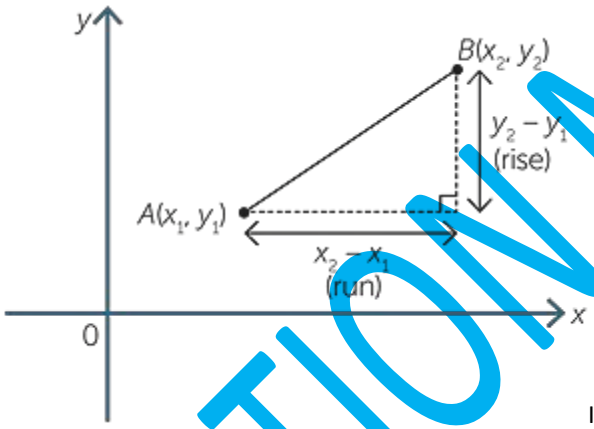
x = $\frac{x_1 + x_2}{2}$ and y = $\frac{y_1 + y_2}{2}$

So, the midpoint of an interval with endpoints $P(x_1, y_1)$ and $Q(x_2, y_2)$:

$$\left[\frac{1}{2}(x_1 + x_2), \frac{1}{2}(y_1 + y_2)\right]$$

THE GRADIENT OF A LINE:

The gradient is a measure of the steepness of line. There are several ways to measure steepness. In coordinate geometry the standard way to define the gradient of an interval ABis $\frac{\text{rise}}{\text{run}}$ where **rise** is the change in the y-values as you move from A to B and run is the change in the x-values as you move from A to B. We will usually the pronumeral m for gradient.

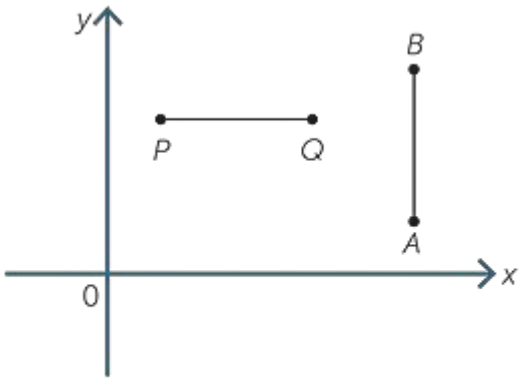


In general:

gradient of line interval AB = $\frac{\text{rise}}{\text{run}}$

m = $\frac{y_2 - y_1}{x_2 - x_1}$

Note that since $\frac{y_2 - y_1}{x_2 - x_1} = \frac{y_1 - y_2}{x_1 - x_2}$ it does not matter which point we take as the first and which point we take as the second.

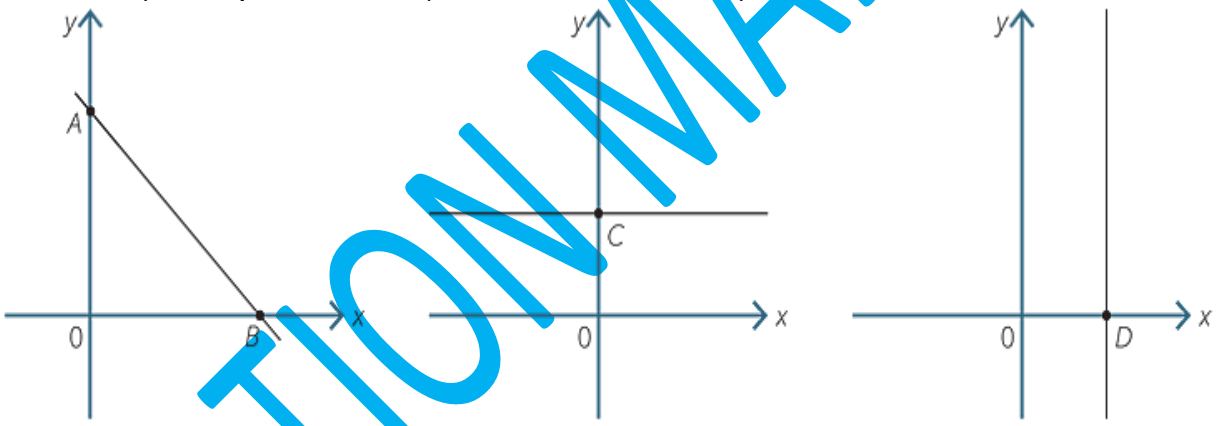


Gradient of PQ is zero
Gradient of AB is not defined

If the interval is vertical, the run is zero and the gradient of the interval is not defined. This is shown by interval AB.If the interval is horizontal, the rise is zero as shown by interval PQ. The gradient of the interval is zero.

Intercepts:

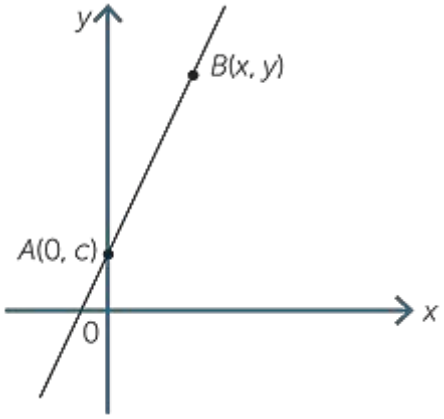
The x-**intercept** of a line is the point at which it crosses the x-axis.
The y-**intercept** of a line is the point at which it crosses the y-axis.



In the diagram to the left the y-intercept is at A and the x-intercept at B.
The second diagram shows a line parallel to the x-axis and it has a y-intercept at C.
The third diagram shows a line parallel to the y-axis and it has an x-intercept at D.

THE EQUATION Y = MX + C

Consider the line with gradient m and y-intercept c. If passes through the point A(0, c).
Let B(x, y) be any point on this line.



Gradient of interval AB $= \frac{y-c}{x-0}$

$= \frac{y-c}{x}$

We know the gradient of the line is m.

So, $\frac{y-c}{x} = m$

$y - c = mx$

$y = mx + c$

That is, the line in the cartesian plane with gradient m and y-intercept c has equation y = mx + c. Conversely, the points whose coordinates satisfy the equation y = mx + c always lie on the line with gradient m and y-intercept c.

Vertical and horizontal lines

Vertical lines:

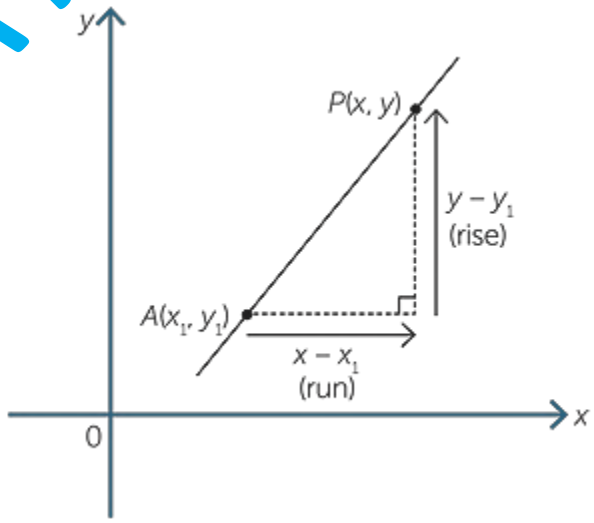
In general, the equation of the vertical line through P(a, b) is x = a.

Because this line does not have a gradient it cannot be written in the form y = mx + b.

Horizontal lines:

A horizontal line has gradient 0.

Equation of a line given its gradient and a point on the line



Let P(x, y) be any point with $x \neq x_1$ on the line passing through the point $A(x_1, y_1)$ and let m be the gradient of this line.Using gradient, $m = \frac{y - y_1}{x - x_1}$

And $y - y_1 = m(x - x_1)$

This is the equation of the straight line with gradient m passing through the point $A(x_1, y_1)$.

Equation of a straight line given two points

Given two points $A(x_1, y_1)$ and $B(x_2, y_2)$ the equation of the line passing through the two points can be found.

The gradient m of the line passing through $A(x_1, y_1)$ and $B(x_2, y_2) = \frac{y_2 - y_1}{x_2 - x_1}$, $x_2 \neq x_1$

Substituting into $y - y_1 = m(x - x_1)$ gives

$y - y_1 = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1)$, $x_2 \neq x_1$

- The x-intercept is found by substituting y = 0 and
- The y-intercept is found by substituting x = 0.

This method does not work if the line is parallel to an axis or passes through the origin.

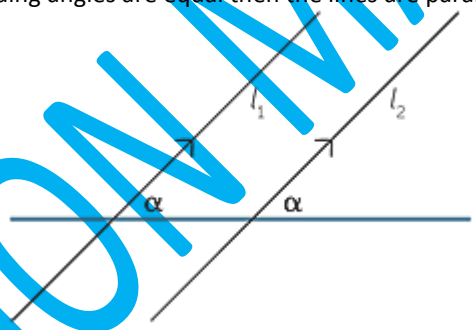
The **general** form for the equation of a line is ax + by + c = 0 where a, b and c are constants and $a \neq 0$ or $b \neq 0$. The equation of every line can be put in general form.

