QUANTITATIVE APTITUDE

INDEX

NUMBER SYSTEM

SUM OF SERIES

Model : 1

Natural Numbers

$1 + 2 + 3 + 4 + \cdots + n$

$\left[\frac{n(n+1)}{2}\right]$

Where n = last digit

$1^2 + 2^2 + 3^2 + \cdots n^2$

$\left[\frac{n(n+1)(2n+1)}{6}\right]$

$1^3 + 2^3 + 3^3 + 4^3 + \cdots + n^3 = ?$

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

Model : 2

$1 + 3 + 5 + 7 \ldots + 33$

(x^2)

where $\left[x = \frac{n+1}{2}\right]$

n = last digit

$2 + 4 + 6 + 8 \ldots + 50$

$x(x+1)$

where $\left[x = \frac{n}{2}\right]$

n = last digit

$51 + 53 + 55 \ldots + 65$

Case : When series doesn't Start from 1 or 2 and start From in between

Q.1 $\mathbf{1+2+3+\cdots..+30}$ =?

Sol. $\frac{n(n+1)}{2} = \frac{30 \times 31}{2}$

$= 15 \times 31$

$= 45$

Q.2 $\mathbf{1^2+2^2+3^2+\cdots+12^2}$ =?

Sol. $\frac{n(n+1)(2n+1)}{6} = \frac{12 \times 13 \times 25}{6}$

$= 50 \times 13$

$= 650$

Q.3 $\mathbf{1^3+2^3+3^3+\cdots\cdot+9^3}$ =?

Sol. $\left(\frac{n(n+1)}{2}\right)^2 = \left(\frac{9 \times 10}{2}\right)^2$

$= 45^2$

$= 2025$

Q.4 $\mathbf{1+3+5+\cdots+49}$ =?

Sol. x^2

We know, $x = \frac{n+1}{2}$

$= \frac{49+1}{2}$

$= 25$

$\therefore x^2 = (25)^2$

$= 625$

Q.5 $\mathbf{2+4+6+\cdots+5+58}$ =?

Sol. $x(x+1)$

We Know, $x = \frac{n}{2}$

$= \frac{58}{2}$

$= 29$

$\therefore x(x+1) = 29(29+1)$

$= 29 \times 30$

$= 870$

Q.6 $\mathbf{51 + 53 + 55 \ldots + 99} = ?$

Sol. $(1 + 3 + 5 + \cdots 99) - (1 + 3 + 5 \cdots + 49)$

For $1 + 3 + 5 + \cdots 99$

by using formula: x^2

Trick: $x = \frac{n + 1}{2}$

$= \frac{99 + 1}{2}$

$x = 50$

$x^2 = (50)^2$

$= 2500$

Trick: x^2

$x = \frac{x + 1}{2}$

$= \frac{49 + 1}{2}$

$= 25$

$x^2 = (25)^2$

$= 625$

For $1 + 3 + 5 \cdots + 49$

Solving : $(1 + 3 + 5 + \cdots 99) - (1 + 3 + 5 \cdots + 49)$

$= 2500 - 625$

$= 1875$

This method can be used when series starts from random number in between. That is series doesn't starts from 1, 2 etc.

Question to Practice

Q.7 $\mathbf{10^2 + 11^2 + 12^2 + \cdots + 20^2} = ?$

FINDING THE SUM "UPTO N TERMS"

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

where $a = 1^{st}$ Digit, d = difference, $n = n^{th}$ term

Q.8 Find the sum

$1 + 3 + 5 + 7 + 9 \cdots$ upto 15 terms

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

$S_{15} = \frac{15}{2}[2(1) + (15-1)2]$

$= \frac{15}{2}[2 + 28]$

$= \frac{15}{2} \times 30$

$= 225$ {d = difference, so difference between any 2 digits as per question is 2}

In this, we don't know what exactly us 15^{th} term, so we used formula of Arithmetic Progression

Question to Practice

Q.9 Find the sum of first 19 terms of the sequence 2, 7, 12, 17, … ?

FINDING A NUMBER

Q.10 What is two third of half of 369?

Sol. $\frac{2}{3} \times \frac{1}{2} \times 369 = ?$

$= 123$

Q.11 If one-third of one-fourth of a number is 15, then three-tenth of the number is?

Sol. $\frac{1}{3} \times \frac{1}{4} \times x = 15$

$x = 15 \times 4 \times 3$

$x = 180$

Now, three-tenth of this number

$= \frac{3}{10} x$

$= \frac{3}{10} \times 180$

$= 54$

Q.12 If the sum of two numbers, one of which is $\frac{2}{5}$ times the other is so, then the numbers are?

Sol. Let's take first no. $= x$

Then according to question, second no. $= \frac{2}{5} x$

$x + \frac{2}{5} x = 50$

$\frac{5x + 2x}{5} = 50$

$7x = 250$

$\boxed{x = \frac{250}{7}}$

$\therefore$ first no. $= x$

$= \frac{250}{7}$

Second no. $= \frac{2}{5} x$

$= \frac{2}{5} \times \frac{250}{7}$

$= \frac{100}{7}$

Q.13 If $\frac{1}{2}$ is added to a number & the sum is multiple by 3, the result is 21 then the number is?

Sol. Let the no. be x

$$\left(\frac{1}{2}+x\right)\times 3 = 21$$

$$\frac{3}{2}+3x = 21$$

$$3x = 21-\frac{3}{2}$$

$$3x = \frac{42-3}{2}$$

$$3x = \frac{39}{2} \Rightarrow \boxed{x = \frac{13}{2}}$$

Question to Practice

Q.14 If $4/5^{th}$ of a number exceeds its $3/4^{th}$ by 8, then the number is

Q.15 If 3/4 of a number is 7 more then 1/6 of the number, then 5/2 of the number is?

PROBLEMS ON AGES

Q.16 The present ages of A and B are in the ratio 4 : 5 and after 5 years they will be in the ratio 5 : 6. The present age A is?

Sol. Let age be 'x'

Present $\xrightarrow[5 \text{ years } (+5)]{\text{after}}$ Future

$4:5 \qquad\qquad 5:6$

$4x : 5x$

After 5 years $\Rightarrow 4x + 5 : 5x + 5 = 5 : 6$

$\frac{4x+5}{5x+5} = \frac{5}{6} \qquad \{a : b = \frac{a}{b}\}$

By cross Multiplication $24x + 30 = 25x + 25$

$x = 5$

$\therefore$ Present Age of $A = 4x$

$= 4 \times 5$

$= 20$ years

Present Age of $B = 5x$

$= 5 \times 5$

$= 25$ years

Q.17 The ratio of present ages of two brothers is 1 : 2 and 5 years back, the ratio was 1 : 3 what will be the ratio of their ages after 5 years?

Sol. Past $\xleftarrow[\text{years}]{-5}$ Present

$1:3 \qquad\qquad 1:2$

$x : 2x$

$x - 5 : 2x - 5 = 1 : 3$

$\frac{x-5}{2x-5} = \frac{1}{3}$

$3x - 15 = 2x - 5$

$x = 10$

After 5 years, ratio of their ages

$\Rightarrow x + 5 : 2x + 5$

$\because x = 10$

$10 + 5 : 2(10) + 5$

$15 : 25$

Q.18 I am three times as old as my son. 15 years hence, 9 will be twice as old as my son. The sum of our ages is?

