

Maths - simplification

V BODMAS
↳ Venice rule.

Square (3)

$$(x)^2 = \underline{xxx} \quad (a+b)^2 = a^2 + b^2 + 2ab \rightarrow \text{first calculate } ab \text{ then double.}$$

$$(64)^2 =$$

$$\begin{array}{r} 6 \\ \times 6 \\ \hline 36 \end{array} \quad \begin{array}{r} 36 \\ \times 36 \\ \hline 144 \end{array}$$

$$\begin{array}{r} 3616 \\ 144 \cancel{+} \\ \hline 4096 \end{array} \quad \text{leave unit digit and write}$$

Exception

53

$$\begin{array}{r} 2509 \\ \times 30 \\ \hline 2809 \end{array} \quad \text{XX Remember}$$

Square of 3 digit

$$(104)^2 = \begin{array}{r} 100 \cancel{16} \\ \times 80 \\ \hline 10816 \end{array}$$

$$(157)^2 = \begin{array}{r} 225 \cancel{49} \\ \times 210 \\ \hline 24649 \end{array} \quad \text{just leave unit digit}$$

Important patterns to remember (ending with 5)

$$(15)^2 = 225$$

$$3(25)^2 = 625$$

$$(35)^2 = 1225$$

$$(45)^2 = 2025$$

$$\begin{array}{r} (65)^2 = 4225 \\ (6+1) \cdot 7 \end{array}$$



Square pattern

$$(1) \rightarrow 1$$

$$(11) \rightarrow 121$$

$$(111) \rightarrow 12321$$

$$(1111) \rightarrow 1234321$$

① count no of 1's

② write in increasing order and followed by decreasing order

① - 3

② 12321

① → 4

② 1234321

Use full pattern (shortcut to calculate 1111 × 111)

1111 × 111 \Rightarrow ① 3 are common
② 1 is useless

123{3}21

$$1111 \times 11 \rightarrow 12221$$

$$8 \times 88$$

$$8888 \times 88 \Rightarrow 8(1111 \times 11)$$

Series of 3 6 9

3

$$(3)^2 = 09$$

$$(33)^2 = \begin{array}{r} 1089 \\ \swarrow +1 \quad \nwarrow -1 \end{array}$$

$$(333)^2 = \begin{array}{r} 110889 \\ \swarrow +1 \quad \nwarrow -1 \end{array}$$

6

$$(6)^2 = 36$$

$$(66)^2 = 4356$$

$$(666)^2 = \begin{array}{r} 443556 \\ 9 \end{array}$$

9

$$(9)^2 = 81$$

$$(99)^2 = 9801$$

$$(999)^2 = \underline{\underline{998001}}$$

Maths simplification

Square root (u)

Perfect square root

$$\textcircled{1} \quad \sqrt{5625}$$

75

(*) but if no end with table "end digit" it may be or may not be perfect square root.

$$\textcircled{1} \quad \sqrt{5625}$$

S1: look at end digit and write corresponding no from table.

5 → 5

S2: square → 25

select a number, whose square is less or equal to 56.

(75) ✓

$$\textcircled{1} \quad \sqrt{625} \quad \sqrt{2401}$$

1089

S1: 5

S1: 1089

S2: 25

S2: ~~01~~

S3: 25 ✓

S3: $4 \rightarrow 16 \leq 25$

XXX

End digit	Numbers
1	1, 9 = 10
4	2, 8 = 10
5	5 = 5
6	4, 6 = 10
9	3, 7 = 10
0	0 = 0

sum will be '10'
trick to remember

2, 7, 3, 8
2378

are not in tabl.

'not ending with 2378' is not a perfect square root

Definitely surely

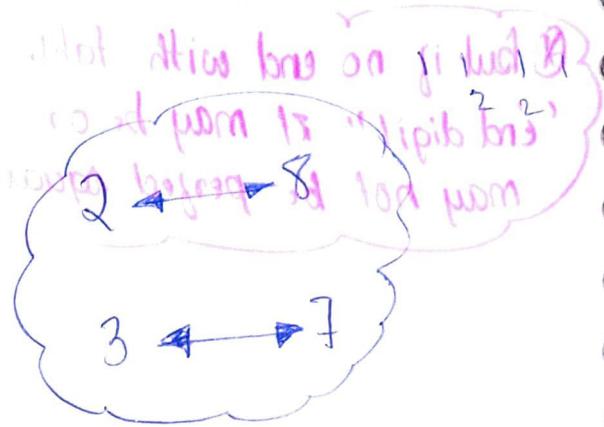
S4: 41 or 49 → calculate square of "digit end" 45 with 5" = 45

$$\begin{array}{l}
 \textcircled{1} \quad \sqrt{1521} \rightarrow 1089 \\
 \textcircled{2} \quad \sqrt{4356} \rightarrow 46 \\
 \textcircled{3} \quad \sqrt{14641} \rightarrow 6460 \quad 65^2 = 4225 \\
 \qquad\qquad\qquad 1089 \\
 \qquad\qquad\qquad 121 \quad 125^2 = 15625 \\
 \qquad\qquad\qquad 121 \quad 121 \quad 11 \times 11 \times 11 \\
 \qquad\qquad\qquad 121 \quad 121 \quad 12
 \end{array}$$

Cube root (6 digit)

$$\sqrt[3]{1728} \downarrow 12$$

$$\sqrt[3]{39304}$$



$$\textcircled{1} \quad \sqrt[3]{1225043} \rightarrow 107$$

$$\textcircled{2} \quad \sqrt[3]{970299} \rightarrow 99$$

Remaining all same digit

How to judge whether perfect or not

simplification
(perfect)

approximation
(not perfect)

Non-perfect square root

$$\sqrt{1234}$$

S1 → any no replace with '0'

S2 → 34 (2 digit)

S3 → 30 ✓

Trial-1
2 8
32 38
(32)X

$$\begin{array}{r}
 900 \rightarrow 1234 \\
 + \\
 \hline
 334 \\
 \hline
 30 \times 2 - 60 = 5 \\
 = 35
 \end{array}$$

$$\sqrt{12345} \text{ (pink box)}$$

$$\begin{array}{r}
 105 \ 110 \rightarrow 200245 \\
 \hline
 12100 \quad 111 \rightarrow 12321
 \end{array}$$

$$\underline{\underline{1225}}$$

$$\sqrt{6021}$$

$$4900$$

$$\begin{array}{r}
 1225 \\
 \hline
 1200 \\
 \hline
 25
 \end{array}
 \quad
 \begin{array}{r}
 1225 \\
 \hline
 112 \\
 \hline
 6084
 \end{array}$$

$$\begin{array}{r}
 70 \\
 \hline
 78
 \end{array}$$

$$\begin{array}{r}
 4964 \\
 \hline
 112 \\
 \hline
 6084
 \end{array}$$

Non-perfect Cube root

$$\begin{array}{r}
 3\sqrt{9250} = 3\sqrt{859} \\
 \textcircled{1} \text{ Step: } 20 \rightarrow 8000 \\
 \textcircled{2} \text{ Step: } 1250 \rightarrow 1200 \approx 1 \\
 400 \times 3
 \end{array}$$

$$\begin{array}{c}
 a^9 \rightarrow a^2 \rightarrow 3a^2 \\
 \text{851} \text{ (P-1)}
 \end{array}$$

Cube calculation (2)

$$(a+b)^3 = a^3 + b^3 + 3ab(a+b) = a^3 + b^3 + 3a^2b + 3ab^2.$$

Q) 13

Trick valid
for ① * 3

1	3	9	27
1	6	18	

2 1 9 7

(72)³

$$\begin{array}{r}
 199 \\
 \times 72 \\
 \hline
 199 \\
 134 \\
 \hline
 1728
 \end{array}$$

① 25% of $x - \frac{1776}{12} - \frac{2023}{7} = 52$

$\left(\frac{x}{4}\right)$ must be divisible by four.