PARALLEL AND PERPENDICULAR LINES:

Parallel lines

If two lines l_1 and l_2 are parallel then corresponding angles are equal.

Conversely, if corresponding angles are equal then the lines are parallel.

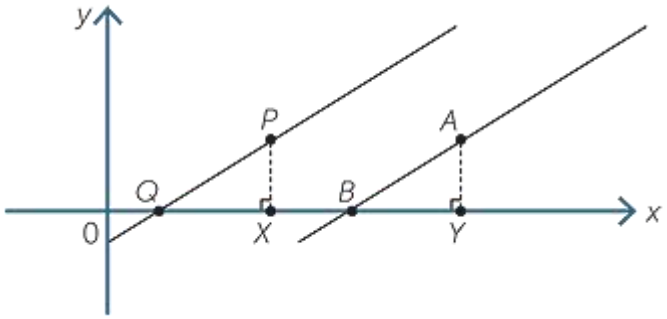


Theorem

Two lines are **parallel** if they have the same gradient and conversely, two lines with the same gradient are parallel.

Proof

In the diagram, two lines are drawn and the right-angled triangles PQX and ABY are added with QX = BY.



If the lines are parallel then $\angle PQX = \angle ABY$ (corresponding angles).

The two triangles are congruent by the AAS test.

So, PX = PY and $\frac{PX}{QX} = \frac{AY}{BY}$.

That is, the gradients are equal.

Conversely. If the gradients are equal $\frac{PX}{QX} = \frac{AY}{BY}$.

Now QX = BY and So, PX = AY.

So, the triangles QPX and ABY are congruent by the SAS test.

So, the corresponding angles PQX and ABY are equal and the lines are parallel.

Area of a Triangle:

Area of $\triangle ABC$ with the given vertices (x_1, y_1) and (x_2, y_2):

$$= \frac{1}{2}\left[x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)\right]$$

EXERCISE

Q1. The distance of point P(8, - 6) from the origin is:
A. 2 units B. 14 units C. 10 units D. none of these

Q2. Find the distance of the point A (12,-5) from the origin.
A. 7 B. 13 C. 17 D. None

Q3. P is a point on x-axis at a distance of 3 units from y-axis on its right side. The co-ordinates of P are:
A. (`1, 0) B. (2, 3) C. (3, 3) D. (3, 0)

Q4. Find the distance between the points A (-3, 4) and B (1, 7).
A. 5 B. 6 C. 6√5 D. 7

Q5. The centroid of ΔABC formed by the pointsA (6, - 2), B (4, - 3) and C (- 1, - 4).
A. (-3,-3) B. (3,3) C. (3,-3) D. (-3,3)

Q6. Find the slop of the line which passes through the pointsA (- 2, 3) and B (4, - 6).
A. 3/2 B. -3/2 C. ¾ D. 3/5

Q7. The point (- 15, -7) lies in which quadrant?
A. First B. second C. third D. fourth

Q8. Find the slope of the line 3x+4y-5 = 0.
A. ¾ B. -3/4 C. ¼ D. -1/4

Q9. If points P(2, 3), Q(5, k) and R(6, 7) are collinear, then k=?
A. 4 B. 6 C. - 3/2 D. 11/4

Q10. Find k for which the line 2x+3y-4 = 0 and kx+6y+5 =0 are parallel.
A. 2 B. 3 C. 4 D. 5

Q11. The points P(- 3, 0), Q(1, - 3) and R(4, 1) are the vertices of
A. An equilateral triangle B. an isosceles right angle triangle
C. a scalene triangle D. None of these

Q12. In which quadrant does the given point (12,-13) lies?
A. I B II C III D. IV

Q13. The lines 3x-4y+6 =0 and 4x+3y-10 =0 are mutually.
A. Parallel B. perpendicular C. opposite D. none of these

Q14. The points P(-3, 2), Q(-5-5), R(2-3) and S(4, 4) are the vertices of a:
A. Rectangle B. Square C. Rhombus D. Parallelopiped

Q15. The points A(-4,-1), B(-2,-4),C(4,0) and D(2,3) are the vertices of a:
A. Rectangle B. Square C. Rhombus D. Parallelopiped

Q16. The area of a triangle formed by the vertices A (10, - 6), B (2, 5) and C (- 1, 3).
A. 49/2 sq.units. B. 47/2 sq.units. C. 45/2 sq.units. D. 43/2 sq.units.

Q17. Find k for which the lines 5x+3y +2=0 and 3x-ky+6= 0 are perpendicular to each other.
A. 2 B. 3 C. 4 D. 5

Q18. If the points A (- 1, 3), B (2, k) and C (5, - 1) are collinear then k is:
A. 1 B. 2 C. 3 D. 4

Q19. Find the ratio in which C(2, - 5) divides the line AB joining A (- 3, 5) and B (4, - 9).
A. 1:2 B. 5:2 C. 2:5 D. 2:1

Q20. If the slope of a line joining A (2, 5) and B(k, 3) is 4, then k=?
A. 1 B. 3/2 C. -1 D. -2

Q21. Points P(0,-2) ,Q(3,1) ,R(0,4) and S(-3,1) are the vertices of a:
A. Rectangle B. Square C. Rhombus D. Parallelopiped

Q22. The points A(2, 3) and B(5, 6) is divided by x axis in the ratio of:
A. 1:2 B. 2:1 C. 3:5 D. 2:3

Q23. Point P(2, - 5) divides the line formed by A(- 3, 5) and B(4, - 9) in the ratio?
A. 2:1 B. 3:1 C. 5:2 D. 7:2

Q24. The area in square unit of triangle formed by the graphs of x=4, y=3 and 3x+4y=12is,
A. 3 B. 5 C. 6 D. None

Q25. The equations 2x+3y=2 and 3x+2y =2 meets in:
A. First quadrant B. econd quadrant C. third quadrant D. fourth quadrant

This chapter contains the topics and questions I discussed and created in our classes or obtained from students as their doubts. All the questions noted, typed, redesigned and rectified by group of volunteers consisting of:

Akash Tripathi,B.sc(Math),MCA
Arpana Tripathi,M.sc(math)
Puja Singh,B.Tech

----------ANSWERS----------

Q1.C	**Q2.B**	**Q3.D**	**Q4.A**	**Q5.C**
Q6.B	**Q7.C**	**Q8.B**	**Q9.B**	**Q10.C**
Q11.B	**Q12.D**	**Q13.D**	**Q14.C**	**Q15.A**
Q16.A	**Q17.D**	**Q18.A**	**Q19.B**	**Q20.A**
Q21.B	**Q22.A**	**Q23.C**	**Q24.C**	**Q25.A**

----------ANSWERS AND SOLUTION----------

Q1.C

Q1 Solution:-

OP = √ (-8-0)2+ (6-0)2 = √64+ 36 = √100 =10 unit

Q2.B

Q2 Solution:-

OA = $\sqrt{[12^2 + (-5)^2]} = \sqrt{(144 + 25)} = \sqrt{169} = 13$ units.

Q3.D

Q3 Solution:-

Clearly, the co-ordinates of P are P (3, 0).

Q4.A

Q4 Solution:-

AB = $\sqrt{[(-2-1)^2 + (4-7)^2]} = \sqrt{[(-3)^2 + (-3)^2]} = \sqrt{(9+16)} = \sqrt{25} = 5$ =5 units.

Q5.C

Q5 Solution:-

The centroid is:

$\frac{6+4-1}{3}, \frac{-2-3-4}{3}$

$\frac{9}{3}, \frac{-9}{3}$ i.e. (3, -3)

Q6.B

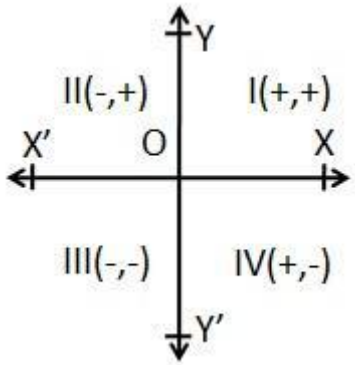
Q6 Solution:-

Slope of AB = $y_2-y_1/x_2-x_1 = \frac{-6-3}{4+2}$ = - 9/6 = - 3/2

Q7.C

Q7 Solution:-

comparing with



We get The point (-15, -17) lies in 3nd quadrant

Q8.B

Q8 Solution:-

$3x+4y-5 = 0$

$\therefore$ $4y=-3x+5$

$\therefore$ $y=-3/4x+5/4$

$\therefore$ slope = $m = -3/4$

Q9.B

Q9 Solution:-

Here $x_1=2$, $x_2= 5$, $X_3 = 6$, $y_1 =3$, $y_2= k$ and $Y_3 = 7$

$\Delta = 1/2 [x_1(y_2-Y_3) +x_2(Y_3-y_1) +X_3 (y_1-y_2)]$

$=>$ $2(k-7) +5(7-3) +6(3-k) =0$

$=>$ $k=6$

Q10.C

Q10 Solution:-

$2x+3y - 4 =0$

$\Rightarrow$ $3y= - 2x+4$

$\Rightarrow$ $y= - 2x/3 +4/3$

$kx+6y+5 =0$

$\Rightarrow$ $6y =-kx-5$

$\Rightarrow$ $y= - kx/6 - 5/6$

The line will be parallel if $- k/6 -2/3 \Rightarrow k= 4$

$\therefore$ $k=4$

Q11.B

Q11 Solution:-

$PQ^2= (1+3) 2+ (-3-0) 2= 16+9= 25$

$QR^2= (4-1) 2+ (1+3) 2=9+16= 25$

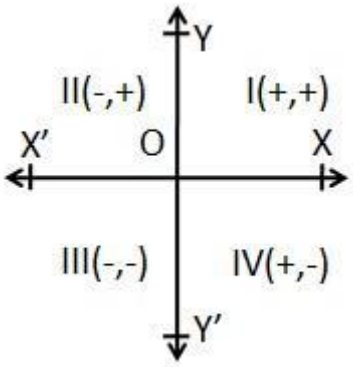
$RS^2= (4+3) 2+ (1-0) 2= 49+1= 50$

Clearly, $PQ= QR$ and $PQ^2+QR^2= PR^2$

$\therefore$ ΔPQR is an isosceles right angle triangle.

