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hyderabad circle

In order to understand this concept, we need to learn some words

Factor - One number is said to be a factor of another when it divides the other exactly. Eg- 6 & 7 are factors of 42.

Highest Common Factor - Hcf of two or more numbers is the greatest number that divides each of them exactly. Thus ,6 is the HCF of 18 & 24.Because there is no number greater than 6 that divides both 18 & 24.
eg- HCF of 1365,1560& 1755
1365 = 3*5*7*13
1560 = 2*2*2*3*5*13
1755 = 3*3*3*5*13
HCF = 3*5*13 = 195

Relation between HCF & LCM
 HCF(n1,n2) x LCM(n1,n2) = n1 x n2

after expressing the given fractions in lowest terms.

LCM - lcm of two or more given numbers is the least number which is exactly divisible by each of them.
15 is a common multiple of 3 & 5
LCM of 8, 12, 15, 21
*8= 2*2*2**
*12= 2*2*3*
*15 = 3*5*
*21= 3*7*
*Here, the prime factors that occur in the given numbers are 2, 3, 5, 7 and their highest powers are respectively 2*2*2, 3, 5, & 7.*
*Hence , the required LCM = 2*2*2**3*5*7= 840*

Ex1: The LCM of two numbers is 2079 and their HCf is 27. If one of the numbers is 189, find the other ?

sol. the required number= LCM * HCF /first number= 2079*27/189 = 297

Some questions on this topic
Q1. Find the least number of square tiles required to pave the

ceiling of a hall 15m 17cm long and 9m 2cm broad.
Ans - 814

Q**2. Find the HCF & LCM of 4/5, 5/6, 7/15?**
Ans - HCF = 1/30
     LCM = 140

HCF of decimals
step 1   -first of all , we make the same no. of decimal places by putting zero or zeroes in the given no .It is done only when the nos have different decimal places i.e. 1.3,1.32
step II - find the HCF of the given numbers without taking decimals into consideration i.e. as integers
step III - put in the result , i.e. HCF as many decimal places as there are in each of the numbers after making them same in step 1.

*Pro**per Fraction**: is one whose numerator is less than denominator. eg - 3/4, 17/19*