$(1956) \rightarrow$ only one option

Unit digit Approach

② 27% of 300 + 43% 400 - 7% 600

1 + 2 - 2

C - 9, Digital sum

always use in exact



When we got $\{-ve\}$
subtract it from 9

76% of 1285 - 35% of 1256

③ add all digit and convert to single digit

(e.g.) $12 \times 13 = 156$

$3 \times 4 = 12$

$12 \approx 3$

$$\begin{aligned}
 & 4 \times 7 - 8 \times 5 + 537 = 15 \\
 & 14 - 40 + 537 = 15 \\
 & -26 + 537 = 15 \\
 & 511 = 15
 \end{aligned}$$

(cancel 9)
C-9 in division \rightarrow 1) two option same
 play with unit digit $\times \times$

① Divide 3, 6, 9 \times

$\frac{1}{100} \Rightarrow$ already ①

$$2 \times 5 = 10 = 1$$

$$4 \times 7 = 28 = 1$$

$$5 \times 2 = 10 = 1$$

$$7 \times 4 = 28 = 1$$

$$8 \times 8 = 1$$

Always search for 9

9 is always replaced by 0 $\times \times$

76% of 1285 - 35% of 1256

$$4 \times 7 = 1 - 8 \times 5$$

$$= 1 - 4 = -3 + 9 = 6$$

573

$$(14)^2 = 196 = 7$$

$$(5)^2 = 25 = 7$$

$$\frac{2 \times 100}{(140 \times 8 - 680)} = 330 + 45^2$$

Rem.

$$\frac{2 \times 1}{4 - 5} = 6 + 0$$

$$2 = 6 \times (8)$$

10362

$$= 48 = 3.$$

18P - 5P + 3P

$$2197 \div 13 \div 12 - 2 \times 18 + 44.44\% \text{ of } 540 + 66.67\% \text{ of } 1800 = x$$

$$= 0$$

2961

2.03

1.33

$$14\frac{2}{7}\% \text{ of } 4200 \div \sqrt{576} = \sqrt{x}$$

$$\left(\frac{1}{7} \times 4200 \times \frac{1}{24} \right) = \sqrt{x}$$

$$\left(\frac{100}{7} \right) \left(\frac{1}{7} \right) \times 4200 \times \frac{1}{24} = \sqrt{x}$$

$$\frac{6}{6} \times 1 (x=1)$$

$$\frac{1}{7} \times 4200 \times \frac{1}{24} = \sqrt{x}$$

$$\frac{6 \times 4}{7 \times 64} = \sqrt{x} \quad + (4)^{\frac{1}{2}} = \sqrt{x}$$

$$\frac{6}{48} \boxed{x=1} \quad x = 16 \\ = 7^2$$

$$\pm 16 \quad 7, -7$$

$$-7 \rightarrow (2)$$

Where $(\sqrt{x}) \rightarrow (\pm)x$ deali.

$$\frac{1}{4} \times 0 \times -*$$

$$\frac{6}{7} \times \frac{1}{6} \quad \frac{1 \times 4}{7 \times 4} = \sqrt{x}$$

$$(4)^{\frac{1}{2}} = \boxed{2} \sqrt{x}$$

$$x = 7$$

(13)

(4), 5

$$\frac{6}{3} 2$$

$$24 = 6, -6 = 3$$

$$\frac{1}{7} \times \frac{4200}{63}$$

$$x = 7$$

$$\boxed{x = (2)^2 = 4}$$

* * Remember

$$\{ 6^4 = 1296 \}$$

(-9) In quite problematic

$$6^3 6^4 6^8 = \text{sum} = 0.$$

$$1.22 \quad 4^2 + 4^2 - 484 = 6^2$$

~~XXXXXX~~ BODMAS

$16\frac{9}{16} \div 1\frac{1}{16} \text{ of } 4 = 2$ work

$$\left(\frac{135}{8} \right) \div \left(\frac{27}{16} \times 4 \right) = \frac{5}{2} = \boxed{2.5}$$

Q Works

$$Q) 0.95 \text{ of } 1990 + 1810 \times \frac{7}{5} + 1450 - \frac{3}{2} \times 1980 = ?$$

$$5 + 5 + 1$$

(2)

~~28~~ 29.04.05

Approximation

nearabout sum sum Round off

(*) solve only if there is gap b/w option.

(**) none of these will not be there.

NEARABOUT SUM SUM

(*) $\overset{24.51}{=}$ $529 + 96 = 5629 - 4 = 625$

$\frac{11}{100}$

(**) $26 \times 13 = \underset{\text{sum sum}}{(13 \times 13 \times 2)} = 169 \times 2 - \cancel{^2 \times D}$

$\frac{2}{2} \rightarrow \cancel{+} + \cancel{+} + \cancel{+} + \cancel{+} + \cancel{+} + \cancel{+} = 23.8$

(*) $\sqrt{288} \rightarrow \sqrt{144 \times 2}$

(*) $\overset{2.45}{=} (25\% \text{ of } 4200) - ? = (112\% \text{ of } 25)^2$

$$\left(\frac{1}{4} \times \overset{1050}{4200} \right) - x = (25\% \text{ of } 112)^2$$

$\frac{1}{4} \times \frac{1}{6}$

$$1050 - 784 = x$$

$$\boxed{216 = x}$$

$$\boxed{266 = x}$$

$$\begin{array}{r} 28 \\ - 24 \\ \hline 4 \\ - 32 \\ \hline 16 \\ - 16 \\ \hline 0 \end{array}$$

in Equality :-

2.02

$$6x + 3y = 9xy \quad \text{--- (i)}$$

$$3x + 9y = 11xy \quad \text{--- (ii)}$$

$$(i) \times 3 - (ii)$$

$$18x + 9y = 27xy$$

$$3x + 9y = 11xy$$

$$18x = 16xy$$

$$y = \frac{3}{2}$$

$$(ii) \times 2 - (i)$$

$$6x + 18y = 22xy$$

$$18y = 15xy$$

$$2 = 1$$

$$y = \frac{5}{2}$$

Quadratic Inequality

$$ax^2 + bx + c$$

$$a \neq 0$$

$$\begin{matrix} + \\ x \end{matrix}$$

$$\begin{matrix} = b/a \\ = c/a \end{matrix}$$

$$ax^2 + bx + c = \frac{\text{sm}}{-} \frac{\text{large}}{-}$$

$$ax^2 - bx + c = + +$$

$$ax^2 - bx - c = \cancel{+} \cancel{-} +$$

$$ax^2 + bx - c = + - + +$$

1.15

$$(i) 5x^2 - 18x + 9 = 0$$

$$20y^2 - 13y + 2 = 0$$

$$20y^2 - 8y - 5y + 2$$

$$4y(5y - 2) - (5y - 2)$$

$$y = \frac{1}{4}, y = \frac{2}{5}$$

$$5x^2 - 18x - 9 = 0$$

$$5x(x-3) - 3(x-3)$$

$$x = \frac{3}{5}, x = 3$$

trick →

$$\left. \begin{array}{r} -15 \\ 5 \\ \hline 15 \end{array} \right. \quad \left. \begin{array}{r} -3 \\ 5 \\ \hline 3 \end{array} \right. \quad \left. \begin{array}{c} \text{sum on at} \\ \text{a time,} \\ -b/a \end{array} \right.$$