Sol. Father Son

$3x$ x

After 15 years

$3x + 15$ $x + 15$

$3x + 15 = 2(x + 15)$

$3x + 15 = 2x + 30$

$x = 15$

Son age $(x) = 15$ years

Father age $(3x) = 3 \times 15$

$= 45$ years

$\therefore$ Sum of their ages $= 45 + 15$

$= 60$ years

Q.19 10 years ago daughter's age was two-fifth of her mother's age that time. while 10 years hence her age will be three-fifth of her mother's age then Find the difference in the ages of the two

Sol. Let daughter's age $= x$

Let Mother's age $= y$

10 year ago

$$(x - 10) = \frac{2}{5}(y - 10) \rightarrow (1)$$

10 year hence

$$(x + 10) = \frac{3}{5}(y + 10) \rightarrow (2)$$

An solving equ. (1)

$5x - 50 = 2y - 20$

$5x - 2y = 30 \rightarrow (3)$

On solving equ. (2)

$5x + 50 = 3y + 30$

$5x - 3y = 20 \rightarrow (4)$

Solving equ. (3) & (4)

$$\begin{array}{r} 5x - 2y = 30 \\ 5x - 3y = 20 \\ - \quad + \quad - \\ \hline y = 50 \end{array}$$

$$5x - 2y = 30$$

$$5x - 100 = 30$$

$$x = 26$$

Difference of ages = Mother age - daughter age

$$= 50 - 26$$

$$= 24$$

Question to Practice

Q.20 4 years ago, the ratio of the ages of A and B was 2: 3 and after 4 years, it will become 5: 7. Find their present ages

Q.21 The present age of a father is 3 year more than three times the age of his son. 3 years hence, father's age will be lo year more than twice the age of son. The father's present age is?

TIME AND WORK

Based On Chain Rule

Formula 1:

$$\frac{P_1H_1D_1}{P_2H_2D_2} = \frac{w_1}{w_2}$$

Formula 2:

$$P_1H_1D_1 = P_2H_2D_2$$

P = No. of person

H = No. of hours

D = No. of days

w = Work

Q.22 15 min can type 3240 pages in 6 days working 2 hours per day. How many men would be required to type 5400 pages working 4 hours per day for 3 days?

Sol. $P_1 = 15, w_1 = 3240, H_1 = 2, D_1 = 6$

$P_2 = ?, \quad w_2 = 5400, H_2 = 4, D_2 = 3$

$$\frac{P_1H_1D_1}{P_2H_2D_2} = \frac{w_1}{w_2}$$

$$\frac{15 \times 2 \times 6}{x \times 4 \times 3} = \frac{3240}{5400}$$

$$\frac{15}{x} = \frac{81}{135}$$

$$x = \frac{135 \times 15}{81}$$

$\boxed{x = 25}$

$\therefore$ No. of men required $= 25$

Q.23 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?

Sol. $P_1 = 39 \quad D_1 = 12 \quad H_1 = 5$ hours

$P_2 = 30 \quad D_2 = ? \quad H_2 = 6$ hours

$P_1H_1D_1 = P_2H_2D_2$

$39 \times 5 \times 12 = 30 \times x \times 6$

$\boxed{x = 13}$

No. of days = 13 days

Q.24 Ajay & Sunil together can complete a piece of work in 10 days, Sunil & Sanjay in 15 days & Sanjay and Ajay. They worked together for 6 days, and then Ajay leaves. Sunil and Ajay worked for 4 more days, and Sunil leaves How long will Sanjay take to complete the work?

Sol. Work done in 1 day:

$$\text{Ajay} + \text{sunil} = \frac{1}{10}$$

$$\text{Sunil} + \text{Sanjay} = \frac{1}{15}$$

$$\begin{array}{rcrcl} \text{Sanjay} & + & \text{Ajay} & = & \frac{1}{20} \\ + & & + & & + \end{array}$$

$$2\,\text{Sunil} + 2\,\text{Ajay} + 2\,\text{Sanjay} = \frac{1}{10} + \frac{1}{15} + \frac{1}{20}$$

$$\text{Sunil} + \text{Ajay} + \text{Sanjay} = \frac{1}{2}\left[\frac{13}{60}\right]$$

$$\text{Sunil} + \text{Ajay} + \text{Sanjay} = \frac{13}{120} \quad \ldots(1)$$

$$\text{Work done in 6 days} = \frac{13}{20} \times 6$$

$$= \frac{13}{20}$$

$$\text{Work done in 4 days} = \frac{1}{15} \times 4$$

$$\text{By Sunil \& Ajay} = \frac{4}{15}$$

$\because$ Sunil left after 4 days, Ajay left after 6 days

$$\text{Remaining work} = 1 - \left[\begin{array}{c}\text{Work done} \\ \text{in 6 days}\end{array} + \begin{array}{c}\text{Work done} \\ \text{in 4 days}\end{array}\right]$$

$$= 1 - \left[\frac{13}{20} + \frac{4}{15}\right]$$

$$= 1 - \frac{55}{60}$$

$$\text{Remaining work} = \frac{1}{2}[\text{to be completed by Sanjay alone}]$$

No. of days required, from equ. (1)

$$\text{Sanjay} + \underbrace{\text{Ajay} + \text{Sunil}} = \frac{13}{120}$$

$$\text{Sanjay} + \boxed{\frac{1}{10}} = \frac{13}{20}$$

(given in question)

That Ajay & Sunil take 10 days

$$\text{Sanjay} = \frac{13}{120} - \frac{1}{10}$$

$$\text{Sanjay} = \frac{1}{120}$$

⇒ Sanjay can complete yob in 120 days.

We know, Remaining work $= \frac{1}{12}$

∴ Days req. to complete $\frac{1}{12}$ work by Sanjay $= 120 \times \frac{1}{12}$

$= \boxed{10 \text{ days}}$

Sanjay will take 10 days to complete work

Question to Practice

Q.25 'A' can complete 2/3 of a work in 4 days & 'B' can complete 3/5 of the work in 6 days. In how many days can both A and B together complete the work?

Q.26 If 72 men can build a wall of 280 m length in 21 days, how many men could take 18 days to build a similar type of wall of length 100 m?

TIME AND DISTANCE

Q.27 Two friends started for a place one by motorcycle and other by car. The speed of motorcycle is 30 km/hr. and that of car is 24 km/hr. The first one takes 6hr. 12 min to reach the destination. Find the time of reaching of second one.

(A) 8:00 hr. **(B) 7.25 hr.** **(C) 7.50 hr.** **(D) 7.75 hr.**

Sol. Motorcycle : 30 km/hr. 6 hr./2min.

$\Rightarrow$ 1 hr. = 30 km

$\therefore$ Distance for 6 hrs. $= 6 \times 30$ km

$= 180$ km

1 hr. = 60 min

60 mins = 30 km

$1 \text{ min} = \frac{30}{60} = \frac{1}{2}$ km

$\therefore$ Distance for 12 min $= \frac{1}{2} \times 12$

$= 6$ km

Distance covered in 6 hrs. 12 min $= 180 + 6$

$= 186$ km

Speed = 24 km/hr.

Time = DIstance/Speed

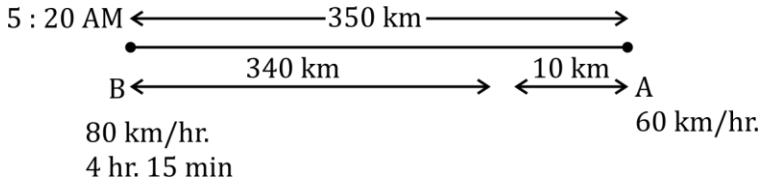
$= \frac{186}{24}$

$\Rightarrow$ Time = 7.75 hr.

Q.28 Kamal left for the City A from City B at 5:20 AM He travelled at a speed of 80Km/ hr. for 4 hrs. 1 min. After that, the speed was reduced to 60 km/hr. If the distance between two cities is 350 km, at what time did hamal reach City A

(A) 9: 20 AM **(B) 9: 25 AM** **(C) 9:35 AM** **(D) 9:45 AM**

Sol.



1 hr. = 80 km

Distance = Speed × Time

$= 80 \times 4$ hr.

$= 320$ km

1 hr. = 80 km

60 min = 80 km

$1 \text{ min} = \frac{80}{60}$

$15 \text{ mins} = \frac{8^{4}}{6_{1}} \times 15^{5}$

$= 20$ km

So Total distance travelled in 4 hr. 15 min $= 320 + 20$

$= 340$ km

Given, Total distance between A to B $= 350$ km

& distance travelled by B $= 340$ km From 4 hrs. 15 min

So remining distance $= 350 - 340$

$= 10$ km

Given speed $= 60$ km/hr.