***Improper fraction**: a fraction whose numerator is equal to or greater than the denominator . eg - 17/12, 18/5*

***Complex fraction**: is one in which the numerator or denominator or both are fractions. eg - 5'7/8*

Q. Simplify :

```
   7                   3 -   2
---------- ÷                ----   5/7
  5-8/3                     3- 3/2
                           -------------
                           4- 3/2
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Q2. One -quarter of one seventh of a land is sold for Rs 30,000. What is the value of an eight thirty - fifths of land?
Ans- one quarter of one seventh = 1/4 * 1/7= 1/28
8/35 of the land will cost 30,000*28*8/35 = Rs 1,92,000.
Recurring Decimals: *a decimal in which a figure or set of figures is repeated continually .*

eg - 1/3 = 0.333------

Simplify:
Q1. 9.5* 0.085/0.0017 * 0.19
(Ans- 0.01)

Q2.   (0.6bar + 0.7bar +0.8bar + 0.3bar) * 9000 = 24,000

Algebraic Expressions: .a number , including literal numbers , along with the signs of fundamental operations .

Eg: **Find the sum of**
1) -15a^2 +3ab -6b^2 , a^2 -5ab + 11b^2 ,-7a^2 -18ab -13b^2 and 26a^2 -16ab -7b^2
Ans- 5a^2 -36ab -15b^2

Remainder Theorem: *this theorem represents the relationship between the divisor of the first degree in the form (x-a) and the remainder r(x)*
Q: Find the remainder when 27x^3 -9x^2 +3x- is divided by 3x+2
Ans : 3x+2=0 , x = -2/3
remainder is f(-2/3)
f(-2/3) = 27(-2/3)^3 -9(-2/3)^2 +3(-2/3) -8
= -8-4-2-8 = -22

CONDITIONS OF DIVISIBILITY:
   1. ***x^n + a^n is exactly divisible by (x + a) only when n is odd.***
   1. ***x^n +a^n is never divisible by (x -a)***
   eg - a^7 +b^7 or a^{10} + b^{10} is not divisible by a - b

Quadratic Equations:
Factorize-
           1)x^2 -3x +4 =0
           2)if a+b+c =0 ,find the value of a^2 +b^2 +c^2/a^2 -bc

Natural Numbers - N (1,2,3,4,.........)
Whole Numbers -   W(0,1,2,3,.....)

Prime Numbers - a number other than 1 , if it is divisible only by 1 and itself

prime numbers

1. the lowest prime no. is 2
1. *2 is the only* even prime no.
1. the lowest odd prime no. is 3.
1. the remainder when a prime no. p>=5 is divided by 6 is 1 or 5. however, if a no. on being divided by 6 gives remainder of 1 or 5 the no. need not be prime.
1. the remainder of the division of the square of a prime number p>= divided by 24 is 1.
1. for prime no. p>3, p^2-1 is divisible by 24.

divisibility rules

1. divisibility by 2: a no. is divisible by 2 if its last digit is 0 or divisible by 2.
1. divisibility by 3: a no. is divisible by 3 if the sum of its digits is divisible by three.
1. divisibility by 4: a no. is divisible by 4 if its last two digits are '00 or divisible by 4.
1. divisibility by 5: a no. is divisible by 5 if its last digit is 0 or 5.
1. divisibility by 6: a no. is divisible by 6 if it is divisible by 2 and 3 both.
1. divisibility by 7: a no. is divisible by 7 if the difference of the number of its thousands and the remainder of its division by 1000 is divisible by 7.
1. divisibility by 8: a no. is divisible by 8 if its last three digits are '000 or divisible by 8.
1. divisibility by 9: a no. is divisible by 9 if the sum of its digits is divisible by 9
1. divisibility by 11: a no. is divisible by 11 if the difference of the sum of the digits at even places and sum of the digits at odd places is zero or divisible by 11.
1. divisibility by 13: a no. is divisible by 13 if the difference of the number of its thousands and the remainder of its division by 1000 is divisible by 13.

certain rules pertaining to number system

1. of n consecutive whole nos. a, a+1,.......a+n-1, one and only one is divisible by n.
1. 3^n will always have an even no. of tens.e.g. 2<u>7</u>,<u>8</u>1, 24<u>3</u>,<u>7</u>29 etc.

1. *a sum of five consecutive whole numbers will always be divisible by 5. e.g. 1+2+3+4+5=15/5=3*
1. *xy-yx is divisible by 9.*
1. *the product of three consecutive natural nos.is divisible by 6.*
1. *odd no.x odd no.=odd no.*
1. *odd no.x even no.=even no.*
1. *even no.x even no.=even no.*
1. *odd no.+ odd no.=even no.*
1. *odd no.- odd no.=even no.*
1. *odd no.+ even no.=odd no.*
1. *even no.+ even no.=even no.*
1. *even no.- even no.=even no.*
1. *the product of 'r' consecutive numbers is divisible by r!*

if m and n are two numbers then (m+n)! is divisible by m!n!

if a and b are any two odd prime then a^2-b^2 is composite. also, a^2+b^2 is composite

❑

Q1) IS 349 a prime number?
Ans- the square root of 349 is approx 19.The prime no. less than 19 are 2,3,5,7,11,13,17
clearly ,349 is not divisible by any of them. Therefore 349 is a prime number.

'VBODMAS' where V ,B,O,D,M,A,S stand for viniculum,bracket, of ,division ,multiplication,addition and subtraction respectively.
Simplify: 3/7 of (6+8* ☐3-2) +[1/5 - {3/7 +8/14}
Sol :   1 3/7 of (6+8*1) + {1/5 / 7/25 - 14/14 }
**   1/ 3/7 of (6+8) + {1/5* 25/7 -1}**
**   1 / 3/7 of 0f 14 +{5/7 - 1 }**
**   1 / 6 +{ -2/7}**
**   1/6 -2/7 = 7-12/42 = -5/42**

Some formulaes:
$a^x * a^y = a^{x+y}$
$a^x / a^y = a^{x-y}$
$a^x = 1$, then x is 0 for all values of a (except 0)
Ascending or descending orders in Rational Numbers:
Q: Which is greater 5/8 or 9/14 ?
Ans : the fraction whose numerator after cross multiplication gives the greater value is greator.
5/8   9/14 we have 5 * 14 = 70 & 8*9 = 72
as 72 is greater than 70 ,therefore 9/14 is greater of the two.

Some rules on counting numbers:

1. *sum of all the first n natural numbers = n(n+1)/2*
eg 1+2+3+......+105 =105(105+1)/2 = 5565
1. *sum of 1st n odd numbers = n^2*
eg 1+3+5+7 = 4^2 = 16
1. *sum of 1st n even numbers =n(n+1)*
2+4+6+8+....+100= 50(50+1) = 2550
1. *sum of squares of first n natural numbers = n(n+1)(2n +1)/6*
1. *sum of cubes of first n natural numbers = {n(n +1)/2 }²*

Digit in unit place
1) for odd numbers
when there is an odd digit in the unit place (except 5) , multiply the no. by itself until you get 1 in the unit place.
1. *for even numbers*
when there is an even digit in the unit place ,multiply the no. by itself until you get 6 in the unit place
For 1,5,6 the unit digit will remain the same , be multiplied any no.times

Q1: A watch ticks 90 times in 95 seconds and another watch ticks 315 times in 323 sec. If both the watches are started together ,how many times will they tick together in the first hour?
Ans- The first watch ticks every 95/90 sec and the sec watch ticks every 323/315 sec
they will tick together after (LCM of 95/90 and 323/315) sec
LCM of 95/90 &323/315 = LCM of 95,323/ HCF of 90, 315
 = 19*5*17/45
The no. of times they will tick in the first 3600 sec = 3600 / 19*5*17/45= 3600*45/19*5*17 =100..
Once they have already ticked in the beginning ; so in 1 hour they will tick 100+1= 101 times.

Q2) Find the least number which , when divided by 13, 15, 19 leaves the remainders 2, 4 and 8 respectively.
Ans - 13-2 =15-4= 19-8 = 11
now LCM of 13,15,19 = 3705
Therefore the required least no = 3705 - 11 = 3694

FIND THE REMAINDER:
Q1) Find the remainder when 7^{13} + 1 is divided by 6?
Ans- 7^{13} = $(6 +1)^{13}$ has each term except 1^{13} exactly divisible by 6. Thus , when 7^{13} is divided by 6 we have the remainder 1^{13} = 1 and hence , when 7^{13} +1 is divided by 6 the remainder is 1+1 = 2

To find the number of different divisors of a composite number

find the prime factors of the no. and increase the index of each factor by 1. The continued product of increased indices will give the result including unity and the number itself.

Q1) $50 = 2*5*5 = 2 * 5^2$
the no of total divisors = $(1+1)(2+1) = 2*3 = 6$
or the no. of divisors excluding 1 and 50 = 6-2 =4

Q2) How many nos. up to 200 are divisible by 4 and 3 together?
Ans - LCM of 4& 3 is 12
Now, divide 200 by 12 and the quotient obtained is the required number of numbers .
$200 = 16 * 12 + 8$
Thus , there are 16 numbers

Q3) If the places of last two digits of a three- digit number are interchanged , a new number greater than the original number by 54 is obtained.What is the difference between the last two digits of that number?
Ans - Let the three -digit no be 100x +10y +z
A/Q $(100x +10z + y) - (100x +10y +z) =54$
or $9z - 9y = 54$ or $z-y = 6$