Q12.D

Q12 Solution:-



Seeing the above figure and comparing we get (12,-13) lies in IVth quadrant.

Q13.D

Q13 Solution:-

$3x-4y+6 = 0$

$\Rightarrow$ $4y = 3x+6$

$\Rightarrow$ $y = 3x/4 + 3/2$

$4x+3y -10 = 0$

$\Rightarrow$ $3y = -4x+10$

$\Rightarrow$ $y = -4x/3 + 10/3$

$\therefore$ $m_1 = 3/4$ and $m_2 = -4/3$. So, $m_1m_2 = -1$

So, they are perpendicular

Q14.C

Q14 Solution:-

$PQ^2 = (-5+3)2 + (-5-2)2 = (-2)2 + (-7)2 = (4+49) = 53$

$QR^2 = (2+5)2 + (-3+5)2 = (7)2 + (2)2 = (49+4) = 53$

$RS^2 = (4-2)2 + (4+3)2 = (22+72) = (4+49) = 53$

$SP^2 = (4+3)2 + (4-2)2 = (72+22) = (49+4) = 53$

$\therefore$ $PQ=QR=RS=SP = \sqrt{53}$

$PR^2 = (2+3)2 + (-3-2)2 = (52) + (-5)2 = (25+25) = 50$

$QS^2 = (4+5)2 + (4+5)2 = (92) + (92) = (81+81) = 162$

$\therefore$ Diagonal PR $\neq$ Diagonal QS

So, all the sides are equal and diagonals are not equal.

$\therefore$ PQRS is a Rhombus.

Q15.A

Q15 Solution:-

$AB^2 = (-2+4)^2 + (-4+1)^2 = 2^2 + (-3)^2 = (4+9) = 13$

$BC^2 = (4+2)^2 + (0+4)^2 = (6^2+4^2) = (36+16) = 52$

$CD^2 = (2-4)^2 = (3-0)^2 = (-2)^2+3^2 = (4+9) = 13$

$DA^2 = (2+4)^2 + (3+1)^2 = (6^2+4^2) = (36+16) = 52$

$\therefore$ $AB=CD = \sqrt{13}$ AND $BC=DA = \sqrt{52}$

$AC^2 = (4+4)^2 + (0+1)^2 = (82+12) = (64+1) = 65$

$BD^2 = (2+2)^2 + (3+4)^2 = (42+72) = (16+49) = 65$

$\therefore$ Diagonal PR= Diagonal QS $= \sqrt{65}$

So, opposite sides are equal and diagonals are equal.

$\therefore$ ABCD is a rectangle.

Q16.A

Q16 Solution:-

Here $x_1=10$, $x_2=2$, $x_3 = -1$ and $y_1 = -6$, $y_2 = 5$, $y_3 = 3$

$\therefore$ $\Delta = 1/2 [x_1(y_2-y_3) + x_2(y_3-y_1) + x_3 (y_1-y_2)]$

$=1/2 [10(5-3) + 2(3+6) - 1(-6-5) = 1/2 (20+18+11) = 49/2$ sq.units.

Q17.D

Q17 Solution:-

$5x+3y+2 = 0 = -5x-2 \Rightarrow y = -5x/3-2/3$

$3x- ky+6 = 0 \Rightarrow ky = 3x+6 \Rightarrow y = 3x/k+6/k$

The line will be perpendicular to each other if $(-5/3)(3/k) = -1 \Rightarrow k=5$.

So, $k = 5$.

Q18.A

Q18 Solution:-

Here x1=-1, x2=2, x3=5 and y1=3, y2=k and Y3=-1

Now, Δ=0 ⇒ X1(y2-Y3) +x2(Y3-Y1) +X3(Y1-Y2) = 0

⇒ -1(k+1) +2(-1-3) +5(3-k) =0

⇒ -k-1-8+15-5k=0

⇒ 6k=6

⇒ k=1

Q19.B

Q19 Solution:-

Let the point divides in x:1.

At that point (4x-3/x+1, - 9 x+5/x+1) that should be equal to C(2, - 5)

∴ 4x-3/ (x+1) =2 ⇒ 4x-3 = 2x+2 ⇒ 2x=5 ⇒ x=5/2

∴ So, the ratio is 5/2:1 that is 5:2

Q20.A

Q20 Solution:-

(3-5)/(k-2) =4

⇒ 4k-8 =-2 ⇒ 4k = - 6

⇒ k= 3/2

Q21.B

Q21 Solution:-

PQ^2= (3-0)^2+ (1+2)^2= (9+9) =18

QR^2= (0-3)^2+ (4-1)^2= (9+9) =18

RS^2= (0-3)^2+ (1+2)^2= (9+9) =18

SP^2= (-3-0)^2+ (1+2)^2= (9+9) =18

∴ PQ= QR=RS=SP = √18 = √(9x2) = 3√2

PR^2=(0-0)2+(4+2)2= (0+36) =36

QS^2= (-3-3)2+ (1-1)2= (36+0) =36

∴ Diagonal AC = Diagonal BD = 6

So, all sides are equal and the diagonals are also equal.

∴ ABCD is a square.

Q22.A

Q22 Solution:-

Let the required ratio be h:1. Then, its co- ordinates are $\frac{5h+2}{h+1}, \frac{6h-3}{h+1}$

But, it lies on x-axis. So, its ordinate is 0.

∴ (6h-3)/h+1 =0

⇒ 6h-3 =0 ⇒ h=1/2

Required ratio is 1/2:1 i.e., 1:2

Q23.C

Q23 Solution:-

Let the required ratio be h:1

Then, the point P is [(4h-3/h+1), (-9h+5/h+1)]

∴ 4h-3/h+1 =2,-9h+5/h+1=-5

⇒ 4h-3= 2h+2 and 9h+5 = -5h-5

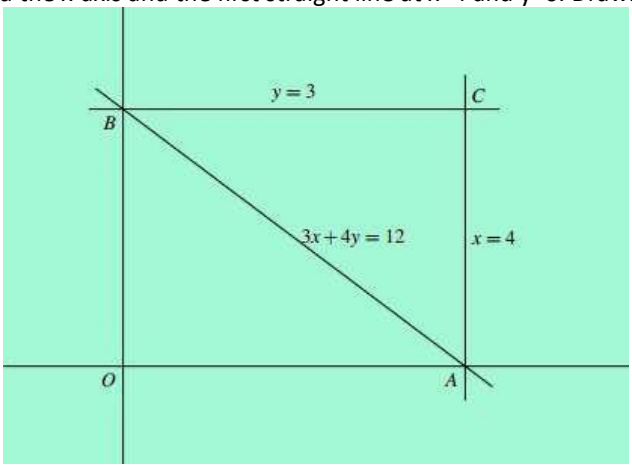
⇒ 2h= 5 and 4h=10 ⇒ h= 5/2

Required ratio is 5/2:1, i.e. 5:2

Q24.C

Q24 Solution:-

at x=0 and y=3 and the x-axis and the first straight line at x=4 and y=0. Drawing the figure we see



Solution:

Area of the triangle △ABC

$= \frac{1}{2}$(Area of rectangle OABC)

$= \frac{1}{2}(4\times3)$

= 6 square units

Q25.A

Q25 Solution:-

2x+3y = 2 ----------(i) ,

3x+2y= 2 ----------(ii)

Multiplying (i) by 2 and (ii) by 3 and subtracting, we get: -5x= -2 ⇒x= 2/5

Putting x= 2/5 in (i), we get 4/5+3y= 2 ⇒3y = (2-4/5) = 6/5 ⇒y = 2/5

∴ the solution can be represented by a point (2/5, 2/5) which lies in 1st quadrant.

CALENDER

AKASH SIR
9748390495

SOME DEFINITIONS:-

ODD DAYS : The number of days more than complete number of weeks in a given period are called odd days. In other words , In a given period, the quantity of days more than the complete weeks are called Odd days or the remainder obtained when the given number of days is converted into weeks by dividing by 7.