$\Rightarrow$ 1 hr. = 60 km

$\Rightarrow$ 60 min = 60 km

$\Rightarrow$ 1 min = 1 km

$\therefore$ 10 km = 10 min

So 10 mins more to reach city A to travel 350 km

So total time = 4 hrs. 15 mins

\+ 10 mins

4 hrs. 25 mins

Journey started at 5: 20 AM

\+ 4: 25

9: 45 AM

Q.29 A man goes to his office by Scorer at a speed of 30 Km/hr. & reaches 6 min earlier. The goes at a speed of 24 km/hr., he reaches 5 minutes late. The distance of his office is

(A) 20 Km **(B) 21 km** **(C) 22 km** **(D) 24 km**

Sol. $T_1 \sim T_2 = 11 \text{ min}$

$$\frac{D}{S} \sim \frac{D}{S} = 11\text{min}$$

$$\frac{D}{30 \text{ km/hr.}} - \frac{D}{24 \text{ km/hr.}} = 11 \text{ min}$$

$$\frac{D}{30 \text{ km/}\cancel{\text{hr.}}} - \frac{D}{24 \text{ km/}\cancel{\text{hr.}}} = \frac{11}{60}\cancel{\text{hr.}}$$

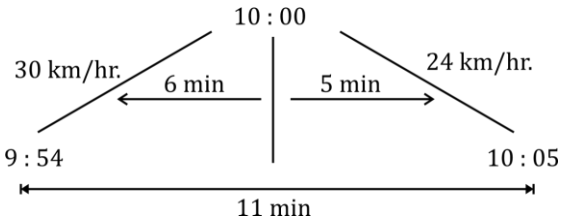
$$\frac{4D - 5D}{12\cancel{0}} = \frac{11}{6\cancel{0}}$$

$$D = \frac{11 \times 12}{6} \text{km}$$

$$\boxed{D = 22 \text{ km}}$$

Just to Understand

Let's consider man goes to Office at 10:00 AM



Question to Practice

Q.30 As car travelling at a speed of 40 km / hr. can complete a journey in 9 hr. How long will it take to travel the same distance at 60 km / hr.

PROBLEMS ON TRAIN

- A 100 m long train crossed a (rock/Pole/standing man) then, the distance travelled = Length of Train by train
- A 100 m long trains crossed a (Platform / Tunnel) of length 200 m, then:
  The distance travelled by Train = Length of Train + Platform Length
- (−) Subtract Speed
  - Train – 1 overtakes Train – 2
  - Train – 1 & Train – 2 running in Parallel direction
- (+) Add Speed
  - Train – 1 crosses Train 2
  - Train – 1 Train 2 proceeds towards each other

Q.31 A train 300 m long is running at a speed of as it will cross a bridge of 200 meters in?

Sol. Distance = 300 + 200, Speed = 25 m/sec.

= 500 m

$$T = \frac{D}{S}$$

$$T = \frac{500\ m}{25\ m/sec.}$$

$$T = 20\ sec.$$

Q.32 On train travelling at a speed of 30 m / sec crosses a platform, 600 m long in 30 seconds. The length (in meter) of train is?

Sol. $S = 30\ m/s$ $P_L = 600\ m$

$T = 30\ sec.$

$D = S \times T$

If train crosses platform, $D = \{$ Platform Length $+$ Platform Train $\}$

$= 600 + x$

$600 + x = 30\ m/sec. \times 30\ sec.$

$600 + x = 900\ m$

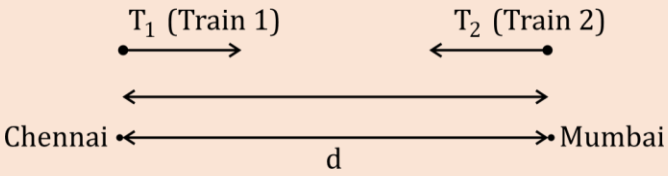
$\boxed{x = 300\ m}$

Question to Practice

Q.33 A train takes 18 seconds to pass through a platform 162 m long and 1 s seconds to pass through another platform 120 m long. The length of the train (in m) is:

TRAINS MEETING

Type – I:



Train speed, distance between stations, length of both Train will be ⌊ given in the question ⌋

To find at what distance & time both Trains meet

Formula:

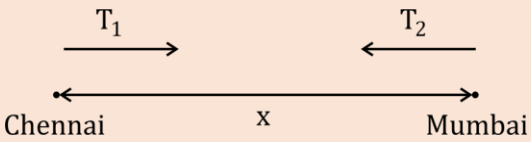
$$\text{Distance} = S_1 \left[\frac{d + S_2T}{S_1 + S_2}\right] \text{km}$$

$$\text{Time} = \left[\frac{d + S_2T}{S_1 + S_2}\right] \text{hours}$$

where, S_1 = speed of 1st Train

S_2 = speed of 2nd Train

Type – II:



To find distance between 2 stations

Formula:

$$d \left[\frac{S_1 + S_2}{S_1 \sim S_2}\right] \text{km}$$

Type – III:

(Trains starting from same station but there will be a delay)

To find: Distance at which both trains meet

Formula:

$$\left[\frac{S_1 \times S_2 \times T}{S_1 \sim S_2}\right] \text{km}$$

To find: Time at which both Trains meet

$$\text{Time} = \left[\frac{S_1T}{S_1 \sim S_2}\right] \text{hours}$$

Q.34 Two trains start at the same time from A & B and proceeds towards B & A at 36 kmph & 42 kmph respectively. When they meet, it is found that one train has maned 48 km more than the other. What is the distance between A & B?

Sol. **Type – II**

$$d\left[\frac{s_1 + s_2}{s_1 \sim s_2}\right] \text{ km}$$

$$= 48\left[\frac{36 + 42}{36 \sim 42}\right]$$

$$= 48 \times \frac{78}{6}$$

$$= 48 \times 13$$

$$= 624 \text{ km}$$

Question to Practice

Q.35 The distance between two stations A & B is 300 km. A train leaves Station 'A' at the speed of 30 km / hr. At the same time another train departs from Station B at speed of 45 km / hr. What will be the distance of the points Where both trains meet from point A?

Q.36 A train leaves the station at 5 am at 60 km / hr. Another train leave the same station at 6:30 am at 75 km / hr. & travels in the direction of the first train. At What time and at what distance from the station will they meet?

Sol. **Type – III**

$$d = \left[\frac{S_1 \times S_2 \times T}{S_1 \sim S_2}\right] \text{ km}$$

$$= \frac{60 \times 75 \times \frac{3}{2}}{15}$$

$$= 450 \text{ km}$$

$$t = \left[\frac{S_1 T}{S_1 \sim S_2}\right] \text{ hours}$$

$$= \left[\frac{60 \quad \frac{3}{2}}{15}\right] \text{ hours}$$

$$= 60 \text{ hours}$$

T = 5 AM
= 6:30 AM
$= 1\frac{1}{2} = \frac{3}{2}$

∵ 1st Train starts at 5 am & 2nd Train starts at 6:30 am

So adding 6 hrs to 6: 30

⇒ Both Trains meet at = 6: 30

$$\begin{array}{r} +\ 6 \\ \hline 12{:}30 \end{array}$$

12: 30 PM

CLOCK

To Find Angle between Hour & Minute Hand

Formula:

$\theta = |30H - \frac{11}{2}M|$

H = Hour

M = Minutes

By using formula, If the angle between hour hand & minute hand is greater than 180^o, then use:

360^o – angle obtained by formula method

Q.37 What is the angle between minute hand and hour hand at 1: 20?

Sol. Using Formula:

$\theta = |304 - \frac{11}{2}(M)|$

$\theta = |30(1) - \frac{11}{2}(20)|$

$\theta = |-80|$

$\theta = 80^\circ$

Q.38 Find at what time between 1:00 and 2:00, the hands of clock will be together

Sol. $\theta = 30H - \frac{11}{2}M$

$0 = 30 \times 1 - \frac{11}{2}M$

$\theta = 0^o$ {as hands of clock} will be together

$-30 = -\frac{11}{2}M$

$30 = \frac{11}{2}M$

$M = \frac{30 \times 2}{11}$

$= \frac{60}{11}$

$= 5\frac{5}{11}$

$\Rightarrow 1:05:\frac{5}{11}\text{sec}$

For H consider lower value between which we have to find, eg – between 1 and 2 lower value is 1.