Q1: The age of the father 3 years ago was 7 times the age of his son. At present the father's age is 5 times that of his son.What are the present ages of the father and the son.
Ans: Let the present age of son = x years
then the present age of father = 5x yrs
3 years ago,
$7(x-3) =5x - 3$
$2x = 18$, x= 9 yrs
so father's age = 45 yrs

Q2: The sum of the ages of a son and father is 56 yrs.After 4 yrs , the age of the father will be 3 times that of the son .What is the age of the son? (ans 12 yrs)

Q3: The ratio of the father's age to that of son's age is 4:1 The product of their ages is 196.What will be ratio of their ages after 5 yrs?

Ans- let the ratio of proportionality be x yrs
$4x*x = 196$ or $4x^2 = 196$ or $x = 7$
thus father's age = 28 yrs, Son's age = 7 yrs
After 5 yrs , father's age = 33 yrs , son's age =12 yrs
Ratio = 33:12= 11:4   TOP)

SI - when interest is calculated on the original principal for any length of time .
SI = p*r*t /100 where p= principal, r= rate of interest , t = no. of years

A =P + I =P +PRT/100
or P = 100 * A/100 + RT

(tip) - in counting the no of days between the two given dates the either day (first or last) is excluded.you have to keep in mind that interest is not charged for the day on which money is borrowed but it is charged for the day it is returned.

Q**: A sum of Rs 468.75 was lent out at simple interest and at the end of 1 year 8 months the total amount was Rs 500.Find the rate of interest percent per annum.**
Ans - I = Rs (500 - 468.75) = Rs 31.25
r = 100*31.25/468.75*5/3 = 100*3125/46875*3/5 = 4

Compound Interest :
$$A = P\{1 + R/100 \}^n$$
where A is amount, R is rate of interest, 'n' is no. of years
CI = amount - principal
if the interest is payable half yearly then $A = P\{1+ R/2 \}^{2T}$

                                                                        100
Monthly Installment = amount to be paid-down payment/no. of installments

1. *when rates are different for different years , say R_1% , R_2% ,R_3% for 1st , 2nd and 3rd year then,*
    amount =px[1+r_1/100][1+r_2/100][1+r_3/100]

Q**: If the compound interest on a certain sum for 2 years at 3 percent be rs 101.50,What would be the simple interest?**
Ans- CI= {1.03*1.03-1} = 609/10000
        SI on Rs 1 = 6/100

SI/CI = 6/100*10000/609 = 200/203
SI = 200/203 of Rs 101.50= Rs 200/203*203/2 = Rs 100

1. " Percent " implies " for every hundred".

2.The base used for the sake of percentage change calculations is always the original quantity unless otherwise stated.

3. In general, if the percentage increase is p%, then the new value is [(p/100) +1]

4. If the new value is k times the old value, then the percentage increase is (k-1) x 100

Eg1: If the percentage increase is 300%, the new value is 4 times the old value.

If the new value is 4 times the old value, the percentage increase is 300%.

5. If there are successive increases of p%, q% and r% in three stages, the effective percentage increase is

= {[(100+p) /100] [(100+q)/100] [(100+r)/100] -1} x 100

Eg2: The percentage increase in the value of exports of apples of a country is as follows:

2001- 2002 => 25 %; 2002-2003 => 20 %; 2003-2004 => 10%

What is the percentage increase in the value of exports of apples of the country from 2001 to 2004?

Ans : Let the value of exports in 2001 be 100 units.

Then total percentage increase is:

= {[(100+25)/100] [(100+ 20)/ 100] [(100+10)/100] - 1} x 100

= {(1.25) (1.20) (1.10) -1} x 100

= [1.65-1.00] x 100

= [0.65] x 100

= 65

6. If the price of an item goes up by x %, the percentage reduction required to bring it down to the original price is:

= {100x / (100+x)} %

E*g3: If the price of an item goes up by 10%, by what percentage should the new price be reduced to bring it down to the original price?*

Ans: Percentage reduction = {100 x 10/ (100 + 10)} %

= (1000/110) %

= 9.09 %

7. If the price of an item goes down by x %, the percentage increase required to bring it back to the original price = {(100 x 10) / (100 - x)} %.

8. If A is x % more/ less than B, then B is {(100 x 10) / (100 - x)} % less/ more than A.

9. If the price of an item goes up by x %, then the quantity consumed should be reduced by {100x /(100 +x)} % so that the total expenditure remains the same.

10. If the price of an item goes downs by x %, then the quantity consumed should be increased by {100x /(100 -x)} % so that the total expenditure remains the same.

Eg4: If the price of tea goes up by 10%, then what should be the percentage decrease in the quantity consumed so that the total expenditure on tea remains the same?

Ans: Required Percentage decrease = { (10 x 100) / (100+10) }%

$$= \ (1000/110) \ \%$$

$$= \ 9.09\%$$

11. If A's income is x% more than that of B, then B's income is less than that of A by [(100r)/(100+r).

12. If B's income is x% less than that of A, then A's income is more that of B by   [(100x)/(100-x)] **(TOP)**

AVERAGE is also called mean. suppose a,b,d,e(in ascending order) are the given nos.and c is the average of given nos=a,b,d,e.

the average value c is such a value ,so that sum of the individual distances of nos.from avg. value c lying below the avg. value. c and sum of the individual distances of nos.from avg. value c lying above c are equal.e.g. take nos.1,2,3,4,5 .their avg.is 3. distance of 1 from 3=3-1=2(a)

distance of 2 from 3=1(b)
distance of 3 from 3=0
distance of 4 from 3=1(c)
distance of 5 from 3=2(d)
here a+b=c+d

normally average is also called arithmetic mean.

avg.=total of items/number of items
or,
formula for average 'c'=(a+b+d+e)/4

there is one more way of calculating average.take one example.
numbers given are.21,25,15,20,26,31,18
we dont know the avg.. let us take 20 as an avg. we could have taken any no.like 21 ,22,10,40 ...anything. now take the summation of distances between the assumed avg.20 and given numbers.for the nos. below 20 take the differences with negative sign and for the nos. above 20 take the differences with positive sign.now add them and divide the summation with the total no. of numbers given.if the resulting no.is negative ,substract it from the asumed avg. to get the original avg. and if the resulting no. is positive add to the assumed avg. to get the original avg.

in the given problem,
sum of the differences=1+5+(-5)+0+6+11+(-1)=16
$$16/7=2.28$$

now add this to assumed avg. 20=20+2.28=22.28(original avg.)

Now let us solve some of the questions to clarify the concept.

Q1. **the avg. age of 30 boys of a class is 14 years.when the age of the class teacher is included the average becomes 15 years. find the age of clas teacher?**

solution:summation of the ages of 30 boys=avg. age of boys x no.of boys

= 14x30=420 yrs-(i).

summation of ages of 30 boys & 1 teacher(total 31 items)=15x31=465 yrs(ii)

now difference of ii and i will give the age of teacher=465-420=45 yrs.

there is one more way of doing this problem.

when avg. is calculated the total value of items is equally distributed among the items whose values has been totalled.in the above problem when avg. age was calculated 14 yrs was distributed equally among 30 boys. when the age of teacher is added the avg. age increases by 1 yr. in other way we can say,each boy was given 1 yr. so total of 30 yrs from the teacher's age was given to the boys. then we have to keep 15 yrs for the teacher(as he also joins the group) so as to maintain the new avg. age of 15 yrs.

so,our answer is 45 yrs(30+15). out of which 30 yrs has been given to 30 boys and remaining 15 yrs is kept to maintain avg. of 15 yrs for the group of 31 people.

Q2.the avg. age of 4 men is increased by 3 kg when one of them who weighs 120 kg is replaced by another man. what is the weight of the new man?

solution: let the avg. age of four men before exit of man with 120kg weight be 'A'.when he exits and new person enters,avg.age becomes 'A+3'. it means the newcomer brings with him weight which is more than 120 kg. the extra amount brought by him must be 12 yrs, as he has to give 3 yrs each to each of four members including himself(4x3=12).so his age must be 120+12 yrs=132 yrs.