Trick

$$\left. \begin{array}{r} +8 \\ 20 \\ +5 \\ 20 \\ \hline \end{array} \right.$$

$$\frac{b}{(-a)}$$

Quadratic Inequalities

$$x = \begin{array}{c} 8 \\ / \quad \backslash \\ 0.4 \quad 0.25 \end{array}$$

$$\begin{array}{l} 3 > (0.4, 0.25) \\ 0.6 > (0.4, 0.25) \end{array} \Rightarrow x > y$$

3.8

$$\text{(1)} \quad 20x^2 - 67x + 56 = 0$$

$$56y^2 - 67y + 20 = 0$$

$$\begin{array}{c} 20x^2 - 67x + 56 \\ \swarrow \quad \searrow \\ 6 \quad 5 \quad 7 \quad 8 \end{array}$$

$$\frac{7}{4} + \frac{38}{20} + \frac{32}{20} = \frac{16}{10}$$

$$7/4 = 1.75$$

$$\begin{array}{c} 1.75 \quad 1.6 \\ 0.6 \quad 0.5 \end{array}$$

Big Big factors

$$\begin{array}{c} 28 \\ 40 \\ 35 \\ 32 \\ \swarrow \quad \searrow \\ 7 \quad 8 \end{array}$$

$$\begin{array}{c} 56y^2 - 67y + 20 = 0 \\ \swarrow \quad \searrow \\ 7 \quad 8 \quad 4 \quad 5 \end{array}$$

$$\frac{7}{4} + \frac{8}{5} = \frac{35}{20} + \frac{32}{20} = \frac{67}{20}$$

$$\frac{7}{4} + \frac{8}{5} = \frac{5}{8} + \frac{35}{36} = \frac{32}{56} + \frac{8}{14} = \frac{4}{7}$$

CND-cas

$$x = 5, 6$$

$$y = 3, 4$$

$5 > 3 \quad x > y$
 $5 < 4 \quad x < y$

$$\text{(1)} \quad 4x^2 - 35x + 75 = 0$$

$$3y^2 - 19y + 30 = 0$$

$$2x_2x_1$$

$$x_5x_3x_5$$

$$12 \cancel{-25} + \cancel{20} + 15 = \frac{15}{4}$$

$$x = 5, 3.7$$

$$y = 3, 3.33$$

$x > y$

$$3y^2 - 19y + 30 = 0$$

$$3x_1$$

$$3x_10$$

$$\frac{9}{3} \quad \cancel{\frac{10}{3}}$$

$$3 \quad 3.3$$

1.28

$$x^3 + 783 = 999$$

$$\frac{12xy}{y^{(4/3)}} - \frac{3xy}{y^{4/3}} = y^{(10/3)}$$

$$x = 6$$

$$y = \pm 6$$

$$x = y \\ x > y \Rightarrow x \geq y$$

Power even = 2 values
Odd = 1 value

$x, \sqrt{x}, x^2, y^2, \sqrt{y}$

$$19 \quad (i) \quad x - \sqrt{64} = 0 \rightarrow \text{linear} = x = 8$$

$$y^2 - 64 = 0 \rightarrow \text{Quadratic} \Rightarrow y = \pm 8$$

$$x = \sqrt{(-8)^2}, \sqrt{8^2}$$

$$y = \sqrt{64}$$

$$x = -8, 8$$

$$y = 8$$

20) $3216x^2 + 3859x + 481 = 0$ $8132y^2 - 4839y + 978 = 0 \Rightarrow y > x$

Playing with sign

Short cut (sign rule) \Rightarrow applicable to quadratic only

x	b	c
y	- +	+

$\Rightarrow ax^2 + bx + c \Rightarrow x > y$

- Vi wala bda

+ -	x
+	+

$$\begin{bmatrix} b \\ + \\ - \end{bmatrix}$$

CND

$$\begin{bmatrix} + \\ + \\ - \end{bmatrix}$$

CND

$$\begin{bmatrix} - \\ - \\ - \end{bmatrix}$$

CND

\downarrow
 $-V \in CND$

\downarrow
CND

$$\textcircled{Q} \rightarrow \begin{bmatrix} + & + \\ - & + \end{bmatrix} \Rightarrow \textcircled{Y>x}$$

to above question.

$$\textcircled{Q} \stackrel{u=0}{=} (2x-3)^2 = 49$$

$$(2y+1)^2 = 9$$

\Rightarrow (CND)

$$2x-3 = \pm 7 \quad 2y+1 = \pm 3$$

$$2x = 10, -4$$

$$x = 5, -2 \quad | \quad y = 1, -2, -4, 1$$

$x > y$

$x > y$

$x < y$

$$\stackrel{u=0}{\leq} (x+y)^2 = 3136$$

$$y + 2513 = 2569 \Rightarrow y = 0056$$

$$x+y = \pm 56$$

$$x = -112, 0$$

$\textcircled{y > x}$

$$\frac{28}{x^2} + 2 = \frac{15}{x}$$

$$\frac{21}{y^2} + 2 = \frac{13}{y}$$

$$2x^2 - 15x + 28 = 0 \quad x = 3, 5, 4$$

$$2y^2 - 13y + 21 = 0 \quad y = 3, 3.5$$

$\textcircled{x \geq y}$

$$18x^2 + 9x - 27 \Rightarrow 2x^2 + x - 3 = 0$$

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

$$y = 0, -16,$$

\textcircled{CND}

$$\begin{array}{r} 3 \\ -2 \\ \hline -2 \end{array}$$

$$-1.5, 1$$

$$3.5x^2 + 8x - 7.5 = 0$$

$$4.5y^2 - 20.5xy - 21 = 0$$

remove 0.5

$$7x^2 + 16x - 15 = 0$$

$$x = -3, 0.7$$

$$y = 3, 1.6$$

$$4 > x$$

$$9y^2 - 4y = 0$$

$$9y^2 - 41y + 42 = 0$$

$$3 \times 3$$

$$7 \times 3 \times 2$$

$$\frac{21}{42} - \frac{35}{42}$$

$$42$$

$$\frac{27}{42} - \frac{14}{42}$$

$$63$$

$$<$$

$$\frac{27}{14}$$

$$11$$

$$(1) 1. x^2 - 239x - 972 = 0$$

$$1. y^2 + 53y + 592 = 0$$

short cut

odd

one
any

$$\begin{array}{c} \boxed{} \\ \text{to even} \end{array} \pm \begin{array}{c} \boxed{4} \\ \text{even} \end{array} = \begin{array}{c} 14/6 \\ \text{even even} \end{array}$$

$$\text{odd} \pm \text{odd} = \text{odd}$$

We will have it as odd only if one factor is odd & other even.