Q.39 Find at what time between 3: 00 & 4: 00, the hands of clock will be at a right angle

Sol. $\theta = 30H - \frac{11}{2}M$

If $\theta = +90^\circ$

$90 = 30 \times 3 - \frac{11}{2}(M) \qquad \{\theta = \pm 90^\circ\}$

$90 - 90 = -\frac{11}{2}M$

$0 = -\frac{11}{2}M \Rightarrow M = 0$

If $\theta = -90^\circ$

$-90 = 30 \times 3 - \frac{11}{2}M$

$-90 - 90 = -\frac{11}{2}M$

$\not{-}180 = \not{-}\frac{11}{2}M$

$M = \frac{180 \times 2}{11}$

$= \frac{360}{11}$

$= 32\frac{8}{11}$ sec

Q.40 At what time between 4: 00 & 5: 00, the hands of Clock will be in opposite direction?

Sol. $\theta = 30\,H - \frac{11}{2}M$

$\theta = \pm 180^\circ$ (Because opposite direction)

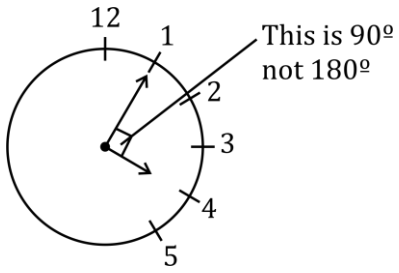
If $\theta = +180^\circ$

$180 = 30 \times 4 - \frac{11}{2}M$

$180 = 120 - \frac{11}{2}M$

$60 = -\frac{11}{2}M$

$M = \frac{60 \times 2}{11}$



therefore we
{cannot consider}
$\theta = +180^\circ$

$$M = \frac{120}{11}$$

If we observe $4:10:\frac{10}{11}$ sec.

$$= 10\frac{10}{11}$$

$\Rightarrow 4:10:\frac{10}{11}$ sec.

└ not Possible as it won't form 180º

If $\theta = -180^{\circ}$

$$-180 = 30 \times 4 - \frac{11}{2} \times M$$

$$-180 - 120 = -\frac{11}{2}M$$

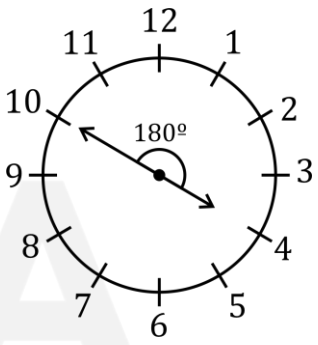
$$-300 = -\frac{11}{2}M$$

$$M = \frac{300 \times 2}{11}$$

$$= \frac{600}{11}$$

$$= 54\frac{6}{11}$$

At $4:54:\frac{6}{11}$ sec. the hands of clock will be in opposite direction.



Question to Practice

Q.41 What is the angle between minute hand and hour hand at 10:10

Q.42 At what time between 3:00 & 4:00, will the hands of a clock be together?

Q.43 Find at what time between 5:30 & 6:00, the hands of clock will be at right angle.

PERCENTAGE

Q.44 If 50% of P = 25% of Q, then P = x% of Q Find x.

(A) 0.5 (B) 20 (C) 50 (D) 30

Sol. $\cancel{50}_2\%$ of P $= \cancel{25}_1\%$ of Q

$2P = Q$

To Find : P = x% of Q

$\frac{\cancel{Q}}{2} = \frac{x}{100} \times \cancel{Q}$

$x = \frac{100}{2}$

$\boxed{x = 50}$

Q.45 In an examination, there were 1000 boys & 800 girls. 60 % of the boys and 50 % of girls passed Find the percent of Candidates failed?

Sol. 1000 Boys 800 Girls

60 % Passed 50 % Passed

40 % Failed 50 % Failed

{Total students Present = 1000 Boys + 800 Girls = 1800}

$\Rightarrow \frac{40}{1\cancel{00}} \times 10\cancel{00}$ $= \frac{50}{1\cancel{00}} \times 8\cancel{00}$

= 400 Boys Failed = 400 Girls Failed

$\Rightarrow$ 400 (Boys) + 400(girls) = 800 failed

$\%$ of candidates $= \frac{\text{Total students who failed}}{\text{Total students paresent in exam}}$

$= \frac{800}{18\cancel{00}} \times 1\cancel{00}$

$= 44.44\ \%$

Q.46 Rath spends 40 % of her salary on food, 20 % on house rent and, 10 % on entertainment & 10 % on conveyance. If her savings at the end of a month are Rs 1500, then her salary per month (in Rs) is:

Sol. Savings : 100 % - expenditure

$= 100\ \% - [40\ \% + 20\ \% + 10\ \% + 10\ \%]$

$= 100\% - 80\%$

$= 20\ \%$

$20\ \% = 1500$

$\therefore 100\ \% = x$

$$x = \frac{1500 \times 10\cancel{0}}{2\cancel{0}}$$

$$\boxed{x = 7500}$$

Question to Practice

Q.47 **If 20 % of $(P + Q) = 50\ \%$ of $(P : Q)$**

(A) 7 : 8 **(B) 7 : 3** **(C) 7 : 5** **(D) 5 : 7**

Q.48 **For an examination, it in required its get 36 % of maximum marks to pass. A student got 113 marks for the examination are?**

Q.49 **30 % of 2800** $=?$

PROFIT & LOSS

Formula:

$$\% \text{ gain} = \frac{SP - CP}{CP} \times 100$$

$$\{^{SP = \text{ Selling Price}}_{CP = \text{ cost Rice}}\}$$

$$\% \text{ loss} = \frac{CP - SP}{CP} \times 100$$

$$CP = \frac{100}{100 - \text{loss } \%} \times SP$$

$$CP = \frac{100}{100 + \text{ gain } \%} \times SP$$

$$SP = \frac{100 + \text{ gain } \%}{100} \times CP$$

$$SP = \frac{100 - \text{loss } \%}{100} \times CP$$

$$\% \text{ change} = a + b + \frac{ab}{100}$$

a = 1st Selling Price

b = 2nd Selling Price

Q.50 By selling a cycle for Rs 4860, a student loses 19 % His cost Price is?

Sol. $CP = \frac{100}{100 - \text{Loss } \%} \times SP$

$= \frac{100}{100 - 19} \times 4860$

$= \frac{100}{81} \times 4860$

$\boxed{CP = 6000}$

Q.51 By selling a cell phone for Rs 2400, a shopkeeper makes a profit of 25%. Then, his profit percentage if he had sold it for Rs 2040, is?

Sol. $CP = \frac{100}{100 + 25} \times 2400$

$= \frac{100}{125} \times 2400$

$\{\because CP = \frac{100}{100 + \text{ gain } \%} \times SP\}$

$\boxed{CP = 1920}$

If $SP = 2040$, gain % = ?

$$\text{gain \%} = \frac{\text{SP} - \text{CP}}{\text{CP}} \times 100$$

$$= \frac{2040 - 1920}{1920} \times 100$$

$$= \frac{120}{1920} \times 100$$

$$\boxed{\text{gain \%} = 6.25\%}$$

Q.52 Rehaan purchased a bike for Rs 54,000. He sold it a Loss of 8%. with that money he again purchased another bike & sold it at a profit of 10%. What is his overall loss/ Profit?

Sol. $\boxed{\%\text{ change} = a + b + \frac{ab}{100}}$

$a = 1^{st}$ selling Price

$b = 2^{nd}$ Selling Price

{If sold at Loss then put negative sign for a or b
If sold at Profit then put positive sign for a or b}

$a = -8$ (Loss)

$b = +10$ (Profit)

$$\%\text{ change} = -8 + 10 - \frac{80}{100}$$

$$= 2 - 0.8$$

$$= 1.2\%$$

$$\text{Overall Profit} = \text{CP} \times \%\text{ change}$$

$$= 54000 \times \frac{1.2}{100}$$

$$= \text{Rs. } 648$$

Question to Practice

Q.53 A Calculator is bought for Rs.350 and sold at a gain of 15% what will be the selling Price of Calculator?