Q3.one third of a certain journey is covered at rate of 25km/hr, one fourth at the rate of 30 km/hr and the rest at 50 km/hr. find the average speed for the whole journey?

solution:let us take the total distance be 120km(as it is divisible by both 3 and 4)

so,distance travelled @25km/hr=1/3 x 120=40 km. time taken to

travel this distance=40/25=1.6 hr
  distance travelled @30km/hr=1/4 x 120=30 km. . time taken to travel this distance=30/30=1 hr
distance travelled @50km/hr=120-40-30=50 km. . time taken to travel this distance=50/50=1hr

so, total time taken=1.6+1+1=3.6 hours.
 total distance travelled=120 km
avg. speed for the journey=120/3.6=33.33 km/hr

Q4.a cricketer has completed 10 innings and his average is 21.5 runs.how many runs he must make in his next inning so as to raise his avg.to 24?
solution:keeping in mind the solutions given in Q1 and Q2, from the runs scored in the 11th inning 2.5 runs is to be given to each of the 10 innings so as to raise their avg. score to 24 runs and in addition to that 11th inning has to keep 24 runs to maintain the avg. score per inning(for 11 innings) at 24 runs.
 so,total runs to be scored in the 11th inning is =2.5x10+24=49 runs.

Q5.the avg. of 11 results is 30,that of the first five is 25 andthat of the last five is 28. find the value of sixth number?
solution:total of 11 results=11x30=330 - 'a'
    total of the first five results=5x25=125
  total of the last five results=5x28=140
     total of the first five results & total of the last five results=125+140=265-'b'
  in this operation,our sixth result has been left as
1 2 3 4 5 6 7 8 9 10 11
1st five   last five

  so difference of 'a' and 'b' will give the value of 6th result =330-265=65

Q6the average of first 61 natural no.is?
solution:first of take the total of first 61 natural nos.={n(n+1)}/2

n=61 so,   61(61+1)/2=1891
 now for avg. of 61 nos.= 1891/61=31

1.   **RATIO- t he ratio of two quantities of the same kind is the**

fraction that one quantity is of the other, in other words to say, how many times a given number is in comparison to another number. A ratio between two nos.x A and B is denoted by A/B

2. Some of the points to be remembered :
    1. The two quantities must be of the same kind.
    2. The units of the two quantities must be the same.
    3. The ratio has no measurement.
    4. The ratio remains unaltered even if both the antecedent(A) and the consequent(B)are multiplied or divided by the same no.

1. If two different ratios (say A /B and C/D) are expressed in different units, then if we are required to combine these two ratios we will follow the following rule= A xC / B xD
   The required ratio is AC / BD

1. The duplicate ratio of A/B is A^2/B^2 the triplicate ratio of A/B is A^3/B^3

1. The subduplicate ratio of A/B is sq.root of A/ sq.root of B

1. The subtriplicate ratio of A/B is cube root of A/ cube root of B

1. To determine which of the given two ratio A/B and C/D is greater or smaller ,we compare A xD and B xC provided B>0 and D>0;
   if AxC> B xD then A/B > C/D and vice versa,but if A xC= B xD then A/B = C/D

1. Properties of ratios.
    1. Inverse ratios of two equal ratios are equal, if A/B=C/D then B/A = D/C.
    2. The ratios of antecedents and consequents of two equal ratios are equal if A/B=C/D then A/C=B/D
    3. If A/B=C/D THEN A+B/B=C+D/D
    4. If A/B=C/D THEN A-B/B=C-D/D
    5. If A/B=C/D THEN A+B/A-B=C+D/C-D
    6. If A/B=C/D=E/F.....so on then each of the ratio(A/B, C/D.....etc) is equal to
       sum of th numerators/sum of the denominators=A+C+E...../B+D+F......=k

PROPORTION
1. Two ratios of two terms is equal to the ratio of two other terms, then these four terms are said to be in proportion i.e. if A/B=C/D then A,B,C and D are in proportion.
   A,B,C and D are called first, second,third and fourth

proportionals respectively.
A and D are called Extremes and B and C are called the Means
and it follows that A xD=B xC

1. **Continued proportion: when A/B=B/C then A, B and C are said to be in continued proportion and B is called the geometric mean of A and C so it follows,**
   A xC=B^2 ,OR square root of (A xC)=B

1. **Direct proportion: if two quantities A and B are related and an increase in A decreases B and vice-versa then A and B are said to be in direct proportion.Here A is directly proportional to B is written as A⚂B.when ⌣ is removed equation comes to be**
   A = kB,where k is constant.

1. **Inverse proportion: if two quantities A and B are related and an increase in A increases B and vice-versa then A and B are said to be in inverse proportion. Here A is inversely proportional to B is written as A⚂1/B or,**
   A=k/B,where k is constant.

1. **Propotional division:**
   It simply means a method by which a quantity may be divided into parts which bear a given ratio to one another .The parts are called propotional parts.
   e.g.divide quantity "y" in the ratio a:b:c then

   first part= a/(a+b+c)=y   second part=b/(a+b+c)=y   third part=c/(a+b+c)=y

Now let us work out some questions to understand the underlying concept.

Q1. Find the three numbers in the ratio of 1:2:3 so that the sum of their squares is equal to 504?
 Ans:let 1st no. be 1x,2nd no. be 2x and 3rd no. be 3x
  their squares- x^2, $(2x)^2$ and $(3x)^2$
  as per the question, $x^2 + (2x)^2+(3x)^2 = 504$
                    $x^2+4x^2+9x^2=504$
                     $14x^2=504$
                     $x^2=504/14=36$
                    so, $x=6$

So the three no. are 1x=6,2x=12 and 3x=18

Q2.A,B,C and D are four quantities of the same kind such that A:B=3:4,B:C=8:9 and C:D= 15:16xfind ratio a)A:D b)A:B:C:D
ans: a)A/D=A/B x B/C x C:D=3/4 x 8/9 x 15/16=5/8
 so A:D=5:8

$$A : B \ \ = \ 3 : 4$$
$$B : C \ \ = 8 : 9$$
$$C : D \ \ = 15 \ :16$$

in A:B:C:D value of A will be given by product of ABC .
        value of **B** will be given by product of BBC
        value of C will be given by product of BCC
        value of D will be given by product of BCD

so A:B:C:D is 3x8x15:4x8x15:4x9x15:4x9x16
        or,30:40:45:48

Q3.if a carton containing a dozen mirrors is dropped, which of the following cannot be the ratio of broken mirrors to unbroken mirrors?
 options:a)2:1 b)3:1 c)3:2 d) 1:1 e)7:5

  There are 12 mirrors in the cartonx in the given options

 antecedents tell the broken mirrors and consequents tell the

 unbroken mirrorsx so, the sum of antecedent and consequent

 in each ratio should divide the noxof mirrors perfectlyxout of

 the given options option 'c' which totals 5 cannot divide 12,

 cannot be the ratio of broken mirrors to unbroken mirrorsx

Q4.find the fourth proportional to the numbers 6,8 and 15?
ans: let K be the fourht proportional, then 6/8=15/K

solving it we get K=(8x15)/6= 20

Q5. find the mean mean proportion between 3 and 75?
ans. this is related to continued proportion.let x be the mean proportionalx then we have
    x^2=3x75 or x=15

Q6.divide Rs 1350 into three shares proportional to the numbers 2, 3 and 4?
ans: 1st share= Rs 1350x(2/2+3+4)=Rs 300
2nd share = Rs 1350x(3/2+3+4)=Rs 450
3rd share= Rs 1350x(4/2+3+4)=Rs 600

Q7. a certain sum of money is divided among A,B and C such that for each rupee A has ,B has 65 paise and C has 40 paisex if C's share is Rs 8, find the sum of money?
ans: here A:B:C = 100:65:40 = 20:13:8

 now 20+13+8=41
as 8/14 of the whole sum=Rs 8

so, the whole sum=Rs 8x41/8=Rs 41

Q8.in 40 litres mixture of milk and water the ratio of milk and water is 3:1. how much water should be added in the mixture so that the ratio of milk to water becomes 2:1.?
ans:here only amount of water is changing. the amount of milk remains same in both the mixtures. so, amount of milk before addition of water =(3/4)X40=30 ltrs. so amount of water is 10 ltrs.

 After addition of water the ratio changes to 2:1.here the mixture has two ltrs of milk for every 1 ltr of water. since amount of milk is 30 ltrs the amount of water has to be 15 ltr so that the ratio is 2:1. so the amount of water to be added is 15-10=5 ltrs.

Q9. three quantities A, B and C are such that AB=kC ,where k is constant. when A is kept constant, B varies directly as C: when B is kept constant, A varies directly C and when C is kept constant, A varies inversely as B.