$$\begin{array}{r} 3 | 972 \\ 3 | 324 \\ 3 | 108 \\ 3 | 36 \\ 3 | 12 \\ 4 \end{array}$$

$$+ \frac{243}{+1}, \frac{+4}{-1}$$

$$243, -4$$

$$\begin{array}{r} 2 | 592 \\ 2 | 296 \\ 2 | 148 \\ 2 | 74 \\ 37 \end{array}$$

$$+16 +37$$

Crossed

$$\begin{array}{c} x > y \\ \cancel{x} \end{array}$$

(15)

$$\begin{cases} x(x+2) - 6\left(\frac{y}{3} - \frac{3}{2}\right) = 0 \\ 5(y-2/3) - y(1+y) = 0 \end{cases}$$

$$\begin{array}{l|l} x^2 - 6x + 9 = 0 & 5y - 10 = -3y - 3y^2 \\ x = 3, 3 & \end{array}$$

$$3y^2 + 12y + 10 = 0$$

$$y = \frac{6+\sqrt{6}}{3}, \frac{6-\sqrt{6}}{3}$$

CND

$$x^2 - 7\sqrt{3}x + 35\sqrt{15} = 5\sqrt{5}x$$

$$35y^2 + 20\sqrt{3}y + 63\sqrt{2}y + 36\sqrt{6} = 0$$

$$x^2 - 7\sqrt{3}x - 5\sqrt{5}x + 35\sqrt{15} = 0$$

$$\begin{bmatrix} - & + \\ + & + \end{bmatrix} (x > y)$$

$$\textcircled{Q}) \quad x^2 - 6\sqrt{3}x - 48 = 0$$

$$y^2 - \sqrt{2}y - 24 = 0$$

$$\begin{bmatrix} - & - \end{bmatrix} \text{ CND.}$$

$$\begin{array}{r} 24 \\ \times 2 \\ \hline 12 \\ + 3 \quad - 4 \\ \hline -1 \quad -1 \end{array}$$

$$\begin{array}{r} S_1 = \frac{48}{3} \\ \quad \quad \quad 16 \\ \quad \quad \quad -8 \quad +2 \\ \hline \quad \quad \quad +8 \quad -2 \end{array}$$

$$S_2 = 8\sqrt{3}, -2\sqrt{3}$$

$$4, -3 \Rightarrow (4\sqrt{2}, -3\sqrt{2})$$

$$(1) \quad x^2 - 7\sqrt{7}x + 84 = 0$$

$$y^2 - 5\sqrt{5}y + 30 = 0$$

Comparison $\sqrt{7} \quad \sqrt{3}$

$$x = (3\sqrt{7})^2 \quad (4\sqrt{7})^2$$

$$\begin{array}{ccc} 63 & 112 & x \\ 20 & 45 & y \\ & & y \end{array}$$

$$y = (2\sqrt{5})^2 \quad (3\sqrt{5})^2$$

$$(2) \quad 5x^2 + 4\sqrt{10}x + 8 = 0$$

$$4\sqrt{3}y^2 + 5y - 2\sqrt{3} = 0$$

$$\left[\frac{-2\sqrt{10}}{5}, \frac{+2\sqrt{10}}{5} \right]$$

$$\begin{array}{r} 4 \times 102 \\ 285 \\ \hline 8 \\ 5 \\ -1.6 \end{array}$$

$$\begin{array}{r} -\frac{8}{4\sqrt{3}} \quad \frac{3}{4\sqrt{3}} \\ \hline 24 \\ 6 \quad 4 \\ 4 \quad 3 \end{array}$$