Example : The number of odd days in a period of 57 days is => 1.
Note => 7a + b odd days , where b is less than or equal to is equivalent to number of odd days .
27 odd days= 7 x 3 + 6 = 6 odd days

LEAP YEAR: Every year divisible by 4 in a leap year. But not all century years are leap years. Only those century years which are divisible by 400 are leap years and other century years are ordinary years. As an example, 1100, 1300, 1400, 1500, 1700 are ordinary years but 1200, 1600, 2000 are leap years. So every 4th century is a leap year.

ORDINARY YEAR: A non-leap year is an ordinary year. A conventional year has 365 days. A leap year has 366 days.

METHOD OF COUNTING ODD DAYS:-

FOR AN ORDINARY YEAR:- It has 365 days (52 weeks+ 1 day)
∴ It has 1 odd day.

FOR A LEAP YEAR:- It has 366 days = (52 weeks+2 days)
∴ It has 2 odd days.

FOR A PERIOD OF 100 YEARS:- 100 year =76 normal year +24 leap year
= (76x1+24x2) odd days =124 odd days
= (17 weeks +5 days) =5 odd days.

FOR A PERIOD OF 200 YEARS:- = 3

FOR A PERIOD OF 300 YEARS:- (5x3) =1 odd day.

FOR A PERIOD OF 400 YEARS:- (5x4+1) = 0 odd days.

EACH MULTIPLE OF 400 i.e. 800 years, 1200 years, 1600 years, 2000 years and so on has 0 odd days.

Corresponding days on ODD days.

No. of odd days:	0	1	2	3	4	5	6
Days:	Sun	Mon	Tue	Wed	Thu	Fri	Sat

SOME POINTS TO KEEP IN MIND:-

1. February: 28 days(ordinary year) gives '0' odd days, 29 days (leap year) gives '1' odd day.
2. January, March, May, July, Aug, Oct and Dec have 31 days each and So give '3' odd days.
3. April, June, Sep and Nov each have 30 days and So give '2' odd days.
4. An ordinary year has 365 days. So we divide 365 by 7 to get the complete number of weeks and the remainder will be the odd days: as 365=(7×52)+1.

5. An ordinary year has 1 odd day .Since a leap year has 366 days, there will be 2 odd days.
6. The last day of a century cannot be a Thursday or a Saturday.
7. The first day of a century must be a Monday, a Tuesday, a Thursday or Saturday.

----------**EXERCISE**----------

Q1. What was the day of the week on 15th June, 1776?
A Sunday B Saturday C Thursday D None of these

Q2. What was day on 15th august 1947?
A Thursday B Friday C Saturday D Sunday

Q3. What was the day of the week on 15th June, 1776?
A Sunday B Saturday C Thursday D None

Q4. Find the no. of odd days in 123 days
A. 1 B. 2 C. 4 D. 6

Q5. What was the day of the week on 16th April, 2000 ?
A. Sunday B. Tuesday C. Wednesday D. Thursday

Q6. Find the number of odd days in 126 years.
A. 0 B. 1 C. 2 D. 3

Q7. Today is Thursday. What will be the day of the week after 94 days?
A. Sunday B. Monday C. Tuesday D. Wednesday

Q8. January 15, 1997 was a Wednesday. What day of the week was on January 5, 2000?
A Wednesday B Thursday C Friday D Saturday

Q9. January 15, 1997 was a Wednesday. What day of the week was on January 15, 2000?
A Wednesday B Thursday C Friday D Saturday

Q10. 1 st January 2005 was Sunday . What day of the week was 1 st January 2004 ?
A. Monday B. Wednesday C. Friday D. Sunday

Q11. Given that on 18th April 1603 is Thursday. What was the day on 18 th April 2003?
A. Tuesday B. Wednesday C. Thursday D. Sunday

Q12. It was Tuesday on 4 th January 2013. What day of the week will be on 18 th March 2013 ?
A. Tuesday B. Wednesday C. Thursday D. Friday

Q13. It was Thursday on 12 th January 2006. What day of the week it will be on January 12 th 2007?
A. Tuesday B. Wednesday C. Thursday D. Friday

Q14. The day on 26th January 1950 was:
A. Tuesday B. Wednesday C. Thursday D. Friday

Q15. The calendar for the year 2007 will be the same for the year:
A 2018 B 2017 C 2016 D 2014

Q16. Calendar of 2003 will be same as:

A. 2014 B. 2015 C. 2016 D. 2017

Q17. The calendar for the year 2007 will be the same for the year:

A 2018 B 2017 C 2016 D 2014

Q18. Today is 5 th August. The day of the week is Wednesday. This is a leap year. What will be the day of the week on this date after 3 years?

A. Monday B. Wednesday C. Thursday D. Saturday

Q19. What was the day of the week on, 16th July, 1776?

A. Saturday B. Tuesday C. Wednesday D. Thursday Q20Qq20q

Q20. Today is Thursday. What day of the week it was 30 days ago?

A. Monday B. Tuesday C. Wednesday D. Thursday

Q21. On what dates of Jull.2004 did Monday fall?

A. 5^{th} B. 6^{th} C. 7^{th} D. 8^{th}

Q22. Dates in March of a year is the same day of the week corresponding date of month.

A. May B. July C. Sept D. November

Q23. How many days are there from 3 rd February, 2012 to 18 rd April 2012 (both inclusive)?

A. 70 days B. 75 days C. 80 days D. 85 days

Q24. On what dates of April 2009 did Thursday fall

A. 1,8,15,22,29 B. 2,9,16,23,30 C. 3,10,17,24 D. 4,11,18,25

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----------ANSWERS----------

Q1.B	**Q2.B**	**Q3.B**	**Q4.C**	**Q5.A**
Q6.C	**Q7.A**	**Q8.A**	**Q9.A**	**Q10.C**
Q11.C	**Q12.D**	**Q13.D**	**Q14.C**	**Q15.A**
Q16.A	**Q17.A**	**Q18.D**	**Q19.B**	**Q20.B**
Q21.A	**Q22.D**	**Q23.B**	**Q24.B**	

----------ANSWERS WITH SOLUTION----------

Q1.B

Q1 Solution:-

15th June 1776 = (1775 years + Period from 01.01.1776 to 15.06.1776)
Counting of odd days:
No of odd days in 1600 years = 0
No of odd days in 100 years = 5
75 years = 18 leap years + 57 ordinary years
= 18x2 + 57x1
= 36 + 57
= 93 odd days
= 13 weeks + 2 odd days = 2 odd days
∴ 1775 years have (0+5+2) = 7 odd days = 0 odd days.
January to May = (31+29+31+30+31)
= 152 days
Add 15 days of June.
= 152 + 15
= 167 days
= 23 weeks + 6 days
= 6 odd days.
∴ Total number of odd days = 0 + 6 = 6 odd days.
So 15.06.1776 was Saturday.

Q2.B

Q2 Solution:-

fifteenth Aug.1947 =(1946 years +period from 1.1.1947 to 15.8.1947)
Odd days in 1600 years =0
Odd days in 300 years = (5x3) =15 =1946 years = (11 jump years+35 customary years)
= (11x2 +35x1) odd days= 57 days
= (8 weeks +1 day) = 1 odd day
∴ odd days in 1946 years= (0+1+1) =2
January + Feb. + March + April + May + June + July + Aug
(31 + 28 +31+ 30 + 31 +30+31+15) = 227 days
227 days = (32 weeks +3 days) = 3 odd days.
Total no. of odd days = (2+3) = 5
So the required day is Friday.

Q3.B

Q3 Solution:-

15th June 1776 = (1775 years + Period from 01.01.1776 to 15.06.1776)
Counting of odd days:
No of odd days in 1600 years = 0
No of odd days in 100 years = 5
75 years = 18 leap years + 57 ordinary years
= 18x2 + 57x1
= 36 + 57
= 93 odd days
= 13 weeks + 2 odd days = 2 odd days
∴ 1775 years have (0+5+2) = 7 odd days = 0 odd days.
January to May = (31+29+31+30+31)
= 152 days
Add 15 days of June.
= 152 + 15
= 167 days
= 23 weeks + 6 days
= 6 odd days.
∴ Total number of odd days = 0 + 6 = 6 odd days.
So 15.06.1776 was Saturday.

Q4.C

Q4 Solution:-

Odd days =>The number of days more than complete number of weeks in the given period are odd days .
123=7×17+4=> 4 odd days.

Q5.A

Q5 Solution:-

16th April, 2000 = (1999 years + Period from 1st January., 2000 to 16thA'
Counting of odd days:
1600 years have 0 odd day. 300 years have 1 odd day.
99 years = (24 leap years + 75 ordinary years)
= [(24 x 2) + (75 x 1)] odd days = 123 odd days
= (17 weeks + 4 days) = 4 odd days.
January. Feb. March April
31 + 29 + 31 + 16 = 107 days = (15 weeks + 2 days) = 2 odd,
Total number of odd days = (0 + 1 + 4 + 2) odd days = 7 odd days = 0 odd day. So, the required day was 'Sunday'.