  initially A was at 5 and A:B:C was 1:3:5. find the value of A when B equals 9 at constant B?
solution: initial values are A=5,B=15 and C=25.
 thus we have 5x15=kx25   hence, k=3
thus the equation becomes AB=3C.
 for the problem C is kept constant at 25. then,
 Ax9=3x25   A=75/9=8.33

partnership is an asociation of two or more persons who invest their money in order to carry on a certain business. a partner who manages the business is called working partner and the partner who simply invests is called the sleeping partner.

if the period of investment is same for each parner, then the profit or loss is divided in the ratio of their investments.

the simple formula involved is (if there are two partners A and B)

$$\frac{\text{investment of A} \times \text{period of investment of A}}{\text{investment of B} \times \text{period of investment of B}} = \frac{\text{profit /loss of A}}{\text{profit /loss of B}}$$

OR,

$$\frac{\text{monthly equivalent investment of A}}{\text{monthly equivalent investment of B}} = \frac{\text{profit /loss of A}}{\text{profit /loss of B}}$$

where,

investment of A x period of investment of A= monthly equivalent investment of A

and the same holds true for B.

if there are more than two parners then respective ratios can be derived using concepts discussed in the chapter on Ratio & Proportion.

let us do some of the questions.

Q1. three partners A, B and C invest Rs 1600, Rs 1800 and Rs 2300 respectively in a business. how should they divide a profit of Rs 399?

solution: here profit is to divided in the ratio 16:18:23

A's share of profit=16/(16+18+23)x 399= Rs 112.
B's share of profit=18/(16+18+23)x 399= Rs 126
C's share of profit=23/(16+18+23)x 399= Rs 161

Q2.A. B and C enter into a partnership. A advances Rs 1200 for 4 months. B gives Rs 1400 for 8 months and C Rs 1000 for 10 months. they gain Rs 585 altogether. find the share of profit each?

solution: *monthly equivalent of A = 1200 x 4= 4800*
monthly equivalent of B = 1400 x 8= 11200
monthly equivalent of C = 1000 x 10= 10000
so, profit is to be divided in the ratio 48:112:100 i.e. 12:28:25
A's share of profit is (12/65)x 585=Rs108
B's share of profit is (28/65)x 585=Rs252
C's share of profit is (25/65)x 585=Rs225

'A' can do a work in 10 days. How much work does he do in 1 day.
If we go by traditional method the prompt answer would be 1/10 of the work.
But multiplicity of such fraction based calculations in a particular question is not going to make our life simpler but harder.
So if we take the whole work to be done as 100% and if we keep some of the percentage values of fractions in our mind, our life becomes easier. So, for the above question in 1 day 10%(100%/10) of the work is done.
This could be applied to the questions related to pipes and cisterns.
To make our concept more clear let us deal with some of the questions.

{some %age values of fractions}

1/1=100%	*½=50%*	*1/3=33.33%*	*¼=25%*
1/5=20%	*1/6=16.66%*	*1/7=14.28%*	*1/8=12.5%*
1/9=11.11%	*1/10=10%*	*1/11=9.09%*	*1/12=8.33%*
1/13=7.69%	*1/14=7.14%*	*1/15=6.66%*	*1/16=6.25%*
1/17=5.88%	*1/18=5.55%*	*1/19=5.26%*	*1/20=5%*

Q.1: Anup can do a piece of work in 10 days and Jagdeesh can do the same work in 15 days.

1. *In how many days the work will be completed if both works together.*
1. *In how many days the work will be completed if Megha who can complete the same work in 30 days joins.*
1. *In how many days the work will be completed if Alankar who destructs the work done in 25 days joins joins the two.*
1. *In how many days the work will be completed if Anup and Jagdeesh do the work on alternate days. Anup starting first.*
1. *With reference to the q.4 who will conclude the work.*
1. *With reference to q.4 when will the work be completed if Alankar who destructs the work in 25 days does the work every third day.*

solutions: 1. Anup can do in 1 day={100%/10}=10% of the work.
 Jagdeesh can do in 1 day= {100%/15}=6.66 % of the work.
   if both of them works together, the work done by them in 1 day=10%+6.66%=16.66%
 so no. of days the total work(100%) will be done=100/16.66=6.002 or 6 days.

 2. Megha can do in 1 day={100/30}=3.33% of the work.
    Anup and Jagdeesh can do the work in 1 day=16.66%. and when Megha joins them in one day the percentage of work done=(16.66+3.33)%=19.99% or 20%
 No. of days the work will be completed=100/20=5 days.

3. Anup and Jagdeesh can do the work in 1 day=16.66%.
  Alankar can destroy the % age of work in 1 day=100/25=4 %.
 Total work done in 1 day=16.66-4=12.66 %
 So total work will be done in=100/12.66=7.88 or 8 days.

4. Since Anup starts first, on the 1st day %age of work done=10%
  On the 2nd day ,only Jagdeesh work,so work done=6.66%
   3rd day=10%
   4th day=6.66%......so on.
 every two day 16.66 % of the work is done.
 so in 6 pairs of days 99.96% of the work is done.or say 12 days. But still some work is left to be done,so in 13 days the work will be completed.

5. If we go by explanation given in solution.4 on 12th day Jagdeesh will do the work. So on the 13th day which is the last day, Anup will do the work, so Anup will conclude the work.

6.On the 1st day only Anup will do the work. Work done on 1st day=10%
   On the 2nd day only Jagdeesh will do the work, work done after expiry of 2nd day=10%+6.66%=16.66%
On the third day Alankar will destroy the work= - 4%(negative sign as work is not being done but   being destroyed)
At the end of third day total work completed=16.66%(work done upto 2nd day) less 4%(work destroyed in the third day=16.66-4=12.66%
So every third day 12.66% of the total work will be completed.
   So in 7 group of every three days 88.62%{12.66*7} of the work is done.In other way, we can say that after expiry of 21 days(7*3) 88.62 % of the work is done.
 On 22nd day work completed =(88.62+10)=98.62%.
   So we see on the 23rd day only 1. 38%(100 - 98.62) of the work is to be done. And on the third day Jagdeesh will do the work ,who can do 6.66% of work in one day. So the work will be completed on the 23 rd day and Jagdeesh will do the conclusion.

   The above concept of 100% could be applied to the questions related to pipes and cisterns. We will do one question and you will understand the link between questions related to time and work & pipes and cisterns.

 Q.1. **Tap A can fill the tank in 8 hours and another hole B can empty the tank in 16 hours.If both are opened simultaneously in how many hours the tank will be full?**

solution: Tap A can do the work of filling the tank in 8 hours. So work done in 1 hour= 100%/8= 12.5%

 Hole B can do the work of emptying the tank in 16 hours. So work done in 1 hour= 100%/16 = 6.25%
 If both A and B work simultaneously, % of the tank filled(work done) in 1 hour= 12.5 - 6.25 = 6.25%.

So time in which the 100% of the work will be done=100%/6.25=16 hours.

In this way we can asociate each and every questions related to time and work to questions related to pipes and cisterns and solve the questions.

RULE OF FRACTION

Q. 15 men can do a work in 20 days. in how many days will 20 men do the full work?

solution:first case:
M1= 15   D1= 20

second case:
M2=20   D2= ?

here there are two variables. men and days. we have full information about men but we have to find the number of days in the second case. we have to see what is the effect of increase or decrease in no.of men on the no.of days in second case. we see the no. of men has increased in the second case as compared to the first case. so we can easily use our common sense that when no. of men will increase the no. of days required to complete the task will decrease as each day more work will be done. so, to find the answer we have to do the following calculations,

D2=20x(15/20){as there is decreasing effect on the no. of days we will

multiply D1 with lower fraction of M1 and M2(i.e.15/20).if

there had been increasing effect we would have multiplied

D1 with higher fraction of M1 and M2(i.e. 20/15)}

answer=15 days.

Q.a garrison of 2200 men has provision for 16 weeks at the rate of 45 gms per day per men. how many men must leave so that the same provision may last for 24 weeks at 33 gm per day