Q.54 By selling an article for Rs.720, a man loss 10% At what price should he sell at, to gain

RATIO AND PROPORTION

Q. 55 **If $A:B = \frac{1}{2}:\frac{1}{3}$**

and $B:C = \frac{1}{2}:\frac{1}{3}$

then $A:B:C$ = ?

Sol. $A:B = \frac{1}{2}:\frac{1}{3}$ $\qquad$ $B:C = \frac{1}{2}:\frac{1}{3}$

Taking L.C.M. $\qquad$ Taking L.C.M.

$= \frac{3:2}{6}$ $\qquad$ $= \frac{3:2}{6}$

$\boxed{A:B = 3:2}$ $\qquad$ $\boxed{B:C = 3:2}$

(Put closest value ∵ B is 3 ∴ Closest to C = 3)

A	:	B	:	C
3	:	2	:	2
3	:	3	:	2
×		×		×
9	:	6	:	4

(Put value which is closest ∵ B = 2 ∴ closest value to C = 2)

By multiplying both ratios

Q.56 **If $a:b = 5:7$**

and $c:d = 2a:3b$

then $ac:bd$ = ?

Sol. $a:b = 5:7$, $\qquad$ $c:d = 2a:3b$

$\frac{a}{b} = \frac{5}{7}$ $\qquad$ $\frac{c}{d} = \frac{2a}{3b}$

$\frac{ac}{bd} = ?$

Putting above values

$\frac{ac}{bd} = \frac{5}{7} \times 2\frac{(a}{3b)}$ ← (Substitute Value of $\frac{a}{b}$)

$= \frac{5}{7} \times \frac{2}{3} \times \frac{5}{7}$

$\frac{ac}{bd} = \frac{50}{147}$

Q.57 **Divide Rs. 1250 among A, B, C, so that A gets 2/9 of B′s share and C gets 3/4 of A′ share**

Find the shares of A, B and C.

Sol. Given: $A = \frac{2}{9}B$, $\qquad$ $C = \frac{3}{4}(A)$ ← (Substitute value of A)

$\frac{A}{B} = \frac{2}{9}$,

$\boxed{A:B = 2:9}$

$C = \frac{\cancel{3}}{\cancel{4}_2} \times \frac{\cancel{2}}{\cancel{9}_3} B$

$\frac{C}{B} = \frac{1}{6}$

$\frac{B}{C} = \frac{6}{1}$

$\boxed{B:C = 6:1}$

	A	:	B	:	C	
	2	:	9	:	9	← Put nearest value
Put nearest value →	6	:	6	:	1	
	12	:	54	:	9	

On Simplifying

$A:B:C = \cancel{12}^{4} : \cancel{54}^{18} : \cancel{9}^{3}$

$= 4 : 18 : 3$

Question to Practice

Q.58 A mixture contains alcohol & water in the ratio 4: 3. If 5 litres of water is added to mixture the ratio becomes 4:5. find the quantity of alcohol in given mixture.

Q.59 If $A:B = 2:3$ and $B:C = 4:5$ then $A:B:C$ =?

Q.60 If $3A = 5B$ and $4B = 6C$ then $A:C$ =?

SIMPLE INTEREST & COMPOUND INTEREST

Simple interest

$$S \cdot I = \frac{PRT}{100}$$

$$A = P\left[1 + \frac{RT}{100}\right]$$

P = Principal
R = Rate of Interest
T = Time Duration
A = Total amount

Compound Interest

$$CI = P\left\{\left[1 + \frac{R}{100}\right]^{n} - 1\right\}$$

$$A = P\left(1 + \frac{R}{100}\right)^{n}$$

Maturity Amount

Total amount = A

Amount becomes

where

P = Principal

R = Rate of Interest

n = no of years

A = Total amount

Compound Interest

(i) for half-yearly

Formula:

$$A = P\left[1 + \frac{R/2}{100}\right]^{2n}$$

(ii) for Quarterly

Formula:

$$A = P\left[1 + \frac{R/4}{100}\right]^{4n}$$

Q.61 Dinesh deposit an amount of Rs 65800 to obtain simple Interest at 14% per annum for 4 years. What total amount will Dines get at the end of 4 years?

Sol. $A = P\left[1 + \frac{RT}{100}\right]$

$A = 65800\left[1 + \frac{(14 \times 4)}{100}\right]$

$$= 65800 \times [1 + \frac{56}{100}]$$

$$= \frac{65800 \times 156}{100}$$

$$= 102648$$

Q.62 'A' invested Rs. 16000 at the rate of 10%p · a fer 1 year. If the Interest is compounded half yearly, then find total amount received by A the end of the year?

Sol. $A = P\,[1 + \frac{P/2}{100}]^{2n}$

$$A = 16000\,[1 + \frac{5}{100}]^{2}$$

$$= 16000\,(\frac{105}{100})^{2}$$

$$= 16000 \times \frac{105}{100} \times \frac{105}{100}$$

$$= 17{,}640$$

Q.63 Simple Interest for sum of Rs.1500 is Rs 30 in 4 year & Rs. 60 in 8 years find the rate?

(A) 2.5% **(B) 1.5%** **(C) 0.5%** **(D) 0.25%**

Sol.

1500

S.I. = 30 60

$SI = 60 \sim 30$

$= 30$

$S.I_1 - S.I_2 = 30$

$$\frac{PRT}{100} - \frac{PRT}{100} = 30$$

$$1500\,[\frac{4x}{100} - \frac{8x}{100}] = 30$$

$$1500 \times \frac{4x}{100} = 30$$

$2x = 1$

$\boxed{x = 0.5\%}$

Question to Practice

Q.64 What will be the Compound Interest for sum of Rs. 8000 after 3 years at rate of 5% p.a.

AVERAGE

Formula: $\text{Average} = \dfrac{\text{Sum of Observation}}{\text{Total Number of Observation}}$

Q.65 The average age of A, B and C is 26 years If the average age of A and C is 29 years. What is the age of B in years?

Sol. given:

$\dfrac{A+B+C}{3} = 26, \qquad \dfrac{A+C}{2} = 29$

$A + B + C = 26 \times 3 \qquad A + C = 29 \times 2$

$A + B + C = 78 \qquad A + C = 54$

$\text{Age of B} = \text{Total} - (A + C)$

$= 78 - 54$

$= 20 \text{ years.}$

Q.66 The average of 7 numbers is 5. If the average of first six of these numbers is 4, the seventh number is?

Sol. $\text{Average} = \dfrac{\text{Total of } 7' \text{ no.}}{\text{No. of terms}}$

$5 = \dfrac{\text{Total of '7' no.}}{7}$

$\text{Total of } '7' \text{ no.}$

$= 7 \times 5$

$= 35$

$\text{Average} = \dfrac{\text{Total of 6 no.}}{\text{No. of Terms}}$

$4 = \dfrac{\text{Total of 6 no.}}{6}$

$\text{Total of 6 no.} = 6 \times 4$

$= 24$

$\therefore \text{Seventh no.} = 35 - 24$

$= 11$

Q.67 The average of marks obtained by 120 candidates was 35. If the average of marks of passed Candidates was 39 & that of failed candidates was 15, the number of candidates who passed the examination is?

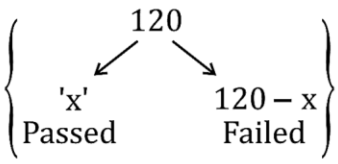
Sol. $\text{Avg} = \dfrac{\text{Total marks obtained}}{\text{No of Students}}$

$$35 = \frac{\text{Total marks}}{120}$$

Total marks $= 120 \times 35$

$= 4200$

Let's assume no of Passed candidates as 'x'



4200 = Marks obtained by passed candidate + Marks obtained by failed Candidate

$4200 = (x \times 39) + [(120 - x) \times 15]$

$4200 = 39x + 1800 - 15x$

$2400 = 24x$

$\boxed{x = 100}$

∴ Passed candidates = 100

Question to Practice

Q.68 Of the three numbers, the first is twice the second and the second is thrice the third. If the average of the three numbers is 10. The number are?

Q.69 The average expenditure of a man for the first 5 months is Rs 3600 and for the next 7 months it is Rs. 3900. If he saves Rs. 8700 during the year, his average income per month is?