Q6.C

Q6 Solution:-

A period of 100 years has 5 odd days . In 26 years , 4 are leap, remaining are ordinary years
125 years = 100 years + 26 years
= 100 years + 6 leap years + 20 ordinary years
= 5 odd days + 12 odd days + 20 odd days
=37 odd days = 5 x 7 +2= 2 odd days

Q7.A

Q7 Solution:-

94 days=(13×7)+3=3 odd days.

The required day is 3 days beyond Thursday i.e., Sunday

Q8.A

Q8 Solution:-

1997, 1998 and 1999 are not leap years.

1998 and 1999 has 2 odd days.

No of days remaining in 1997 = 365 - 15 = 350

= 50 weeks of 0 odd days.

05.01.2000 = 5 odd days.

Total no of odd days = 2 + 0 + 5 = 7

7 days from Wednesday is Wednesday.

∴ January 5, 2000 was also Wednesday.

Q9.A

Q9 Solution:-

1997, 1998 and 1999 are not leap years.

1998 and 1999 has 2 odd days.

No of days remaining in 1997 = 365 - 15 = 350

= 50 weeks of 0 odd days.

05.01.2000 = 5 odd days.

Total no of odd days = 2 + 0 + 5 = 7

7 days from Wednesday is Wednesday.

∴ January 5, 2000 was also Wednesday.

Q10.C

Q10 Solution:-

Number of days from 1st January 2004 to 1st January 2005 = 366 days (because 2004 is leap year and February 29th is counted)

So we have 2 odd days .

The day is two days before Sunday , i.e Friday

Q11.C

Q11 Solution:-

After every 400 years, the same day occurs. (Because a period of 400 years has 0 odd days)

So, 18th April 1603 is Thursday, After 400 years i.e., on 18 th April 2003 has to be Thursday.

Q12.D

Q12 Solution:-

Total number of days from 4th January 2013 to 17th March 2013

= January + February + March

= 27 + 28 + 18

= 73 days

Number of odd days = 10 x 7 + 3 = 3 odd days

The day is 3 days beyond Tuesday, i.e, Friday.

Q13.D

Q13 Solution:-

There is exactly 1 year , (365 days) between two dates .
2006 is an ordinary year. It has one odd day.
The day of the week on January 12th 2007 is one day beyond Thursday=> Friday

Q14.C

Q14 Solution:-

Clearly,The number of odd days in first 1600 years are 0
number of odd days in 300 years = 1
In 49 years we have 12 leap year and 37 normal year.
So, number of odd days in 49 years = (12 x 2 + 37 x 1) = 61 days = 5 odd days
total number of odd days in 1949 years = 1 + 5 = 6 odd days
Now look at the year 1950
jan 26 = 26 days = 3 weeks + 5 days = 5 odd days
Total number of odd days = 6 + 5 = 11 => 4 odd days
(odd days - 0 = sunday ; 1 = monday ; 2 = tuesday ;
So,Jan 26th 1950 was Thursday

Q15.A

Q15 Solution:-

We will count the no of odd days from the year 2007 onwards to get the sum equal to 0 odd days.

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Odd day	1	2	1	1	1	2	1	1	1	2	1

Sum = 14 odd days = 0 odd days
Calendar for the year 2018 will be the same for the year 2007.

Q16.A

Q16 Solution:-

In this type of sums we have to compare the first day of years. If they are same then we can use the same calendar keeping in mind both should be leap/no-leap year.
Our first option is 2014 so at first we will match it's first day with 2003We must have same day on 1.1.2003 and 1.1.2014.
Along these lines, number of odd days somewhere around 31.12.2002 and
31.12.2013 must be 0. This period has 3 jump years and 8 common years.
Number of odd days = (3x2+8x1) =14=0 odd days.
∴ Calendar for the year 2003 will serve for the year 2014.

Q17.A

Q17 Solution:-

We will count the no of odd days from the year 2007 onwards to get the sum equal to 0 odd days.

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Odd day	1	2	1	1	1	2	1	1	1	2	1

Sum = 14 odd days = 0 odd days
Calendar for the year 2018 will be the same for the year 2007.

Q18.D

Q18 Solution:-

This is a leap year.
So none of the next 3 years will be leap years.
Each ordinary year has one odd day, so there are 3 odd days in next 3 years.
So the day of the week will be 3 odd days beyond Wednesday i.e. it will be Saturday

Q19.B

Q19 Solution:-

16th July, 1776 = (1775 years + Period from 1st January., 1776 to 16th July,1776)
Counting of odd days :
1600 years have 0 odd day. 100 years have 5 odd days.
75 years = (18 leap years + 57 ordinary years)
= [(18 x 2) + (57 x 1)] odd days = 93 odd days
= (13 weeks + 2 days) = 2 odd days.
1775 years have (0 + 5 + 2) odd days = 7 odd days = 0 odd day.
January. Feb. March April May June July
31 + 29 + 31 + 30 + 31 + 30 +16 = 198days
= (28 weeks + 2 days) =2days
Total number of odd days = (0 + 2) = 2. Required day was Tuesday.

Q20.B

Q20 Solution:-

30 days = 4 x 7 + 2 = 2 odd days
The day is 2 days before Thursday i.e Tuesday

Q21.A

Q21 Solution:-

Let us find the day on 1st July, 2004.
2000 years have 0 odd day. 3 ordinary years have 3 odd days.
January. Feb. March April May June July
31 + 29 + 31 + 30 + 31 + 30 + 1
= 183 days = (26 weeks + 1 day) = 1 t .
Total number of odd days = (0 + 3 + 1) odd days = 4 odd days. '
∴ 1st July 2004 was 'Thursday'
So, 1st Monday in July 2004 _as on 5th July.
So, during July 2004, Monday fell on 5th, 12th, 19th and 26th. .

Q22.D

Q22 Solution:-

By inspection If We show that the number of odd days between last day of February and last day of October is zero then.
March April May June July Aug. Sept. Oct.
31 + 30 + 31 + 30 + 31 + 31 + 30 + 31
= 245 days = 35 weeks = 0 odd day. ,Number of
odd days during this period = O.
So, 1st March of an year will be the same day as 1st November of that year.

Q23.B

Q23 Solution:-

Here we have to count the number days from 3 rd February, 2012 to 18 rd April 2012 (both inclusive)

The given year is leap year , So February month has 29 days .

From 3 rd to 29 th February

= 27 days

In March

= 30 days

From 1^{st} to 18^{th} April

= 18 days

Total number of days

= 75 days

Q24.B

Q24 Solution:-

We first find , the day of the week on 1^{st} April 2009.

1^{st} April 2009 means, 2008 years 3 months and 1 day

= 2000 years + 8 years + January + February + March + 1 st April

= 0 odd days + 2 leap years + 6 ordinary years + 31 days + 28 days +31 days + 1 day

= 0+ 4 odd days + 6 odd days + 3 odd days + 0 odd days +3 odd days + 1 odd day

=17 odd days = 3 odd days

From the date in the above problem, when number of days is 3, the day of the week becomes Wednesday.

So, first Thursday falls on 2^{nd} April.

In that month, Thursday falls on 2^{nd} , 9^{th} ,16^{th}, 23^{rd} and 30^{th}.

CLOCK

The face or dial of a watch is a circle whose outline is partitioned into 60 equivalent amounts of,called time . A timekeeper has two hands, the shorter one is known as the hour hand or short hand while the bigger one is known as the time hand or long hand.

1. In an hour, the time hand cover 55 minutes on the hour hand.
2. In consistently, both the hands concur once each hour.
3. The hands are in the same straight line when they are incidental or inverse to one another.
4. Edge covered by hour hand in 12 hrs = 360°
5. Angel covered by time hand in 60 min. = 360°
6. The hour are 30° apart. (360°/12 = 30°)
7. The minute are 6° apart. (360°/60 = 6°)
8. When the two hands are at rights angles 90°, they are 90/6 = 15 minutes apart. This occurs twice in every hour.
9. When the two hands are in opposite directions, they are 180/6 = 30 minutes apart. This occurs once in each hour.
10. When the hands coincide, they are 0^0 and zero minutes apart.

Too quick:

If a watch showed higher time to real time then it is said to be quick. For example, If a watch or a clock shows 8.15, when the right time is 8, it is said to be 15 minutes too quick.

Too moderate:

If a watch showed lesser time to real time then it is said to be quick. For example, If it showed 7.45, when the right time is 8,it is said to be 15 minutes too moderate.

----------EXERCISE----------

Q1. The two hands of a clock will be together between h and (h+1) o'clock at
A. (60/11)h minutes past h o' clock B. (50/11)h minutes past h o' clock
C. (40/11)h minutes past h o' clock D. (30/11)h minutes past h o' clock

Q2. At what time somewhere around 3 and 4 o'clock will the hand of a clock be together?
A. 180/11 min. past 3 B. 180/11 min
C. 120/11 min. past3 D. 120/11 min

Q3. At what time between 2 and 3 o'clock will the hands of a clock be together?
A. 110/11 min. past 2 B. 120/11 min. past 2
C. 130/11 min. past 2 D. 140/11 min. past 2

Q4. At what time somewhere around 7 and 8 o' clock will the hand of a check be in the same straight line yet not together?
A. 60/11 min. past 7. B. 30/11 min. past 7.
C. 60/11 min. D. 30/11 min.