$y > x$

$$\boxed{-\frac{2}{\sqrt{3}} \quad \frac{\sqrt{3}}{4}} \rightarrow y > x$$

$y > x$

 ~~$\boxed{-\frac{4}{3}}$~~

$$\boxed{\left(\frac{4}{3}\right) - 1.33}$$

Square and Compare

$$63x - 94\sqrt{x} + 35 = 0$$

$$63(\sqrt{x})^2 - 94\sqrt{x} + 35$$

$$32y - 52\sqrt{y} + 21 = 0$$

$$7 \times 9$$

$$\downarrow$$

$$16 \times 2$$

$$\downarrow$$

$$7 \times 3$$

$$32$$

$$\frac{+14}{32} \quad \frac{+48}{32}$$

$$\begin{array}{r} 48 \\ 14 \\ \hline 2 \end{array}$$

$$\begin{array}{r} +49 \\ 63 \\ +45 \\ \hline 63 \end{array}$$

$$\begin{array}{r} 49 \\ 45 \\ \hline 4 \end{array}$$

$$\left(\frac{7}{9}\right) \left(\frac{5}{7}\right)$$

CND

$$\frac{7}{16} \quad \frac{21}{16} \quad \left(\frac{3}{2}\right)$$

$$0.4 \quad 1.5$$

$$x > y, x \geq y$$

$$3x^2 - (6 + \sqrt{17})x + 2\sqrt{17}$$

$$10y^2 - (15 - 2\sqrt{17})y - 3\sqrt{17}$$

$$3x^2 - 6x - \sqrt{17} = 0$$

$$\frac{+6x}{+8} - \frac{\sqrt{17}}{-3}$$

$$\left(2, \frac{\sqrt{17}}{3}\right)$$

$$x > y, x > 4$$

$$x < y, x > 4$$

$$\frac{+15}{+10} + \frac{2\sqrt{17}}{-10}$$

$$\left(\frac{3}{2}\right), -\frac{\sqrt{17}}{5}$$

$$1.5$$

CND

$$(x-9)^2 = 0$$

$$\Rightarrow x-9 = 0$$

$$x=9$$

$$y-\sqrt{81} = 0$$

$$y=9$$

Multiplication Short cut *

$$12 \quad 13 \quad 14$$

$$(12 \times 14) = 13^2 - 1$$

$$9 \cdot 10 \quad 11$$

$$9 \times 11 = 10^2 - 1$$

$$8 \quad 9 \quad 10$$

$$8 \times 10 = 9^2 - 1$$

Trick

$$ax^2 + bx + c$$

$$ax^2 + bx + c$$

$\begin{array}{c} + \\ - \\ - \\ + \end{array}$ tension

$\begin{array}{c} + \\ + \\ - \\ - \end{array}$ no need to

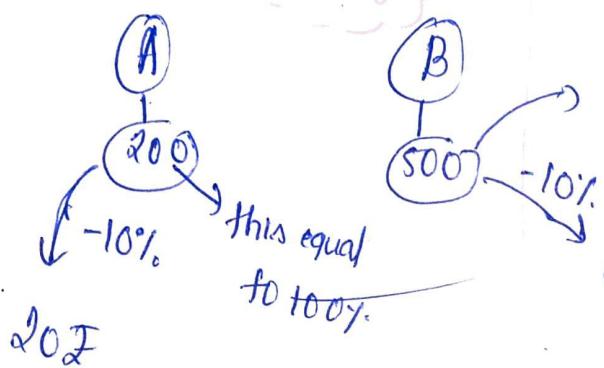
Percentage

Per cent → 100
 ① ↓ ② ③
 out of / upon / out of / Divide

$$0.5 \rightarrow \frac{1}{8} = 12\frac{1}{2}\%$$

$\frac{1}{3}/\frac{2}{3}$	$\frac{1}{3} = 33\frac{1}{3}\%$	$\frac{1}{12} = 8\frac{1}{3}\%$
$\frac{1}{6} = 16\frac{2}{3}\%$		
$\frac{1}{15} = 6\frac{2}{3}\%$		

Ex Number $\frac{3}{14}$ is 100% .
 It is $\frac{1}{11}$.



this equal to 100%.

fundamental without jillion M

$$1 \rightarrow 100\%.$$

$$\frac{1}{10} = 10\%$$

$$\frac{1}{2} \rightarrow 50\%.$$

$$\frac{1}{11} = 9\frac{1}{11}\%$$

$$\frac{1}{3} \rightarrow 33\frac{1}{3}\%$$

$$\frac{1}{12} = 8\frac{1}{3}\%$$

$$\frac{1}{4} \rightarrow 25\%.$$

$$\frac{1}{13} = 7\frac{9}{13}\% = 7\frac{1}{13}\%$$

$$\frac{1}{5} \rightarrow 20\%.$$

$$\frac{1}{14} = 7\frac{1}{14}\%$$

$$\frac{1}{6} = 16\frac{2}{3}\%.$$

$$\frac{1}{15} = 6\frac{2}{3}\% = 6.\overline{6}\%$$

$$\frac{1}{7} = 14\frac{2}{7}\%.$$

$$\frac{1}{16} = 6\frac{1}{4}\% = 6.25\%$$

$$\frac{1}{8} = 12\frac{1}{2}\%.$$

$$\frac{1}{17} = 5\frac{5}{17}\% = 5.88\%$$

$$\frac{1}{9} = 11\frac{1}{9}\%.$$

$$\frac{1}{18} = 5\frac{5}{9}\%.$$

$$\frac{1}{19} = 5\frac{5}{19}\%$$

$$\frac{1}{20} = 5\%$$

$$\frac{1}{21} = 4\frac{16}{21}\%$$

$$\frac{1}{22} = 4\frac{6}{11}\%$$

$$\frac{1}{23} = 4\frac{8}{23}\%$$

$$\frac{1}{24} = 4\frac{1}{6}\%$$

$$\frac{1}{25} = 4\%$$

$$\frac{2}{9} = 22\frac{2}{9}\%$$

$$\frac{4}{7} = 57\frac{1}{7}\%$$

$$\frac{4}{9} = 44\frac{4}{9}\%$$

$$\frac{3}{8} = 37\frac{1}{2}\%$$

$$1\% = \frac{1}{100}$$

$$3\% = \frac{3}{100}$$

only one 0.1 in whole table

% Percentage

Conversion from fraction \longleftrightarrow %.

$$\frac{1}{3} \rightarrow \frac{1}{3} \quad \frac{1}{6} \quad \frac{1}{15}$$

$$25\% \xrightarrow{\frac{1}{100}} \frac{25}{100} = \frac{1}{4} \xrightarrow{\times 100} 25\%$$

$$\frac{3}{7} \approx 42\frac{6}{7}$$

Step 1 = 1st observation

$$\frac{1}{7} \rightarrow 14\frac{2}{7}$$

$$3 \times \left(\frac{1}{7}\right) \rightarrow 14\frac{2}{7} \times 3$$

$$\frac{3}{7} \quad 42\frac{6}{7}$$

$$\frac{5}{8} = 60\frac{5}{10}\frac{1}{2}$$

$$= 60 + \frac{5}{2} = 60 + 2\frac{1}{2}$$

$$= 62\frac{1}{2} = (62.5) \checkmark$$

$$108\frac{1}{3}\%$$

$$100 + 8\frac{1}{3}$$

$$283\frac{1}{3} = 200 + 83\frac{1}{3}$$

$$\frac{1}{6} \rightarrow 16\frac{2}{3}$$

$$1 + \frac{1}{12} = \left(\frac{13}{12}\right)$$

$$= 2 + 15\frac{1}{3}$$

$$\frac{5}{6} \approx 80\frac{10}{3}$$

$$\left(17\frac{1}{6}\right)$$

$$83\frac{1}{3}$$

OTB \rightarrow Deno.

Various Statement: keyword \rightarrow Of, than, by etc
Gf gft element gti
Denominator

① a is what % of b

$$\left(\frac{a}{b}\right)$$

③ what % of a is b

$$\left(\frac{b}{a}\right)$$

⑤ How much % a is b

$$\frac{b-a}{b} \text{ less than } b$$

② b is what % of a

$$\left(\frac{b}{a}\right)$$

④ what % of b is a

$$\left(\frac{a}{b}\right)$$

⑥ How much % a

is more than b.

$$\textcircled{1} \quad \frac{a}{b}$$

$$\textcircled{2} \quad \frac{b}{a}$$

$$\textcircled{3} \quad \% \quad \textcircled{4} \quad \left(\frac{b}{a}\right)$$

$$\textcircled{5} \quad \left(\frac{b-a}{b}\right)$$

$$\textcircled{6} \quad \left(\frac{b-a}{a}\right)$$

$$\textcircled{7} \quad \left(\frac{a-b}{b}\right)$$

How To Calculate % quickly (Break method)

Ex. 27% of 520

Trick:

$$\frac{27}{100} \times 520 =$$

$$\begin{array}{r}
 27 \quad \text{of } 520 \\
 \downarrow \quad \downarrow \\
 25\% \quad 1\% \\
 \downarrow \quad \downarrow \\
 13 + \quad 1 \\
 10 + 4 \\
 \hline
 28.4
 \end{array}$$

$\rightarrow (20+1)\%$
 $\rightarrow (10+10+1)\%$

21% of 550

$$8088\% \text{ of } 37.5 = 100\% + 10\% + 10\% + 7\frac{1}{2}\%$$

$$110 +$$

$$115.50$$

~~$8(10\% + 10\% + 10\%)$~~

$$\begin{array}{r}
 808.8 \\
 \times 3 \\
 \hline
 2426.4
 \end{array}$$

$$\frac{15}{2} \times \frac{1}{100}$$

$$\frac{3}{8} \times 808.8$$

(30.33)

X X
 % is interchangeable.
 $10\% \text{ of } 500$ $500\% \text{ of } 10$

$$\begin{array}{rcl}
 \frac{10}{100} \times 500 & = & \frac{500 \times 10}{100}
 \end{array}$$

① 512% of 620.5 + 216% of $83\frac{1}{3}\%$.

$$\begin{array}{r}
 \frac{5}{8} \times 512 + \frac{5}{8} \times 216 \\
 \downarrow \quad \downarrow \\
 320 + 136
 \end{array}$$

$$320 -$$

$$\begin{array}{r}
 180 \\
 \hline
 500
 \end{array}$$

Tricky Concept

% \longrightarrow Ratio



% $\longrightarrow \frac{+N}{D}$

D \longrightarrow Real Value/original value

+ \rightarrow Increase.