per man?

solution: first case:
m1=2200   w1=16   p1 =45

second case:
m2=?   w2=24   p2=33

here we have to see the effect of increase or decrease in other variables on m2 :
weeks has increased so if weeks increases less men will be supported.
provision has decreased so more men will be supported.

m2=2200 . 16/24 . 45/33=2000
so we see with given variables in the second case only 2000 men will be supported. so (2200-2000) =200 men should leave.
Q.if 15 books cost Rs 35, what do 21 books cost?
ans. b1=15   c1=35
b2=21   c2=?

so, c2= 35x(21/15)=Rs 49.00

in this way we can see this rule of fraction is applicable to any area whereever there is comparision.

------------------ X -----------------

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This method is used when the following criteria are satisfied:
   1. **data is in the form of per cent, per Kg, per hour, average or in the other words data available is in the form of per unit of something.**

 suppose mixture A has avg. weight of 'a' whereas mixture B has avg. weight of 'b'.in what proportion they should be mixed so that the avg. weight becomes 'c'.?

mix. A   mix. B

a   **b**

c

+ve difference of(b-c)=x   +ve difference of (a-c)=y

so mix A and mix B should be mixed in the ratio of x:y.here x and y pertains to kg if data is in the form of /kg,hour if data is in the form of /hour etc.

below some questions have been solved which will clarify the concept involved.

Q.1_____a tea merchant blends two typesof tea(a) costing Rs15/Kg and (b) Rs 20/Kg each respectively. in what ratio should these two types of tea be mixed so that the resulting mixture may cost Rs16.50/Kg?

               tea(a)   tea(b)

               15   20

                    16.50

          20-16.50   16.50-15
               i.   (y)
here the ratio x:y is to be found . this ratio will tell in what ratio the two given teas will be mixed.
x pertains to part of tea a and y pertains to tea b

we get x=3.5 and y=1.5 and x/y is 7/3
7 kg of tea a should be mixed with 3 kg of tea b.
NOTE: the ratios reached at pertains to kg if data is in the form of per kg , cent if data is in the form of per cent, hour if data is in the form of per hour etc.

Q.2: 21 litres of a mixture of 95% is obtained when two solutions are mixed. if the purity of solution A is 90% and the purity of solution B is 97%,then how much solution of purity 97% is taken?
solution: sol.A   sol. B

                                 90   97

                                        95

                              97-95   95-90

so we get that 2 parts of sol A is to be mixed with 5 parts of sol.B.so the ratio in which two mixtures are to be mixed is 2:7. so 5/(2+5)*21 ltr is to be mixed .so answer is 15 ltrs of sol.B is to mixed.

Q3.10 % are drawn from a cask full of 100 ltrs of water and it is then filled with milk.10 % of the mixture are again drawn and the cask is again filled with 10 ltr of milk.what is amount of milk in the mixture.?

sol: in the first operation 10 ltr(10% of the cask) are drawn so water left in the cask is 90 ltr. then 10 ltrs of milk is added.so resulting 100 ltrs of mixture has 90 ltr of water and 10 litre of milk.again 10% of the mixture is drawn. here it is to be noted that in this operation 10% of 90 ltrs of water and 10% of 10 ltrs of milk is being drawn. so, amount of water drawn is 9 ltrs. so in the mixture 81 ltr(100-10-9=81) of water is left.

Q4.a trader had 100 kg of sugar. Part A of it he sold at 7% of profit and the rest part B at 17% of profit. if he got 10% of profit in all, then how much did he sell part B?
solution.

                                   A   B

                                  7%   17%

10%

17%-10%=7%   10%-7%=3%

so 7 parts of 100 kg was sold at 7% profit(part A) and and 3 parts of 100 kg was sold at 17% profit. so, 30 kg of 100kg of sugar was sold at 17% sugar.

1. Profit = Selling Price - Cost price

2. Selling Price = Cost Price + Profit

3. Cost Price = Selling Price - Profit

4. Loss = Cost Price - Selling Price

5. Selling Price = Cost Price - Loss

6.Cost price = Selling Price + Loss

7. Percentage profit / loss is always calculated on CP unless otherwise stated.

8. Profit Percentage = (Profit x 100) / CP

9. Loss Percentage = (Loss x CP) / CP

10. Selling Price = {[(100+ Gain %) x CP] / 100}

11. Selling Price = {[100- Loss %) x CP] /100}

12.Cost Price = {(100 x SP) / (100+ Gain %)}

: Cost price of the chair = [(300 x 100) / (100 + 20)]

= 30000/120

= Rs. 250.

13.Cost Price = {(100 x SP) / (100 - Loss %)}

14. If a man buys 'p' articles for 'a' rupees and sells 'q' articles for 'b' rupees. Then,

The % profit or loss = (p x b) - (q x a) / (a x q).

Note: If the Sign is +ve, there is gain. If the sign is -ve, there is a loss.

Eg : A trader buys oranges at 9 for Rs. 16 and sells them at 11 for Rs. 20. What does he gain or lose percent?

Ans: % profit or loss = [(9 x 20) - (16 x 11)]/ 16 x 11

= 2 3/11 %.

Since the sign is +ve, there is a gain of 2 3/11%.

15. If a shopkeeper sells his goods at x% loss on cost price but uses y gm instead of z gm, then,

His % profit or loss = [(100 - x) (z/y)] - 100.

Eg: A dishonest trader sells goods at 6 ¼ % loss on cost price but uses 875 gm instead of 1 kg. What is his percentage profit or loss?

Ans: Profit or loss percentage = [(100-6 ¼) (1000/875)] - 100

= [(375/4) (8/7)] - 100

= (107.1428) -100

= 7.1428 %

Since sign is +ve, there is a profit of 7.1428%.

16. If a shopkeeper sells his goods at x% profit on cost price but uses y gm instead of z gm, then,

His % profit or loss = [(100 + x) (z/y)] - 100.

Eg: A dishonest trader sells goods at 4 % gain on cost price but uses 840 gm instead of 1 kg. What is his percentage profit or loss?

Ans: Profit or loss percentage = [(100+4) (1000/840)] - 100

= [123.8095] - 100

= 23.8095%

Since sign is +ve, there is a profit of 7.1428%.

14. When two articles are sold at the same price such that there is a Profit of x % on one article and a Loss of x% on the other. Then Percentage Loss is:

= (Common profit or loss) ^{2} /100

= X^2 /100

15. Marked Price or List Price is the price that is indicated or marked on the product or it is the price, which is given in the price list. This is the price at which the product is intended to be sold. However, there can be some DISCOUNT given on this price and consequently, the actual Selling Price of the product may be less than the Marked Price.

Selling Price = Marked Price - Discount.

16. Discount Percent = (Marked Price - Selling Price) x 100 / Marked Price

17. If the successive discounts given on a product are p%, q% and r%, then the selling price after all the discounts is:

= [Marked Price x (100-p) (100-q) (100-r)]/ 100 x 100 x 100

18. If 'x' articles are purchased for 'p' rupees and 'y' articles are sold for 'p' rupees. Then, Percentage profit / loss = (x-y) / y.

19. If selling price of 'x' pens is equal to the cost price of 'y' pens. Then profit percentage = (y-x) x 100 / x

E.**g 2:** The selling price of 12 pens is equal to the cost price of 20 pens. Find the profit percentage?

Ans: Percentage profit = (20 - 12) / 20

= 8/20

= 66.66%.

E.g3: If 12 oranges are purchased for Rs. 100 and 10 oranges are sold for Rs. 100. Find the percentage profit / loss ?

Ans: Percentage Profit = [(12 - 10) /10]x 100.

= (2 /10) x 100

= 20 %.

20. By using false weight, if a substance is sold at cost price the overall gain % is given by [(100 + Gain %) / 100]. = True weight/ False weight.

1. Distance = Speed x Time

2. Time   = Distance / Speed

3. Speed   = Distance / Time

4. **To convert speed in kmph to m/sec, multiply it with 5/18**.

Eg 1: Express a speed of 72 km/hr in m/s?

Ans: 72 x (5/18) = 20 m/s

5. To convert speed in m/sec to kmph , multiply it with 18/5.

Eg 2: Express a speed of 20 m/sec in km/hr?

Ans: 20 x (18 /5) = 72 km/hr

6. If a body travels from point A to point B with a speed of 'p' and back to point A (from point B) with a speed of q, then the average speed of the body is:

$$= 2pq/(p+q).$$