Q5. At what time between 8 and 9 o'clock will the hands of a clock being the same straight line but not together.
A. 120/11 min. B. 125/11 min. C. 130/11 min. D. 140/11 min.

Q6. At what time between 4 and 5 o'clock will the hands of a clock becomes perpendicular?
A. 10/11 min. past 4 B. 20/11 min. past 4
C. 30/11 min. past 4 D. 40/11 min. past 4

Q7. How many times hour and minute hands of a clock coincides in a day?
A 20 B 21 C 22 D. 24

Q8. How many times hour and minute hands of a clock becomes perpendicular in a day??
A 22 B 23 C 44 D. 48

Q9. Angle created by hour hand at 10 min. past 5:
A. 145° B. 150° C. 155° D. 160°

Q10. The angle between the time hand and the hour hand of a clock when the time is 4.20, is:
A. 0° B. 10° C. 5° D. 20°

Q11. At what time between 4 and 5 o' clock are the hands of a clock 3 minutes apart?
A. 45.09 minutes past 4 o' clock. B. 35.09 minutes past 4 o' clock.
C. 25.09 minutes past 4 o' clock. D. 15.09 minutes past 4 o' clock.

Q12. At what time between 5 and 6 o'clock are the hands of a clock 3 min apart?
A. 316/11 min. past 5 B. 326/11 min. past 5
C. 336/11 min. past 5 D. 346/11 min. past 5

Q13. What is the Angle between the two hands of a clock, the time is 4:35
A. 145° B. 145°/2 C. 140° D. 143°/2

Q14. Find the angle between the two hands of a clock at 3.25 P.M.
A. 45x1/2° B. 45x1/2° C. 47x1/2° D. 48x1/2°

Q15. Find the angle between the two hands of a clock at 5:30 PM.

A. 15° B. 20° C. 25° D. None of these

Q16. Find the angle between the two hands of a clock at 15 minutes past 5 o' clock.

A. 30° B. 35° C. 67.5° D. 37.5°

Q17. A clock is set right at 6 a.m. The clock loses 16 minutes in 24 hours.What will be the true time when the clock indicates 10 p.m. on 4th day?

A. 9 P.M. B. 10 P.M. C. 11P.M. D. 12P.M.

Q18. A clock is set right at 8 a.m. The clock gains 10 minutes in 24 hours will be the true time when the clock indicates 1 p.m. on the following day?

A. 41 min. past 12 B. 44 min. past 12 C. 46 min. past 12 D. 48 min. past 12

Q19. The minute hand of a clock overtakes the hour hand at intervals of 65 minutes of the correct time. How much a day does the clock gain or lose?

A. gains 440/43 minutes B. gains 410/43 minutes
C. lose 440/43 minutes D. lose 410/43 minutes

Q20. A watch which cover consistently is 2 minutes moderate at twelve on Monday What's more, i 4 min.48 sec quick at 2 p.m. on the next Monday. At the Angle when Is it true that it was right?

A. 2 p.m on Tuesday B. 2 p.m on Wednesday
C. 3 p.m on Thursday D. 1 p.m on Friday

Q21. The time hand of a clock surpasses the hour hand at interims of 65 minutes of the right time. The amount of a day does the clock cover or loses?

A. losses B. picks up

Q22. A watch which picks up consistently is 5 min.slow at 8 o'clock in the morning on Sunday and it is 5 min.48 sec. quick at 8p.m on taking after Sunday. At the Angle when was it right?

A. 20 min. past 4 p.m on Wednesday. B. 20 min. past 7 a.m on Wednesday.
C. 20 min. past 7 p.m on Wednesday. D. 20 min. past 4 a.m on Wednesday.

Q23. A watch which gains uniformly, is 6 min. slow at 8 o'clock in the morning Sunday and it is 6 min. 48 sec. fast at 8 p.m. on following Sunday.When was it correct?

A. 20 min. past 7 a.m. on Wednesday B. 20 min. past 7 p.m. on Tuesday
C. 20 min. past 7 a.m. on Tuesday D. 20 min. past 7 p.m. on Wednesday

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----------ANSWERS----------

Q1.A	**Q2.A**	**Q3.B**	**Q4.A**	**Q5.A**
Q6.D	**Q7.C**	**Q8.C**	**Q9.C**	**Q10.B**
Q11.C	**Q12.D**	**Q13.B**	**Q14.C**	**Q15A**
Q16.C	**Q17.C**	**Q18.D**	**Q19.A**	**Q20.B**
Q21.B	**Q22.C**	**Q23.D**		

----------ANSWERS AND SOLUTION----------

Q1.A

Q1 Solution:-

At h o' clock, the minutes hand is 5xh minute behind the hour hand.
The minute hand gains 55 min in 60 mins.
∴ The minute hand will gain 5h minute in 60/55 x 5h = 60h/11 minutes.
∴ The two hands will be together between 'h' and 'h+1' o' clock at (60/11)h minutes h o' clock.

Q2.A

Q2 Solution:-

At 3 o'clock, the hour hand is at 3 and the time hand is at 12.So, they are 15 minutes away.
To coincide, the time hand must cover 15 minutes over the hour hand.
55 Min. are covered by min. hand in 60 min.
So, 15 min. will be covered by it in (60/55x15) min. = 180/11 min.
So, the hand will match at 180/11 min. past 3.

Q3.B

Q3 Solution:-

At 2 o'clock, the hour hand is at 2 and the minute hand is at 12, i.e. they are 10 min apart.
To be together, the minute hand must gain 10 minutes over the hour hand.
Now, 55 minutes are gained by it in 60 min.
So, 10 minutes will be gained in (60 x 10)/55 min. = 120/11 min.
So, The hands will coincide at 120/11 min. past 2.

Q4.A

Q4 Solution:-

At 7 o'clock, the hour hand is at 7 and the time hand is at 12.
In this way, The two hands are 25 min. away.
To be in the same straight line yet not together, they will have to be 30 min. away.
∴ The time hand will cover (30-25) min.=5 min. over the hand.
55 min. are gained by hr. hand in 60 min.
So, 5 min. will be covered by hr. hand in (60/55x5) min. =60/11min.
∴ The hands will be in the same straight line but not together at 60/11 min. past 7.

Q5.A

Q5 Solution:-

At 8 o'clock, the hour hand is at 8 and the minute hand is at 12, i.e. the two hands_ are 20 min. apart.
To be in the same straight line but not together they will be 30 minute apart.
So, the minute hand will have to gain (30 - 20) = 10 minute over the hour hand.
55 minute are gained. in 60 min.
So, 10 minute will be gained in (60 x 10)/55 min. = 120/11min.
∴ The hands will be in the same straight line but not together at 120/11 min.

Q6.D

Q6 Solution:-

At 4 o'clock, the minute hand will be 20 min. behind the hour hand,
Now, when the two hands are at right angles, they are 15 min. apart. So,
they are at right angles in following two cases.
Case I. When minute hand is 15 min. behind the hour hand: In this case min. hand will have to gain (20 - 15) = 5 minute . 55 min. are gained by it in 60 min.
So, 5 min will be gained by it in 60x5/55 min=60/11min.
∴ They are at right angles at 60/11min. past 4.

Case II. When the minute hand is 15 min. ahead of the hour hand: To be in this position, the minute hand will have to gain (20 + 15) = 35 minute
55 min. are gained in 60 min.
35 min are gained in (60 x 35)/55 min =40/11
∴ They are at right angles at 40/11 min. past 4.

Q7.C

Q7 Solution:-

The hands of a check match 11 times in at regular intervals.
∴ The hands concur 22 times in a day.

Q8.C

Q8 Solution:-

In 12 hours, they are at right Angle 22 times.
∴ In 24 hours , they are at right Angle 44 times.
∴ So, time=60/11 min. past 7.

Q9.C

Q9 Solution:-

Angle covered by hour hand in 12 hrs =360°
Angle covered by hour hand in 5 hrs 10 min.
=31/6 = (360/12x31/6)°= 155°

Q10.B

Q10 Solution:-

Angle covered by hour hand in 13/3 hrs. =(360/12x13/3)°= 130°
Angle covered by min. hand in 20 min. = (360/60x20)°= 120°
∴ So, Angle = (130-120)°= 10°

Q11.C

Q11 Solution:-

At 4 o' clock, the minute hand is 20 min behind the hour hand.
There are two possible cases for the given scenario.
Case I: Minute hand is 3 min behind the hour hand.
In this case the minute hand has to gain (20-3) = 17 minutes.= (60/55) x 17 = (12/11) x 17= 204/11
∴ The minute hand will be 3 minute apart at 204/11 min or 18.54 min past 4.
Case II ? Minute hand is 3 minutes ahead of the hour hand.
In this case the minute hand has to gain (20+3) = 23 minute .= (60/55)x23= (12/11)x23= 276/11
= 25.09 minutes
∴ The hands will be 3 minute apart at 25.09 minutes past 4 o' clock.