- \rightarrow decrease.

$$\uparrow 25\% = \frac{1}{4} = 4 \rightarrow 5$$

(Q) If $x\%$ of y is equal to z then what % of z is x .

$$\frac{x}{y} \times 100 = z$$

$$\left(\frac{x}{100}\right) \times y = z$$

$$\left(\frac{x}{z}\right) \times 100 = y$$

$$\left(\frac{x}{z}\right) \times 100 = \frac{100^2}{y}$$

Q. $\frac{2}{5}$ fifth of $\frac{1}{3}$ of $\frac{3}{7}$ three-seventh of a number is 15 what is 40% of a number.

$$\frac{2}{5} \times \frac{1}{3} \times \frac{3}{7} x = 15$$

$$x = \frac{15 \times 35}{2} \times \frac{4}{105} = 105$$

Q. If hanish height is 25% more than of yogesh? How much yogesh height is less than hanish.

A ↑ B ↓

Short cut

H

$\frac{1}{5}$

$\frac{1}{5}$

$$\uparrow \frac{1}{4} \text{ Y. } \left(\frac{1}{5}\right) \text{ %} \rightarrow 20 \text{ %}$$

$$\uparrow \left(\frac{1}{n}\right) +$$

more

-1

$\frac{1}{n}$

$$\downarrow \text{? } \left(\frac{1}{n+1}\right)$$

less

$$\frac{4}{5} \cdot \frac{5}{4} = 1$$

$$\frac{1}{5} = 20 \text{ %}$$

hanish

yogesh direction less

Q3 Rohit
If height-weight of is $5\frac{5}{9}\%$ less than of Mohit, How much % Mohit
height is more than of Rohit

(47) $\frac{1}{19} \rightarrow \frac{1}{18} = 5\frac{5}{9}\% \text{ more}$

If $16\frac{2}{3}\%$ of a number is added with itself then the result becomes 560

If 12.5% is subtracted from it self then new number = ?

$$\begin{array}{ccc} & T & D \\ 16\frac{2}{3} & \downarrow & \rightarrow X \rightarrow 560 \\ \frac{1}{6} & 480 & 60 \\ 12\frac{1}{2} & \frac{1}{8} \rightarrow & \rightarrow \begin{matrix} \cancel{240} \\ 420 \end{matrix} \end{array}$$

A number is multiplied by $\frac{6}{5}$ instead of $\frac{5}{6}$ error % = ?

$$\begin{array}{cc} \frac{6}{5} & \frac{5}{6} \\ \curvearrowleft & \curvearrowright \\ \text{take Lcm or multipl.} & \text{Assumption is important} \end{array}$$

$$30 \times \frac{6}{5} = 36$$

$$30 \times \frac{5}{6} = 25$$

$$\frac{11}{28} \times 100^4 = 44\%$$

~~short cut~~

If x is a% less than y then y is $\left(\frac{a}{100-a}\right) \times 100\% \text{ more than } x$

Marks Based Question

1.33

A student who score 30% marks failed by 5marks, another student who scored 40% marks passed by 10marks find

① max marks

② minimum passing mark

③ minimum passing %.

A

B

$$30\% + 5$$

$$40\% - 10$$

① $30\% + 5$

$$\text{Step 2} = 30\% + 5 = 40\% - 10$$

$$45 + 5 = 50 \text{ marks}$$

$$15 = 10\%$$

③ $\frac{180}{150} \times 100 = 33.33\%$

$$1\% = 1.5$$

$$100\% = 150 \text{ marks}$$

→ max marks

Q In an examination a student scores 240, he failed by 5%. but if ^{V. ut} he scores 300 marks got 7% more than passing %. find passing %.

$$240 + 5\% = 300 - 7\%$$

$$60 = 12\%$$

$$1\% = 5 \text{ marks}$$

$$\text{passing \%} = \frac{240}{5} + 5\%$$

$$= 48\% + 5\% = 53\%$$

XXX

Expenditure, Saving, Remaining part

2.14

A man spends 25% on house rent ~~20% of remaining~~ on food, 10% on travelling and finally saves \$100 find income.

I	5
X	3
5	4
10	9

$$50 : 27 = 8100 \\ 300$$

$$\text{Income} = 15000$$

Q15 A person spends $12\frac{1}{2}\%$ on food, 20% of remaining on travelling
 $16\frac{2}{3}\%$ of entertainment expenditure = 3500, find incom.

I Sav

82 T

6 S

8 X

$$12 : 7 = 8 : 380 \quad \text{Income} = 8400$$

$$1 : 900$$

Q16

A person spend $16\frac{2}{3}\%$ on food, 17% of income remaining part on medical and 23% on education, 10% of remaining on travelling
 Ratio of Income : expenditure

I Savin
26 5 $17\% + 23\%$

100% of incom 8 3

$\frac{8}{100}$ $\frac{9}{100}$ $\frac{2}{100}$ $\frac{\text{Income}}{9}$ $\frac{\text{Expenditure}}{11}$

$$20 : 9 \Rightarrow 20 : 11$$

Q17 A person spends $x\%$ of his income on petrol, $16\frac{2}{3}\%$ of remaining on entertainment and finally saves $\frac{3}{4}$ th of income $x=2$