Eg 3: A car covers a certain distance at a speed of 90 km/hr while going and returns to the starting point at a speed of 60 km/hr. Find the average speed of the car for the whole journey?

Ans: Average speed = (2 x 90 x 60)/ (60+90)

$$= 72 \text{ km/hr}$$

.

7. If a car does a journey in 'T' hrs, the first half at 'p' km/hr and the second half at 'q' km/hr. The total distance covered by the car:

$$= (2 \text{ x Time x p x q }) / (p + q).$$

Eg 4: A motorcar does a journey in 10 hrs, the first half at 21 kmph and the second half at 24 kmph. Find the distance?

Ans: Distance = (2 x 10 x 21 x 24) / (21+24)

= 10080 / 45

= 224 km.

8. If a body covers part of the journey at speed p and the remaining part of the journey at a speed   q and the distances of the two parts of the journey are in the ratio m : n, then the average speed for the entire journey is:

= (m+n) pq / (mq+np).

9. If a person travelling between two points reaches p hours late (If time is given in minutes, it should be converted in hrs by dividing it by 60) travelling at a speed of 'a' km/hr and reaches 'q' km/hr and reaches q hours early travelling at 'b' km/hr, the distance between the two points is:

= (ab/a-b)(p-q)

Eg 5:   A person travelling at 6 kmph reaches his office 15 minutes late. Had he travelled at 8 kmph he would have been 25 minutes early. Find the distance the person has to travel to reach his office ?

Ans: Distance = (6 x 8 / 8-6) / (15/60 + 25/60)

= 16 km.

10.If a person goes from 'A' to 'B' at a speed of 'p' kmph and returns

at a speed of 'q' kmph and takes 'T' hours in all, then the distance

between the A and B:

= Total time taken x (Product of the two Speeds / Addition

of the two speeds)

Eg 6: A boy goes to school at a speed of 3 kmph and returns to the village at a speed of 2 kmph. If he takes 5 hrs in all, what is the distance between the village and the school?

Ans: Let the required distance be x km.

Then time taken during the first journey = x/3 hr.

and time taken during the second journey = x/2 hr.

x/3 + x/2 = 5 => (2x + 3x) / 6 = 5

=> 5x = 30.

=> x   = 6

Required distance = 6 km.

Eg 7: Walking ¾ of his speed, a person is 10 min late to his office. Find his usual time to cover the distance?

Ans: Usual time = Late time / {1/ (3/4) - 1)

= 10 / (4/3 -1)

= 10 / (1/3)

= 30 minutes.

Eg 8: Running 4/3 of his usual speed, a person improves his timing by 10 minutes. Find his usual timing by 10 minutes. Find his usual time to cover the distance?

Ans: Usual time = Improved time / { 1 - (1/ (3/4)}

$\qquad$ = 10 / { 1- (3/4) }

$\qquad$ = 40 minutes.

11. A train travelling at a speed of 'S1' kmph leaves A at 't1' hrs. and another train travelling at speed 'q' kmph leaves A at 'S2' hrs in the same direction. Then the meeting point's distance from starting starting point:

$\qquad$ **= (S1 x S2 X Difference in time) / Difference in speed.**

Eg 9: A train travelling 25 kmph leaves Delhi at 9 a.m. and another train travelling 35 kmph starts at 2 p.m. in the same direction. How many km from will they be together ?

Ans: Meeting point's distance from the starting point = [25 x 35 x (2p.m. - 9 a.m)] / (35 -25)

$\qquad$ = (25 x 35x 5) / 10

$\qquad$ = 4375 / 10

$\qquad$ = 437.5 km .

12. If two persons A and B start at the same time in opposite direction from two points and after passing each other they complete the journeys in 'a' and 'b' hrs respectively, then A's speed : B's speed =   Square root of b : Square root of a.

Eg 10: A sets out to cycle from Delhi to Rohtak, and at the same time B starts from Rohtak to cycle to Delhi. After passing each other they complete their journeys in 3 1/3 and 4 4/5 hours respectively. At what rate does the B cycle if A cycles at 8 km per hour?

Ans: As per the above formula, the ratio of A's speed to B's speed = Square root of 4 4/5 / Square root of 3 1/3.

> A's speed : B's speed = 6/5.
>
> A's speed   = 8 kmph
>
> B's speed   = (5/6) x 8
>
>   = 6 2/3 kmph.

13. If A travels certain distance at the rate of 'S1' kmph and B covers the same distance at the rate of 'S2' kmph and if one of them takes 't' minutes longer than the other, then:

Distance covered = {(S1 x S2) x Difference in time to cover the distance} / (S1-S2)

Note :- If speed is given kmph and time is given in minutes, then time is to be expressed in hrs. before solving the problem using this formula.

Eg 11: Two runners cover the same distance at the rate of 15 km and 16 km per hour respectively. Find the distance travelled when one takes 16 minutes longer than the other?

Ans: Distance travelled = {(15 x 16) x (16/60)} / (16-15)

= 64 km

1. When a train passes a stationary point, the distance covered (in the passing) is the length of the train.

Eg 1: What is the time taken by a train of length 360m to cross a pole at a speed of 72 kmph ?

Ans: Time taken by the train to cross the pole = Length of the train / Speed of the train

Speed of the train is given in kmph, whereas the length of the train is given in mts. So the speed of the train is to be expressed in m/sec.

Speed of the train (in mts/sec) = 72 x (5/18)

= 20 mts/sec

Time taken by the train to cross the pole = 360/20

= 18 seconds.

2. If the train is crossing a platform or a bridge, the distance covered by the train is equal to the length of the train plus the length of the platform or a bridge.

Eg 2: How long will a train 200 m long travelling at a speed of 54 kmph take to cross a platform of length 100 m?

Ans: Distance covered by the train = Length of the train + Length of the platform

= 200 + 100

= 300 m

Speed of the train is given in kmph, whereas the distance covered by the train is given in mts. So speed of the train is to be expressed in mts / sec.

Speed of the train = 54 x (5/18)

= 15 mts/ sec

Time taken by the train = 300/15

= 20 seconds.

3. If two trains pass each other (travelling in the same direction or in opposite directions) , the total distance covered (in the crossing/ overtaking as the case may be) is equal to the sum of the lengths of the two trains.

Eg3: Two trains 121 mts and 99 mts in length respectively are running in opposite directions, one at the rate of 40 kmph and the other at the rate of 32 kmph. In what time will they be completely clear of each other from the moment they meet?

Ans: As the trains are moving in opposite directions their relative speed = 40 + 32 km/hr.

= 72 km/hr.

The length to be travelled by the trains = 121 + 99

= 220 mts.

The speed of the train is given in Kmph, whereas the length is

given in mts. Hence, the relative speed of the trains is to be expressed in mts/sec.

The relative speed in mts/sec = 72 x (5/18)

= 20 mts /sec

Time required to completely clear of each other from the moment they meet = 220 / 20

= 11 secs.

4. If two bodies are moving in the same direction at speeds S1 and S2 respectively, then the relative speed is:
Relative speed   = S1 - S2

5. If two bodies are moving in opposite direction at speeds S1 and S2 respectively, then the relative speed is:
Relative speed   = S1+ S2.

6. **Two trains of length 'p' m and 'q' m respectively run on parallel lines of rails. When running in the same direction the faster train passes the slower one in 'a' seconds, but when they are running in opposite directions with the same speeds as earlier, they pass each other in 'b' seconds. Then,**

Speed of the faster train = [(p + q)/ 2] x [(a+b) / (a x b)]

Speed of the slower train = [(p-q) / 2] x [(a-b) / (a x b)]

Note : The speeds obtained using the above formula are in mts/ sec, if the speeds are to be expressed in kmph, they have to be multiplied by 18/5.
Eg 4: Two trains of length 100 m and 250 m run on parallel lines.

When they run in the same direction it will take 70 seconds to cross each other and when they run in opposite direction, they take 10

seconds to cross each other. Find the speeds of the two trains?

Ans: Speed of the faster train = [(100 + 250) / 2] [(70 + 10) / (70 x 10)].

$$= 175 \times (8 / 70)$$

$$= 20 \text{ m/sec.}$$

Speed of the slower train = [(100 + 250) / 2] [(70-10) / (70 x 10)]

$$= 175 \times (6 / 70)$$

$$= 15 \text{ m/ sec.}$$

Therefore, speeds of the trains are 72 kmph (20 x 18 /5) and 54 kmph (15 x 18/5) respectively.