Q12.D

Q12 Solution:-

At 5 o'clock, the minute hand is 25 min. behind the hour hand.
Case I. Minute hand is 3 min. behind the hour hand.
In this case, the minute hand has to gain' (25 - 3) = 22 minute . 55 min. Are gained in 60 min.
22 min. are gaineg in (60x22)/55min. = 24 min.
∴ The hands will be 3 min. apart at 24 min. past 5.
Case II. Minute hand is 3 min. ahead of the hour hand.
In this case, the minute hand has to gain (25 + 3) = 28 minute . 55 min. Are gained in 60 min.
28 min. are gained in (60 x 28)/55=346/11
The hands will be 3 min. apart at 346/11 min. past 5.

Q13.B

Q13 Solution:-

Angle covered by hour hand in 12 hours=360°.
Angle covered by hour hand in 275/60 hrs i.e. 55/12 hours = (360/12x55/12)= (275/2)°
Angel covered by min, hand in 60 min =360°
Angel covered by min, hand in 35 min= (360/60x35)° = 210°
So, angle = (210°-275°/2) = 145°/2

Q14.C

Q14 Solution:-

angle traced by the hour hand in 12 hours = 360°
Angle traced by it in three hours 25 min (ie) 41/12 hrs=(360x41/12x12)°
=102x1/2°
angle traced by minute hand in 60 min. = 360°.
Angle traced by it in 25 min. = (360 X 25)/60= 150°
So, angle = 150^0 – 102x1/2°= 47x1/2°

Q15A

Q15 Solution:-

At 5:30 PM, the minute hand is at 6 and hour hand is past 5 but behind 6.
In 60 minutes, the hour hand moves ahead by 30°.
∴ In 30 minutes, hour hour hand moves ahead by= 30x(30/60)°= 15°
Angle between 5 and 6 hour = 30°.
SO, angle between the two hands at 5:30 PM = (30 - 15) = 15°.

Q16.C

Q16 Solution:-

At 15 minutes past 5 o' clock, the minute hand is at 3 and hour hand is slightly ahead of 5.
In 60 minutes, the hour hand moves ahead by 300
∴ In 15 minutes, the hour hand moves ahead by = (30/60)x15= 7.5°
Angle between 3 and 5 hour = 60°.
∴ The total angle between the two hands at
15 minutes past 5 o' clock = 60 + 7.5 = 67.5°

Q17.C

Q17 Solution:-

Time from 5 a.m. on a day to 10 p.m. on 4th day = 89 hours.
Now 23 hrs 44 min. of this clock = 24 hours of correct clock.
356/15 hrs of this clock = 24 hours of correct clock.
89 hrs of this clock = [24 x (15/356) x 89] hrs of correct clock.= 90 hrs of correct clock.
So, the correct time is 11 p.m.

Q18.D

Q18 Solution:-

Time from 8 a.m. on a day 1 p.m. on the following day = 29 hours.
24 hours 10 min. of this clock = 24 hours of the correct clock.
145 /6 hrs of this clock = 24 hrs of the correct clock
29 hrs of this clock = (24 x 6/145 x 29) hrs of the correct clock= 28 hrs 48 min. of correct clock
The correct time is 28 hrs 48 min. after 8 a.m.This is 48 min. past 12.

Q19.A

Q19 Solution:-

In a correct clock, the minute hand gains 55 min.over the hour hand in 60 minutes.
To be together again, the minute hand must gain 60 minutes over the hour hand.
55min. are gained in 60 min.
60 min are gained in $\frac{60x60}{55}$ min =720/11 min.
But, they are together after 65 min.
Gain in 65 min =720/11-65 =5/11min.
Gain in 24 hours =(5/11 x (60x24)/65)min =440/43
The clock gains 440/43 minutes in 24 hours.

Q20.B

Q20 Solution:-

Time structure 12 p.m. on Monday to 2 p.m. on the accompanying
Monday =7 days 2 hours =7x24+2 hours = 170 hours.
∴ The watch gains(2+24/5)min.
on the other hand 34/5 min. in 170 hrs.
Now,34/5 min. are covered in 170 hrs.
∴ 2 min. are covered in (170(5/34x2) hrs=50 hrs.
So, the watch is right 2 days 2 hour after 12 p.m. on
Monday i.e.it will be right at 2 p.m. on Wednesday.

Q21.B

Q21 Solution:-

In a right clock, the time hand picks up 55 min. over the hour hand in an hour.
To coincide once more, the time hand must increase 60minutes over the hour hand.
55 min. are covered in 60 min.1
60 min. are covered in (60/55x60) = 716/11 min.
Be that as it may, they are as one after 65 min.
∴ pickup in 65 min.(716/11-65)= 5/11 min.
Cover in 24 hours= (5/11x1440/65) min.
∴ the clock picks up =440/43 min. in 24 hours.

Q22.C

Q22 Solution:-

Time from 8a.m on Sunday to 8p.m on taking after Sunday = 7 days 12 hours = 180 hours
∴ the watch increases (5+29/5) min.
on the other hand 54/5 min. in 180 hrs.
Presently 54/5 min. are covered in 180 hrs.
∴ 5 min. are covered in (180x5x5/54) hrs.= 83 hrs. 20min. = 3days 11 hrs and 20 min.
∴ Watch is right 3 days 11 hrs and 20 min. after 8 am of Sunday.
∴ it will be right at 20 min. past 7 p.m on Wednesday.

Q23.D

Q23 Solution:-

Time from 8 a.m. on Sunday to 8 p.m. on following Sunday = 7 days 12 hours= 180 hours
The watch gains (5 + 29/5) min. or 54/5 min. in 180 hrs.
Now 54/5 min. are gained in 180 hrs.
5 min. are gained in (180 x 5/54 x 5) hrs. = 83 hrs 20 min. = 3 days 11 hrs 20 min.
Watch is correct 3 days 11 hrs 20 min. after 8 a.m. of Sunday.
It will be correct at 20 min. past 7 p.m. on Wednesday.

When you are enthusiastic about what you do, you feel this positive energy.

RACES AND GAMES

Important Formulas :

1. Race: A race is a contest of speed in running, riding, driving, sailing, rowing etc over a particular distance.

2. RaceCourse: Race course is the ground or path on which contests are conducted.

3. Starting Point: Starting Point is the point from which a race starts.

4. Winning Point (or Goal): Winning Point (or Goal) is the point where a race finishes.

5. Dead-heat Race: A race is said to be a dead-heat race if all the persons contesting the race reach the winning point (goal) exactly at the same time.

6. Winner: Winner is the person who first reaches the winning point.

7. Let A and B be two competitors in a race. Lets examine some of the general statements and their mathematical interpretations.

Some statements and their mathematical interpretations:

A beats B by t seconds	=>	A finishes the race t seconds before B finishes.
A gives B a start of t seconds	=>	A starts t seconds after B starts from the same starting point.
A gives B a start of x metres	=>	While A starts from the starting point, B starts x meters ahead from the same starting point at the same time. [To cover a race of 100 metres in this case, A will have to cover 100 metres while B will have to cover only (100 - x) metres.]

8. If A is n times as fast as B and A gives B a start of x meters, then the length of the race course, so that A and B reaches the winning point at the same time $=x(nn-1)$ metres

9. If A can run x metre race in t_1 seconds and B in t_2 seconds, where $t_1 < t_2$, then A beats B by a distance $xt_2(t_2-t_1)$ metres

----------EXERCISE----------

Q1. In a 100m race, A can beat B by 25m and B can beat C by 4m. In the same race, A can beat C by
A. 29m B. 21m C. 26m D. 28m

Q2. In a 500 m race, the ratio of the speeds of A and B is 3:4. A has a start of 140m. A wins by:
A. 10m B. 20m C. 40m D. 60m

Q3. In a 100m race, A beats B by 10m and C by 13m. In a race of 180m, B will beat C by :
A. 4.5m B. 5.4m C. 6m D. 7.5m

Q4. In a game of 100 points , A can give B 20 points and C 28 points. Then, B can give C:
A. 8 points B. 10 points C. 12 points D. 14 points

Q5. A and B take part in a 100m race. A runs at 5km/hr. A gives B a start of 8m and still beats him by 8 sec. B's speed is:
A. 5.15 km/hr B. 4.15 km/hr C. 4.25 km/hr D. 4.14 km/hr

Q6. In a 300m race, A beats B by 15 meters or 5 sec. A?s time over the course is
A. 90 sec B. 95 sec C. 100 sec D. 105 sec

Q7. In One-Km.. race, A beats B by 40m or 8 seconds. Find A's time over the course.
A. 1 min. 12 sec. B. 2 min. 12 sec. C. 3 min. 12 sec. D. 4 min. 12 sec.

Q8. A can run 1 km in 3 min.10sec. And B can cover the same distance in 3 min. 20 sec. By what distance can A beat B?
A. 80 m B. 70 m C. 60 m D. 50 m

Q9. In 100m race, A runs at 6 km/h. If A gives B a start of 4m and still beats him by 12 seconds, what is the speed of B?
A. 1.8 km/hr B. 2.8 km/hr C. 3.8 km/hr D. 4.8 km/hr

Q10. A can run 1 km in 4min. 50 sec. and B in 5 min. How many meters start A give B in One-Km. race so that the race may end in a dead heat?
A. 500/3 m B. 400/3 m C. 100/3 m D. 200/3 m

Q11. In a race of 600m, A can beat B by 60m and in a race of 500m, B can beat C by 50m. By how many meters will A beat C in a race of 400m?
A. 46 m. B. 56 m. C. 66 m. D. 76 m.