Income Saving

$100-x$

6

120

$100-x$

5

$100-x$

$$100-x = \frac{3}{4} \times 120$$

$$100-x = 90$$

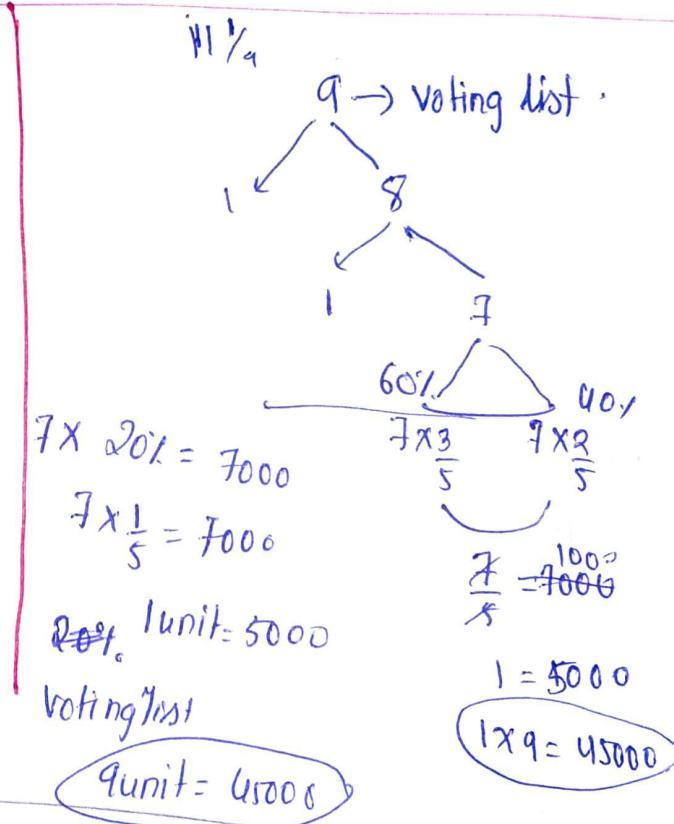
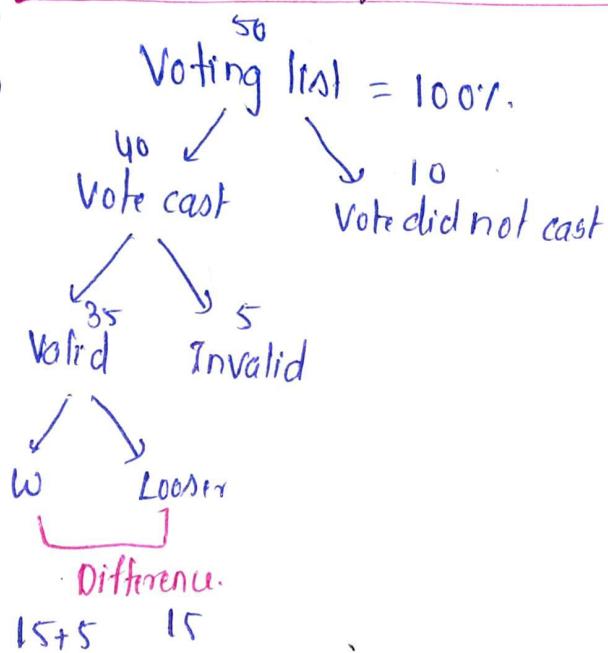
$$\boxed{x = 10\%}$$

Q2 A person spends 75% of his income & saving ↓ by 20%. Then how much % income should be ↑ so that expenditure would be ↑ by 20%.

$$\begin{array}{ccc} E & S \\ 100 = 75 + 25 & \xrightarrow{5 \rightarrow 4} & 5 \rightarrow 6 \\ 110 & 25 & 20 \end{array}$$

↑ 10%

Q3 In an election $11\frac{1}{4}\%$ voter did not participate in voting, $12\frac{1}{2}\%$ voters were invalid. Winner got 60% of valid voters won by 7000. Find total no of voters in voting list.



Q4 In an election 20% voters couldn't cast their vote out of total cast. Voter 3200 becomes invalid, 60% to of total valid voters secured by 'B' and 'A' wins the election by 14720 voters, find voter who did not cast their voter.

$$\begin{array}{c} 5x \\ 1 \quad \swarrow \quad \searrow \\ 4x \quad (4x - 3200) \\ 3200 \end{array}$$

$$\begin{array}{l} A \quad B \\ 60\% \quad 40\% \\ 20\% \text{ of } (4x - 3200) = 14720 \\ \frac{1}{5} (4x - 3200) = 73600 \\ 4x = 73600 + 3200 \\ 4x = 76800 \\ x = 19200 \end{array}$$

Multiplication by 5

$$10 \times 5 = 50$$

$$10 \xrightarrow{\text{1/2}} 5 \xrightarrow{\text{+1 zero}} 50$$

$\textcircled{1} \quad \textcircled{2}$

$$250 \times 5$$

$$\textcircled{1250}$$

$$500 \times 5$$

$$\textcircled{2500}$$

$$\textcircled{2500}$$

① half and add zero to it

$$\begin{aligned} 4x &= \frac{35200}{4} \\ 4x &= 70400 \\ 2x &= 14600 \\ \therefore 5x &= 88000 \end{aligned}$$

$x = 17600$

$$b) \frac{1}{5}(4x - 3200) = 14720$$

$$\begin{aligned} 4x - 3200 &= 73600 \\ 4x &= 76800 \\ x &= \frac{76800}{4} \\ x &= 19200 \end{aligned}$$

$$\therefore 5x = 96000$$

$$\textcircled{x = 19200} \rightarrow \text{lunil did not cast vote}$$

Q) In a election b/w two candidate
10% Voter couldn't cast their
Vote and 60 voters casted were invalid, A wins by getting 48% of
all the voter in list and got 600 more than 'B' find votes secured by B.

$$\begin{array}{c} 10x \\ \swarrow \quad \searrow \\ 9x \\ \swarrow \quad \searrow \\ 9x - 60 \quad 60 \\ \swarrow \quad \searrow \\ 4.8x \quad 4.2x - 60 \end{array}$$

$$48\% \text{ of } 10 = 10\% \text{ of } 48.$$

$$\begin{array}{r} 360 \\ 18 \\ \hline 378 \\ 40 \end{array}$$

$$42 \times 90 - 60$$

$$0.6x + 60 = 600$$

$$0.6x = 5400$$

$$\textcircled{x = 900}$$

$$\textcircled{80}$$

$$= 3780 - 60$$

$$= 3720$$

ans

5.29

Maths

The population of city is 7900, If number of males ↑ 11% and females ↑ by 14.5%. final population becomes 8839. find difference b/w initial number of males and females in city

Minimum Satisfactory Method

$$7900 \longrightarrow 8839$$

m

F

11%

14.5%

11%

11.1% + 3.5%

Step 2 $11\% \times 7900$

$$\begin{array}{r} 790 \\ 79 \\ \hline 869 \end{array}$$

93

$$\text{Step 2} = 31 + 39$$

$$= 70$$

$$\text{Step 3} = 3.5\% = 70$$

$$35\% = \frac{700}{20}$$

$$10.5\% = 2000$$

(Sx) 1.09.

There are two types of animals in zoo, some are rabbits and some are cats each rabbit → 9 bread, cat → 11 bread, per day consumption = 580
 Total no of animals = 60 find no of cats.

$$\begin{array}{l} \text{Zoo} \rightarrow 60 \\ \downarrow \quad \downarrow \\ \text{Cat} \quad \text{Rabbit} \\ 9+2 \quad 9 \end{array}$$

$$\therefore 60 \times 9 = 540$$

$$\text{but total} = 580$$

∴ 40 extra is consumed by cat

$$\therefore \text{no of cats} = \frac{40}{2} = 20 \text{ cats.}$$

a value of machine depreciates at 10% per annum If present
 2nd Net value 3645000 find its worth after 3 years