AVERAGE SPEED

Note 1: If the certain distance is covered at the speed of 'x' km/hr and the same distance is covered at 'y' Km/hr.then the average speed during entire journey is:

$$\left(\frac{2xy}{x+y}\right) \text{ km/hr.}$$

Where $x, y =$ speed

Note 2: If the person covers 'A' Km at a speed of 'x' Km/hr., 'B' Km at a speed of 'y' km/hr. and 'C' km at a speed of 'z' km/hr. Find out average speed of entire journey

$$\left(\frac{A+B+C}{\frac{A}{x}+\frac{B}{y}+\frac{C}{z}}\right) \text{ km/hr.}$$

where, $A, B, C =$ distance

$x, y, z =$ speed

Q.70 An person covers 9 km at a speed of 3 km/hr., 25 km at a speed of 5 km/hr and 30 km at a speed of 10 km/hr. Find out the average speed of the entire journey.

Sol. $\left(\frac{A+B+C}{\frac{A}{x}+\frac{B}{y}+\frac{C}{z}}\right)$ km/hr.

$$\text{Avg. speed} = \left(\frac{9+25+30}{\frac{9}{3}+\frac{25}{5}+\frac{80}{10}}\right)$$

$$= \left(\frac{9+25+30}{3+5+3}\right)$$

$$= \frac{64}{11}$$

$$= 5.81 \text{ km/hr.}$$

PROBABILITY

$$\text{Probability} = \frac{\text{Sum of Observation}}{\text{Possibility}}$$

"Coins"

Possibility

1. One Coin tossed : {H, T} = 2 → Possibility

2. Two Coins Tossed Simultaneously = {HH, HT, TH, TT} = 4

3. Three Coins Tossed Simultaneously = $\{$ HHH, TTT / HHT, TTH / HTH, THT / THH, HTT $\}$ = 8

4. Four Coins Tossed = $\{$ HHHH, TTTT / HHHT, TTTH / HHTH, TTHT / HTHH, THTT / THHH, HTTT / HHTT, THHT / HTTH, HTHT / TTHH, THTH $\}$ = 16

Q.71 3 coins are tossed find the probability of exactly 2 heads.

Sol. Possible Outcomes : $\{$ ×HHH, TTT× / ✓HHT, TTH× / ✓HTH, THT× / ✓THH, HTT× $\}$ = 8

Probability of exactly 2 heads = $\frac{3}{8}$

Question to Practice

Q.72 3 coins are tossed find the probability of no heads?

DICE

Possible Outcomes

(1) 1 Dice $= 6^n =$ (Where n = No. of Dice)

$= 6^1$

$= 6$

(2) 2 Dice $= 6^2$

$= 36$

(3) 3 Dice $= 6^3$

$= 216$

Q.73 In a single throw of 2 dice, find the probability of getting a total of 3 or 5

Sol. Possible Outcomes

2 Dice $\begin{Bmatrix} (1,1) & (1,2) & (1,3) & (1,4) & (1,5) & (1,6) \\ (2,1) & (2,2) & (2,3) & (2,4) & (2,5) & (2,6) \\ (3,1) & (3,2) & (3,3) & (3,4) & (3,5) & (3,6) \\ (4,1) & (4,2) & (4,3) & (4,4) & (4,5) & (4,6) \\ (5,1) & (5,2) & (5,3) & (5,4) & (5,5) & (5,6) \\ (6,1) & (6,2) & (6,3) & (6,4) & (6,5) & (6,6) \end{Bmatrix}$

$$\text{Probability} = \frac{6}{36}$$

$$= \frac{1}{6}$$

Question to Practice

Q.74 In a single throw of 2 dice, what is the probability of a doublet (same number)?

Q.75 In a single throw of 3 dice, then find the probability of getting a total of 5

Sol. Possible Outcomes $= 6^n$

$= 6^3$

$= 216$

Total of 5 : $\{(1,1,3) \quad (1,3,1) \quad (3,1,1) \quad (2,2,1) \quad (2,1,2) \quad (1,2,2)\}$

$$\text{Probability} = \frac{6}{216}$$

$$= \frac{1}{36}$$

PERMUTATION

Q.76 How many ways the word can be arranged?

(i) Non-Repeated Letters

(A) CAT

(B) MACHINE

(C) GAME

(D) CRYSTAL

(E) EDUCATION

Sol. (A) CAT $= 3!$ ← Total No. of letter

$= 3 \times 2 \times 1$

$= 6$

(B) MACHINE $= 7!$

$= 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$

$= 5040$

(C) GAME $= 4!$

$= 4 \times 3 \times 2 \times 1$

$= 24$

(D) CRYSTAL $= 7!$

$= 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$

$= 5040$

(E) EDUCATION $= 9!$

$= 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$

$= 362880$

(ii) Repeated Letter

(A) SISTER

(B) PERCENTAGE

Sol. (A)SISTER $= \frac{6!}{2!}$ ← Total No. of letter; ← No. of repeated letter

$= \frac{6 \times 5 \times 4 \times 3 \times \cancel{2} \times 1}{\cancel{2} \times 1}$

$= 360$

(B) PERCENTAGE $= \frac{10!}{3!}$

$$= \frac{10 \times 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1}{3 \times 2 \times 1}$$

$= 604800$

Q.77 How many ways the word can be arranged?

(i) Vowel that comes together

(A) JUDGE

(B) MACHINE

Sol. (A) JUDGE

Vowel: (UE)

JDG(UE)

we can place (UE) at following places

↓ J ↓ D ↓ G ↓

$= 4! \times 2!$

No. of places where we can place vowels

Vowels (UE) [2 Letters] (No. of ways we can re-arrange vowel)

(B) MACHINE

Vowel: (AIE)

We can place (AIE) in following places

↓ M ↓ C ↓ H ↓ N ↓

$= 5! \times 3!$

No. of places where we can (AIE) place vowel

(No. of ways (AIE) can be re-arrange [3 Letters])

(ii) Vowels always comes together

(A) SISTER

Sol. Vowels : (IE)

We can place (IE) in following places

↓ S ↓ S ↓ T ↓ R ↓

$= \frac{5! \times 2!}{2!}$

No. of places where we can place (IE) vowel

No. of repeated Letters

No. of ways (IE) can be re-arranged [2 Letters, 2ways]

COMBINATION

Q.78 Different committee's are to be made as per the requirement in each question. In how many ways can it be done?

8 students out of which 5 are doctors and 3 are scientist

(i) A committee of 4 in while 3 are doctors & 1 is scientist

Sol. 3 doctor & 1 scientists

Given total 5 doctors in question → $= {}^5C_3 \times {}^3C_1$ ← Given total 3 scientists

$^5C_3$: 3 doctor; $^3C_1$: 1 scientist

$$= \frac{5 \times 4 \times \cancel{3}}{1 \times 2 \times \cancel{3}} \times \cancel{3}$$

$= 30$

(ii) A committee of 5 in while which 3 are doctors

Sol. To make committee of 5

3 are doctors (given)

$\Rightarrow$ 2 are scientists [5 – 3 = 2]

Committee ← doctor

Total 5 doctors given → $= {}^5C_3 \times {}^3C_2$ ← Total 3 scientists given

$$= \frac{5 \times 4 \times \cancel{3}}{1 \times 2 \times \cancel{3}} \times \frac{3 \times \cancel{2}}{1 \times \cancel{2}}$$

$= 30$

(iii) A committee of 2 in which there is no doctor

Sol. (No doctor)

Committee of 2 $\Rightarrow$ only 2 scientists

Total 3 scientists given → $^3C_2 = \frac{3 \times \cancel{2}}{1 \times \cancel{2}} = 3$

$^3C_2$: 2 scientists

(iv) Committee of 2 unit which either both are doctors or both are scientists

Sol. 5 doctors 3 scientists (given)

Committee of 2

$$^5C_2 \oplus {}^3C_2$$

either both doctor or scientist

$$= \frac{5 \times 4}{1 \times 2} + \frac{3 \times \cancel{2}}{1 \times \cancel{2}}$$

$$= 10 + 3$$

$$= 13$$

SQUARE AND CUBE ROOTS

Q.79 What least number should be multiplied with 384 to make it a perfect square?