Q12. At a game billiards, A can give B 10 points in 60 and he can give C 15 in 60. How many can B can give C in a game of 90?
A . 9 B. 8 C. 7 D. 6

Q13. A, B, C are the three competitors in One-Km. race. If A can give B a start of 40m and A can give C a start of 64m, how many meters start can B give C?
A. 15 m. B. 20 m. C. 25 m. D. 30 m.

Q14. A race course is 400 m long. A and B run a race and A wins by 5m. B and C run over the same course and B win by 4m. C and D run over it and D wins by 16m. If A and D run over it, then who would win and by how much?
A. D by 7.2 m B. C by 8.1 m C. B by 9.0 m D. A by 9.6 m

Q15. In a km race, A beats B by 28 metres or 7 seconds. Find A's time over the course.

A. 1 min. 13 sec B. 2 min. 9 sec C. 3 min. 6 sec D. 4 min. 3 sec

Q16. A runs 1 ¾ times as fast as B. if A gives B a start of 84 m, how far must winning point be so that A and B might reach it at the same time?

A. 108 m B. 130 m C. 180 m D. 196 m

Q17. In a 100 m race, A runs at 8km per hour. If A gives B a start of 4 m and still him by 15 seconds, what is the speed of B ?

A. 5.76 km/hr B. 6.76 km/hr C. 7.76 km/hr D. 8.76 km/hr

Q18. A, Band C are three competitors in a km race. If A can give B a start of 40 m and A can give C a start of 64m how many metre's start can B give C ?

A. 20 m B. 25 m C. 30 m D. 50 m

Q19. In a game of 80 points; A can give B 5 points and C 15 points. Then how many points B can give C in a game of 60 ?

A. 2 m B. 4 m C. 8 m D. 16 m

Q20. Three athletes X, Y and Z run a race, Y finished 24 meters ahead of C and 36 m ahead of X, while C finished 16 m ahead of X. If each athlete runs the entire distance at their respective constant speeds, what is the length of the race?

A. 108 m B. 90 m C. 80 m D. 96 m

Q21. In a kilometer race, If Vikram gives Abhilash a 40 m start, Vikram wins by 19 sec. But if Vikram gives Abhilash a 30 sec start, Abhilash wins by 40 m. Find the time taken by Abhilash to run 5,000 m?

A. 150 sec B. 450 sec C. 750 sec D. 825 sec

This chapter contains the topics and questions I discussed and created in our classes or obtained from students as their doubts. All the questions noted, typed, redesigned and rectified by group of volunteers consisting of:

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----------ANSWERS----------

Q1.D	**Q2.B**	**Q3.C**	**Q4.B**	**Q5.D**
Q6.B	**Q7.C**	**Q8.D**	**Q9.D**	**Q10.C**
Q11.D	**Q12.A**	**Q13.C**	**Q14.A**	**Q15.D**
Q16.D	**Q17.A**	**Q18.B**	**Q19.C**	**Q20.D**
Q21.C				

----------ANSWERS WITH SOLUTION----------

Q1.D

Q1 Solution:-

A :B = 100:75 and B :C = 100:96

∴ A : C = (A/B x B/C) = (100/75x100/96) = 100/72 = 100:72

So, A beats C by (100-72) m = 28m

Q2.B

Q2 Solution:-

To reach the winning point A has to cover (500-140)m = 360m

While A covers 3 m , B covers 4 m.

While A covers 360m , B covers (4/3x360)m = 480m

∴ A wins by 20 m.

Q3.C

Q3 Solution:-

A: B :C = 100: 90:87

∴ B/C = 90/87 = 90x2/87x2 = 180/174

Thus, while B covers 180m , C covers 174 m.

∴ B beats C by 6m.

Q4.B

Q4 Solution:-

A:B:C = 100:80:72

∴ B:C = 80/72 =10/9 =100/90

If B scores 100, then C scores 90.

So, B can give C 10 points.

Q5.D

Q5 Solution:-

A's speed =(5x5/18) m/s = 25/18m/s.

Time taken by A to cover 100m = (100x 18/25) sec. =72 sec.

∴ B covers 92 m in (72+8) sec.= 80 sec.

∴ B's speed = (92/80)m/sec. = (92/80x 18/5) km/hr = 4.14km/hr

Q6.B

Q6 Solution:-

B covers 15m in 5 sec.

300 m are covered by B in (5/15x300) sec. = 100 sec.

Time taken by A =(100-5) sec.= 95 sec.

Q7.C

Q7 Solution:-

Clearly, B covers 40 m in 8 seconds.

∴ B's time over the course = (8/40x1000) sec. = 200sec.

A's time over the course = (200-8) sec. =192 sec. = 3 min. 12 sec.

Q8.D

Q8 Solution:-

Clearly, A beats B by 10 sec.
Distance covered by B in 10 sec. = (1000/200x10)m = 50m
∴ A beat B by 50 m.

Q9.D

Q9 Solution:-

Time taken by A to run 100m = (60x60/6000x100) sec. = 60 sec.
B covers (100-4) m in (60 +12) sec.
∴ B's speed = 96/72m/sec. = (96/72x18/5) km/hr = 4.8 km/hr

Q10.C

Q10 Solution:-

Time taken by A to run 1 km = 290 sec.
Time taken by B to run 1 km = 300 sec.
A can give B a start of (300-290) = 10sec.
In 300 sec, B runs (1000/300x10) m = 100/3 m
∴ A can give B start of 100/3 m.

Q11.D

Q11 Solution:-

If A runs 600m, B runs 540 m.
If A runs 400m, B runs (540/600x400) m = 360m
When B runs 500m, C runs 450m.
When B runs 360 m, C runs (450/500x360) m = 324 m.
∴ A beats C by (400-324) m =76 m

Q12.A

Q12 Solution:-

If A score 60 points, B score 50 points and C score 45 points.
When B scores 50 points, C scores 45 points.
When B scores 90 points, C scores (45/50 x90) points = 81 points.
∴ B can give C, 9 points in a game of 90.

Q13.C

Q13 Solution:-

While A covers 1000m, B covers (1000-40)=960m and C covers (1000-64) =936m.
When B covers 960 m, C covers 936 m.
When B covers 1000m, C covers (936/960x1000)m =975m
∴ B gives C a start of (1000-975) m = 25 m.

Q14.A

Q14 Solution:-

If A covers 400m, B covers 395 m
If B covers 400m, C covers 396 m
If D covers 400m, C covers 384 m
Now if B covers 395 m, then C will cover 396/400×395=391.05m
If C covers 391.05 m, then D will cover 400/384×391.05=407.24
If A and D run over 400 m, then D win by 7.2 m (approx.)

Q15.D

Q15 Solution:-

Clearly, B covers 28 m in 7 seconds.

∴ B's time over the course = (7/28 x 1000) sec = 250 seconds.

∴ A's time over the course = (250 - 7) sec = 243 sec = 4 min. 3 sec.

Q16.D

Q16 Solution:-

Ratio of the speed of A and B = 7/4 : 1 = 7 : 4.

So, in a race of 7 m, A gains 3m over B.

∴ A gains 3 m in a race of 7 m.

∴ A gains 84 m in a race of (7/3 x 84) m = 196 m.

∴ So race must be of length 196 m.

Q17.A

Q17Solution:-

Time taken by A to cover 100 m =(60 X 60/ 8000) x 100 sec = 45 sec.

B covers (100 - 4) m = 96 m in (45 + 15) sec = 60 sec.

B's speed = (96 x 60 x 60)km/hr = 5.76 km/hr.

Q18.B

Q18 Solution:-

When A covers 1000 m,

Then B covers (1000 - 40) m = 960 m and C covers (1000 - 64) m or 936 m.

When B covers 960 m, C covers 936 m

When B covers 1000 m, C covers 936x1000/960 m.=975m

So, B can give a start of 25m to C

Q19.C

Q19 Solution:-

A: B = 80 : 75, A : C = 80 : 65.

B/C = (B/ A x A/C) = (75/ 80 x 80/ 65) = 15/13 = 60/52 = 60: 52

So ,In a game of 60, B can give C 8 points.

Q20.D

Q20 Solution:-

Let the length of the race be 'd'.

When Y finished the race, X and Z would have run (d−36) and (d−24) meters respectively.

When C finishes the race, X would have run (d−16) meters.

The ratio of speeds of C and X in first case: (d-36)/(d-24)

The ratio of speeds of C and X in first case: (d-16)/d

So we get

d−24:d−36=d:d−16

solving we get:- d=96 m

So length of race is 96 mtr.

Q21.C

Q21 Solution:-

If Vikram takes S seconds and Abhilash takes T seconds to run 1 km, then:

⇒ y=150 sec and x=125 sec

x+19=960y/1000

960x1000+30=y

⇒ y=150 sec and x=125 sec

Answer =1501000×500=1501000×500 = 750 sec

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