6. If a train passes by a stationary man in 'p' seconds and passes by a platform / bridge, the length of which is 'm' mts, completely in 'q' sec. Then
Length of the train = (m x p) / (q-p).
Eg 5: A train crosses by a stationary man standing on the platform in 7 seconds and passes by the platform completely in 28 seconds. If the length of the platform is 330 meters, what is the length of the train?
Ans: Length of the train = (330 x 7) / (28-7)
= 330x 7 / 21
= 110 mts.

1.When a boat is moving in the same direction as the stream or water current, the boat is said to be moving with the stream or moving downstream.

2.Instead of boats in water, it could be a swimmer or a cyclist cycling against or along the wind.

3. When a boat is moving in a direction opposite to that of the stream or water current, the boat is said to be moving against the stream or water current or moving downstream.

4. When the speed of the boat is given, it is the speed of the boat in still water.

5. Speed of the boat against stream or while moving upstream = Speed of the boat in still water - Speed of the stream.

6. Speed of the boat with stream or while moving downstream= Speed of the boat in still water + Speed of the Stream.

7. If 'p' is the speed of the boat down the stream and 'q' is the speed of the boat up the stream, then,

Speed of the boat in still water = (p+q) / 2.

Speed of the boat of the water stream = (p-q) / 2.

Eg 1: A boat travels 36 km upstream in 9 hours and 42 km downstream in 7 hours. Find the speed of the boat in still water and the speed of the water current ?

Ans: Upstream speed of the boat = 36/9 = 4 kmph

Downstream speed of the boat = 42/ 7 = 6kmph.

Speed of the boat in still water = (6+4) / 2.

$$= 5\ kmph$$

Speed of the water current $\quad = (6\text{-}4)\ /2$

$$=\ 1\ kmph$$

Eg 2: A man can row at 10 kmph in still water. If it takes a total of 5 hours for him to go to a place 24 km away and return, then find the speed of the water current ?

Ans: Let the speed of the water current be y kmph.

Upstream speed   = (10- y) kmph

Downstream speed = (10+y) kmph

Total time   = (24/ 10+y) + (24/10-y) = 5

Hence, 480/ (100-y²) = 5

$$480=\ 500\text{-}5y^2$$

$$5y^2 = 20$$

$$y^2 = 4$$

$$y = 2\ kmph.$$

8. A man can row x kmph in still waters. If in a stream which is flowing at y kmph, it takes him z hrs to row from A to B and back (to a place and back), then

The distance between A and B = z (x² - y²) / 2x.

Eg 3: A man can row 6 kmph in still water. When the river is running at 1.2 kmph, it takes him 1 hour to row to a place and back. How far is

the place?

Ans: Required distance = 1 x (6^2 - (1.2)^2) kmph

$$= (36 - 1.44) / 12$$

$$= 2.88 \text{ km.}$$

9. In the above case, If distance between A and B, time taken by the boat to go upstream and back again to the starting point, speed of the stream are given; then the speed of the boat in still waters can be obtained using the above given formula.

10. A man rows a certain distance downstream in x hours and returns the same distance in y hrs. If the stream flows at the rate of z kmph then,

The speed of the man in still water = z(x+y) / (y-x) kmph.

EG 4: Ramesh can row a certain distance downstream in 6 hours and return the same distance in 9 hours. If the stream flows at the rate of 3 kmph. Find the speed of Ramesh in still water?

Ans: Ramesh's speed in still water = 3 (9+6) / (9-6)

$$= 15 \text{ kmph.}$$

11. A man rows a certain distance downstream in x hours and returns the same distance in y hours. If the speed of the man in still water z kmph, then

Speed of the stream = z (y-x) / (x+y) kmph.

Eg 5: Ramesh can row a certain distance downstream in x hours and returns the same distance in y hours. If the speed of Ramesh in still water is 12 kmph. Find the speed of the stream?

Ans: Speed of the stream = 12 (9-6) / (9+6)

= 2.4 kmph.

Areas of plane figures:

Area of Rectangle = l *b (where l = length, b = breadth)

Area of square = A *A (where a is side of the square)

Area of triangle = 1/2 * h * b(where h is height , b is measure of base

Area of Parllelogram = b * h(where b is base , h is height)

Area of Trapezium = 1/2(sum of parallel

sides *perpendicular distance   between them) = 1/2 (a+b)h {where a & b are parallel sides and h is the perpendicular distance between them}

Area of Circle = ○ r^2 where r is the radius of the circle

Circumference of the circle = 2○r(where r is radius of the circle)

Area of Equilateral Triangle = ○3 /4 a^2

A.rectangle

1] [diagonal]$_2$ = [length]^2+[breadth]^2
2] perimeter= 2[l+b]

B.square
1] area=[side]^2=1/2 [diagonal]$^{2.}$
2] perimeter =4 x side
C.area of four walls= 2 x [l+b]xh
D.area of //gram=base x height
E.area of an equlateral triangle= sq. root 3 xside^2
                                                    4
F.perimeter of an equilateral triangle=3x side
G.if a,b and c are side of a triangle and s=[a+b+c]/2 then
 area of triangle= sq. root of [s(s-a)(s-b)(s-c)]

H. circumference of a circle=2○r

I.area of a circle=○r^2

mensuration

Q1.the length of garden is 120 m and breadth is 80 m. the perimeter will be?
sol. l=120 m   b= 80 m
perimeter = 2(l+b)=2(120+80)=400 m

Q2. the length and breadth of a courtyard are 15m and 12m. find the number of tiles which are 50cmx40cm in size?
sol. area of the court yard= lxb=15x12=180 sq.m
   area of tile = 50/100 x 40/100=1/5 sq m.
number of tiles = area of court yard/ area of a tile=180/(1/5)=900

tiles.

Q3. the lenght ,breadth and heigth of a room are respectively 12 m,8m and 5 m. if all the four walls of it are to be pastedwith paper 80 cm wide. find the length of the paper?
sol.area of four walls= 2(l+b)x h=2(12+8)x5=200 sq m
the length of the paper =200/(80/100)=250 m

Q4.three sides of a triangle are 13cm,14cm and 15 cm. the area of a triangle will be?
sol. a=13   b=14   c= 15
  semiperimeter of triangle=(13+14+15)/2=21
area of the triangle= sq.root of [s(s-a)(s-b)(s-c)]
                = sq.root of [21(21-13)(21-14)(21-15)]
                =sq .root of 7056=84 sq.cm

Q5.a wheel covers the distance 220 m in one round . the radius of the wheel is?
sol. *circumference of the wheel=>2πr=220 m,solving this radius of the wheel comes=35 cm*

Q6:the area of the circle is 616 sq cm. what is its radius ?
sol. given, $πr^2$ =616
                r=sq.root of 616/(22/7)=14 cm.

Q**7: the radius of the cylinder is 14 cm and the height 50 cm.the area of the whole surface is?**
sol. the whole surface area of a cylinder is =2 π rh+2πr
                        putting the respective data here we get the answer=5632 sq m

Q8.the radius of the sphere is 7 cm.the area of its surface will be?
sol: area of surface of a sphere = $4πr^2$
                = 4 x (22/7)x 7x7=616 sq m

Q9:the side of the cube is 10 cm. the area of all the surfaces is?
sol: area of all surfaces=6x(side)^2
                =6x 10x10 = 600 sq cm

Q 10:a rectangle is 24 cm x 6 cm. what is the perimeter of a square with equal area?
sol: area of the rectangle=24x6=144 sq.cm=area of square.
     area of square=side^2 =144
                side = 12 cm

now, perimeter of square = 4x side =4x12=48 cm

Q11:the area of a square garden is 576 sq m. what is the area of a path 2m around it?
sol. side of the square = sq root of 576=24 m.
   side including the path= 24+4=28 m
 area including path= 28x28=784 sq m
area of the path= 784-576=208 sq m

Q12.if the side of the square is doubled ,its area is increased by what %?
sol.present side =a $A=a^2$

when side is doubled, $A=(2a)^2 =4a^2$

so increase in area = $3a^2$
so increase percentage =$(3a^2/a^2$)x100= 300%

Q13. the largest possible square inscribed in a circle of radius 7cm.find the area of the square?
sol: when the largest square is inscribed inside the circle its diagonal is equal to the diameter of the circle.
 therefore, d=14 cm
  area of the square =$d^2/2$=196/2=98 sq cm

Q14: the length, breadth and height of a tank are 4m, 3m and 1.5 m.how many litres of water it will contain?
sol: volume of tank=4x3x1.5=18 m^3 now since ,$1m^3$=1000ltr
    so, 18 m^3 = 18000 litres

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