Sol. $384 \times ? =$ Perfect Square

$384 = 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3$

$= \underbrace{2^2 \times 2^2 \times 2^2} \times \underbrace{2^1 \times 3^1}$

Perfect squares not perfect squares

To make $2^1 \times 3^1$ perfect square,

we have to multiply it by $2^1 \times 3^1$

$\Rightarrow 2^1 \times 3^1 \times 2^1 \times 3^1$

$\Rightarrow \underbrace{2^2 \times 3^2}$

(Perfect Square) (6)

$\therefore$ 6 is Least number to be multiplied with 384 to make it a perfect square.

Question to Practice

Q.80 What is the smallest number with which 5400 may be multiplied so that product is perfect cube?

Q.81 Square of difference between two numbers is 9 while the sum of squares of those two number is 225 what is their product?

Sol. Given: $(a - b)^2 = 9 \ldots (1)$

$a^2 + b^2 = 225 \ldots (2)$

We know identity,

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

From (1) & (2)

$9 = 225 - 2ab$

$ab = 116$

$\boxed{ab = 58}$

$\therefore$ Produce $= 58$

LOGARITHM

Q.82 Find the value of:

(A) $\log_5(25)$

Sol. $\log_5(5)^2 = 2 \times \log_5(5)$

$= 2 \times 1$

$= 2$

(B) $\log_{81}3$

Sol. $81 = 3^4$

$\log_{3^4}(3) = \frac{1}{4} \times \log_3(3)$

$= \frac{1}{4} \times 1$

$= \frac{1}{4}$

(C) $\log_{\sqrt{7}}(\frac{1}{243})$

Sol. $\frac{1}{243} = \frac{1}{(7)^3} = 7^{-3} \quad (1)$

$\sqrt{7} = 7^{1/2}$

$\log_{7^{1/2}}(7^{-3}) = -3 \times \log_{7^{1/2}}(7)$

$= -3 \times \frac{1}{\frac{1}{2}} \log_7 7$

$= -3 \times 2 \times 1 = -6$

(D) $\log_{.0001}(1000)$

Sol. $1000 = 10^3$

$\bullet\ 0001 = \frac{1}{1000} = \frac{1}{10^4} = 10^{-4}$

$\log_{10^{-4}}10^3 = 3 \times \frac{1}{(-4)} \log_{10} 10$

$= -\frac{3}{4} \times 1$

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

(E) $\log_2\left(\frac{512 \times 256}{32}\right)$

Sol. $32 = 2^5 ; 256 = 2^8$

$512 = 2^9$

$$= \log_2 \frac{(2^9 \times 2^8)}{2^5}$$

$$= \log_2(2^9 \times 2^3)$$

$$= \log_2(2^{12})$$

$$= 12 \times \log_2(2)$$

$$= 12 \times 1 \Rightarrow 12$$

Q.83 Find the value of y, if $\log_y(25/9) = -2$

Sol. $\log_y(25/9) = -2$

$a^m = x \; [\log_a(x) = m]$

$$y^{-2} = \frac{25}{9}$$

$$y^2 = \frac{9}{25}$$

$$y = \frac{3}{5}$$

Q.84 Find the value of:

$$\log\left(\frac{15}{16}\right) - \log\left(\frac{27}{45}\right) + \log\left(\frac{48}{75}\right)$$

Sol.

Product Rule:

$\log_a(xy) = \log_a(x) + \log_a(y)$

Quotient Rule:

$\log_a(x/y) = \log_a(x) - \log_a(y)$

$$\log\left(\frac{15}{16}\right) - \underbrace{\log\left(\frac{27}{45}\right)}_{\text{Quotient Rule}} + \underbrace{\log\left(\frac{48}{75}\right)}_{\text{Product Rule}}$$

$$\log\left(\frac{\cancel{15}^{1}}{\cancel{16}} \times \frac{\cancel{45}^{5}}{\cancel{27}_{1}} \times \frac{\cancel{48}^{\cancel{3}^{1}}}{\cancel{75}_{\cancel{5}_{1}}}\right)$$

$$= \log 1 = 0$$

Question to Practice

Sol. 7 $(1^2 + 2^2 + \cdots + 20^2) - (1^2 + \cdots + 9^2)$

$(\text{Total}) - (\text{First})$

$$= \frac{n(n+1)(2n+1)}{6} - \frac{n(n+1)(2n+1)}{6}$$

$$= \frac{20 \times 21 \times 41}{6} - \frac{9(10)(19)}{6}$$

$$= 2870 - (15 \times 19)$$

$$= 2585$$

Sol. 9 $a = 2$

$$d = 7 - 2 = 5$$

$$n = 9$$

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

$$S_{19} = \frac{19}{2}[2(2) + (19-1)5]$$

$$= \frac{19}{2}[4 + (18 \times 5)]$$

$$= \frac{19}{2} \times 94 = 893$$

Sol. 14 Let the no. be x

$$\frac{4}{5}x - \frac{3}{4}x = 8$$

$$\frac{16x - 15x}{20} = 8$$

$$x = 160$$

Question to Practice

Sol. 15 Let the no. be x

First no.-second no. = 7

$$\frac{3}{4}x - \frac{1}{6}x = 7$$

$$\frac{3x}{4} - \frac{x}{6} = 7$$

$$\frac{9x - 2x}{12} = 7$$

$$x = 12$$

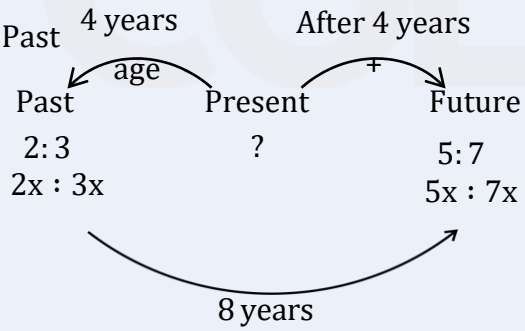
$\frac{5}{3}$ of the number

$$\Rightarrow \frac{5}{3}x$$

$$= \frac{5}{3} \times 12$$

$$= 20$$

Sol. 20



$$\frac{2x + 8}{\cancel{3x + 8}} = \frac{5}{\cancel{7}}$$

$$14x + 56 = 15x + 40$$

$$x = 6$$

Present ages, of A & B.

$$2x + 4 \Rightarrow 2(16) + 4$$

$$= 36 \text{ years}$$

$$3x + 4 \Rightarrow 3(16) + 4$$

$$= 52 \text{ years}$$

Question to Practice

Sol. 21

	Son	Father
Present age	x	3 + 3x
Future age	x + 3	3x + 6

After 10 years,

$3x + 6 = 10 + 2(x + 3)$

$3x + 6 = 10 + 2x + 6$

$x = 10$

$\therefore$ Father Present age $= 3 + 3x$

$= 3 + 3(10)$

$= 33$ years

Sol.25 'A' : $\frac{2}{3}$ of work $= 4$ days

1 work done by ' A ' $= 4 \times \frac{3}{2}$

$A = 6$ days

'B' : $\frac{3}{5}$ of work = 6 days

1 work done by ' B ' $= 6 \times \frac{5}{3}$

$B = 10$ days

$A + B = ?$

$= \frac{1}{6} + \frac{1}{10}$

$= \frac{\cancel{3}^{4}}{\cancel{30}_{15}} \Rightarrow \frac{4}{15}$

$= \frac{4}{15}$

Final answer will be reciprocal $\Rightarrow \frac{15}{4}$ days

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

Question to Practice

Sol.26 $P_1 = 72 \quad D_1 = 21 \quad w_1 = 280$

$P_2 = ? \quad D_2 = 18 \quad w_2 = 100$

We know, $\frac{P_1H_1D_1}{P_2H_2D_2} = \frac{w_1}{w_2}$

But in above question nothing is mentioned about no. of hours

$\therefore$ we use $\frac{P_1D_1}{P_2D_2} = \frac{w_1}{w_2}$

$\frac{72 \times 21}{x \times 18} = \frac{280}{100}$

$\frac{6}{x} = \frac{1}{5}$

$x = 6 \times 5$

$\boxed{x = 30}$

No. of men required = 30

Sol.30 $40 \text{ km/hr.} \times 9 = 360 \text{ km}$ ($\because$ Distance = Speed × Time)

$60 \text{ km/hr.} \times ? = 360 \text{ km}$

$\text{time} = \frac{360}{60}$

time = 6 hr.

Sol.33

162 m, 18 sec. and 120 m, 15 sec. → Speed

$S_1 = S_2$

$\frac{D}{T} = \frac{D}{T}$

$\frac{(\text{Length of Train} + \text{Platform Length})}{\text{Time}} = \frac{\text{Length of Train} + \text{Platform Length}}{T}$

$\frac{x + 162}{18_6} = \frac{x + 120}{15_5}$

$5x + 810 = 6x + 720$

$\boxed{x = 90 \text{ m}}$

Question to Practice

Sol.35 **Type – I**

$$d = S_1\left[\frac{d + s_1 t}{s_1 + s_2}\right] \text{km}$$

t = Time difference

$= T_1 \sim T_2$

$= 0$ ($\because$ beth trains start at same time)

$$d = 30\left[\frac{300 + 30(0)}{30 + 45}\right]$$

$$= 30\left[\frac{300}{75}\right]$$

$$= \frac{9000}{75}$$

$= 120$ km

Sol. 41 $\theta = |30H - \frac{11}{2}(M)|$

$\theta = |30(10) - \frac{11}{2}(10)|$

$\theta = |300 - 55|$

$\theta = 245^\circ$

$\because$ angle $> 180^\circ$

$\therefore 360^\circ - 245^\circ$

$= 115^\circ$

Question to Practice

Sol. 42 $\theta = |30H - \frac{11}{2}(M)|$

$0^\circ = 30 \times 3 - \frac{11}{2}M$

$0 = 90 - \frac{11}{2}M$

$-90 = -\frac{11}{2}M$

$M = \frac{90 \times 2}{11}$

$= \frac{180}{11}$

$= 16\frac{4}{11}$

$\Rightarrow 3: 16: \frac{4}{11}$ sec.

Sol. 43 $\theta = 30H - \frac{11}{2}M$

$\theta = \pm 90^\circ$

If $\theta = -90^\circ$

$-90 = 30 \times 5 - \frac{11}{2}M$

$-90 - 150 = -\frac{11}{2}M$

$240 = \frac{11}{2}M$

$M = \frac{480}{11}$

$= 43\frac{7}{11}$

Between 5:30 & 6:00, the hands of clock will be at right angle at 5:43:7/11 sec.

Question to Practice

Sol.47 20% of $(P + Q) = 50\%$ of $(P - Q)$

$2(P + Q) = 5(P - Q)$

$2P + 2Q = 5Q - 5Q$

$2Q + 5Q = 5P - 2P$

$7Q = 3P$

$$\boxed{\frac{P}{Q} = \frac{7}{3}}$$

Sol.48 Pass Mark $= 113 + 85$

$= 198$

$36\ \% = 198$

$100\ \% = x$

$36x = 198 \times 100$

$$x = \frac{198 \times 100}{36}$$

$$\boxed{x = 550}$$

Sol. 49 $$= \frac{30}{100} \times 2800$$

$= 30 \times 28$

$= 840$

Sol. 53 $$SP = \frac{100 + P\%}{100} \times CP$$

$$= \frac{100 + 15}{100} \times 350$$

$$= \frac{115}{100} \times 350$$

$$\boxed{SP = 402.5}$$

Question to Practice

Sol. 54 $\text{CP} = \dfrac{100}{100 - \text{Loss}\%} \times \text{SP}$

$= \dfrac{100}{90} \times 720$

$= 800$

$\text{SP} = \dfrac{100 + \text{gain}\ \%}{100} \times \text{CP}$

$= \dfrac{100 + 5}{100} \times 800$

$\boxed{\text{SP} = 840}$

Sol. 58 Alcohol: Water $= 4:3$

$= 4x:3x$

Alcohol $= 4x$, water $= 3x$

Given: 5 litres of water is added

$\dfrac{4x}{3x+5} = \dfrac{4}{5}$

$4x \times 5 = 4(3x + 5)$

$20x = 12x + 20$

$8x = 20$

$x = 20/8$

$x = 5/2$

Quantity of alcohol $= 4x$

$= 4^2 \times \dfrac{5}{2}$

$= 10$ litres

Sol.59 A: B $= 2:3$, B: C $= 4:5$

(Choose value which is nearer to it i.e. 4)

A	:	B	:	C
3	:	2	:	3
4	:	4	:	5
×		×		×
8	:	12	:	15

(Choose value which is nearer to it i.e. 3)

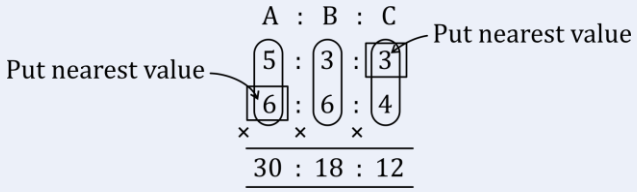
A: B: C $= 8:12:15$

Question to Practice

Sol.60 $3A = 5B, \quad 4B = 6C$

$\frac{A}{B} = \frac{5}{3} \quad \frac{B}{C} = \frac{6}{4}$

$A:B = 5:3 \quad B:C = 6:4$



But we want A: C

$30:12$

On Simplifying $\Rightarrow 30^{5}:12^{2}$

$\Rightarrow \boxed{A:C = 5:2}$

Sol. 64 $A = P\left[1 + \frac{R}{100}\right]^{n}$

$= 8000\left[1 + \frac{5}{100}\right]^{3}$

$= 8000\left[\frac{105}{100}\right]^{3}$

$= 8000 \times \frac{105}{100} \times \frac{105}{100} \times \frac{105}{100}$

$= 21 \times 21 \times 21$

$A = 9261$

$A = P + I$

$9261 = 8000 + I$

$I = 9261 - 8000$

$\boxed{I = 1261}$

C. I. = Rs. 1261

Question to Practice

Sol.68 Third = x

Second = 3x

First = 2(3x)

= 6x

$$\frac{6x + 3x + x}{3} = 10$$

$10x = 10 \times 3$

$10x = 30$

$\boxed{x = 3}$

First number = 6x

$= 6 \times 3$

= 18

Second number = 3x

$= 3 \times 3$

= 9

Third number = x

= 3

Sol.69 Total expenditure = 3600×5

= 18,000

Next 7 months = 3900×7

= 27,300

Total Income for 12 months = 18,000 + 27,300 + 8,700

= 54,000

$\therefore$ Arg. Income per month = $\frac{54000}{12}$

= Rs. 4,500

Question to Practice

Sol.72 Possible Outcons = { ×HHH, TTT✓ ×HHT, TTH× ×HTH, THT× ×THH, HTT× } = 8

Probability of no heads $= \frac{1}{8}$

Sol.74 Possible Outcomes

2 Dice

(1,1)	(1,2)	(1,3)	(1,4)	(1,5)	(1,6)
(2,1)	(2,2)	(2,3)	(2,4)	(2,5)	(2,6)
(3,1)	(3,2)	(3,3)	(3,4)	(3,5)	(3,6)
(4,1)	(4,2)	(4,3)	(4,4)	(4,5)	(4,6)
(5,1)	(5,2)	(5,3)	(5,4)	(5,5)	(5,6)
(6,1)	(6,2)	(6,3)	(6,4)	(6,5)	(6,6)

Probability $= \frac{6}{36}$

$= \frac{1}{6}$

Sol.80 $5400 = 2 \times 2 \times 2 \times 3 \times 3 \times 3 \times 5 \times 5$

$= \underbrace{2^3 \times 3^3}_{\text{Perfect cube}} \times \underbrace{5^2}_{\text{not perfect cube}}$

∴ To make 5^2 a perfect cube, we have to multiply it by 5

$= 5^2 \times (5)$

$= 5^3$

∴ Smallest number to be multiplied with 5400 to make it perfect cube.