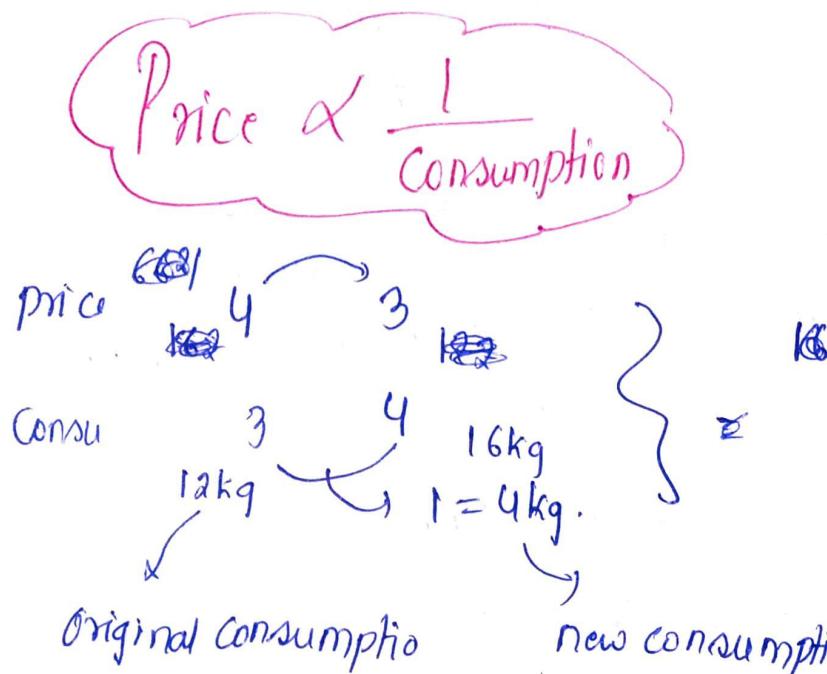
$$\begin{array}{r}
 1st \rightarrow 10 \quad 9 \\
 2nd \rightarrow 10 \quad 9 \\
 3rd \rightarrow 10 \quad 9 \\
 \hline
 1000 \quad 729
 \end{array}
 \text{ Use } \underline{\underline{C-9}}$$

$\therefore 3645 \times 729$
 $0 \times 0 = 0$
 $(2657205) = 0.$

Consumption & Saving Price Expenditure

Q) A Reduction of 25% in price of sugar enables a wife to purchase 4kg more for Rs 800 find

- a) original price
- b) current price
- c) original consumption
- d) current consumption



$$\text{Price original} = \frac{800}{12} \quad 66\%/\text{kg} \left(\frac{800}{12} \right) = 50 \text{ Rs/kg}$$

Trick: - Original price

Expenditure (Reduction/Increment) = more how much we can

$$800 \times (25\%) = 200 = 4\text{kg}$$

1 kg = 50 F. (After 1 month) bus trade

Original price is 100%.

$$\therefore 75\% = 50$$

$$100\% = \frac{50^2}{75} \times 100 = \left(66\frac{2}{3}\right)$$

Q1) A price of sugar reduced by 2%. How many kg of sugar can now be bought for the money which was sufficient to buy 49 kg of sugar earlier.

assume 1 kg = 100, 4900

~~Price~~ → 50 → 49

Consumption → 49 → 50

~~100~~ → ~~98~~ → ?
4900 → ?

→ calculate expenditure

98

4900
98

50kg

4900

100 kg. Initially → 49 kg
Now → 50 kg.

Q) length increased by $14\frac{2}{7}\%$ and breadth ↑ by $12\frac{1}{2}\%$. % area change = ?

I F A

$$\begin{pmatrix} 7 \\ 8 \end{pmatrix} \cdot \begin{pmatrix} 8 \\ 9 \end{pmatrix}$$

~~56 : 7 : 9~~

$$\frac{2}{7} \times 1000 = \left(14\frac{2}{7}\%\right) \times 2 = \left(28\frac{4}{7}\%\right)$$

Product Constant method

$$\textcircled{1} \ A = L \times B \quad \textcircled{2} \ Exp = P \times C \quad \textcircled{3} \ D = S \times T.$$

Short cut (length breadth)

$$14\frac{2}{7} \rightarrow \frac{1}{7} \uparrow \quad , \quad \left(\frac{1}{7} \right) \left(\frac{1}{8} \right) = \frac{1}{56}$$

$$12\frac{1}{2} \rightarrow \frac{1}{8} \uparrow$$

$$\left(\frac{1}{8} \right) \left(\frac{1}{5} \right) = \frac{1}{40} = 2\frac{4}{7} \quad = 28\frac{4}{7}$$

1st $20\% \uparrow$ 16% \downarrow overall change = ?

$$\frac{1}{5} \quad \frac{1}{6} \quad \frac{10}{24} \left(\frac{2}{5} \right) = 40\%$$

Q) If the length of rectangle decrease by $44\frac{4}{9}$ what % of bread should be increased.

Standard procedure

$$\begin{array}{c} \text{1st} \xrightarrow{\text{B}} x \quad y \\ \text{and} \xrightarrow{\text{L}} q \quad s \\ \text{3rd} \xrightarrow{\text{A}} 1 \cancel{q} \end{array} \Rightarrow \begin{array}{l} x : y \\ s : q \end{array}$$

$$\frac{y}{s} \times 100 = 80\%$$

Q1) If radius of cylinder increased by 50%, height decreased by 20%. % change in Volume

Volume of $\text{Cylinder} = \pi r^2 h$

$$\begin{aligned} r &= 5 \quad r^2 = 25 \\ h &= 4 \quad h = 4 \\ &\frac{r^2}{h} = \frac{25}{4} \quad \therefore \frac{4}{5} \times 100 = 80\% \end{aligned}$$

~~80%~~
~~20%~~

If radius of a Cone ↑ by 20% what % height ↓ so volume remain constant:

$$\begin{aligned} r^2 &= 25 \quad r = 5 \quad h = x \quad h = 4 \\ b &= 36 \quad r^2 = 25 \quad 36 \\ &\frac{r^2}{h} = \frac{25}{4} \quad \boxed{x : 4} \\ v &= 36 : 1 \quad \boxed{36 : 25} \quad \frac{11}{36} \times 100 = \frac{275}{9} \\ &\therefore \frac{275}{9} = 30 \frac{5}{9}\% \downarrow \end{aligned}$$

Volume of Cone = $\frac{1}{3} \pi r^2 h$

$$\frac{3}{275} \times 100 = 0.050$$

length ↑ 20%, breath ↑ 25%. % change in perimeter

Parameter = (ND)

Q2) The price of sugar ↑ 15% but consumption ↑ by 25%. % change in expenditure

$$\begin{aligned} P &= 100 \\ C &= 4 \quad \therefore \frac{P}{C} = \frac{100}{4} = 25 \end{aligned}$$

$$\frac{18}{100} \times 25 = 3$$

$$P = 20 \quad C = 8 \quad \therefore \frac{P}{C} = \frac{20}{8} = 2.5$$

$$\frac{7}{16} \times 100 = 43.75$$

$$C = 4 \quad \therefore \frac{C}{P} = \frac{4}{20} = 0.2$$

$$43.75 + 4 = 47.75$$

(Q) If the price of petrol ↑ by 20% and expenditure also ↑ 10%, then find how much consumption will change.

x	y
5	6
10	11.5
60	68
12	11

$$\frac{1}{12} \times 100 = 8\frac{1}{3}$$

(Q) If petrol price ↑ 10%, consumption ↑ by 15 liter, expenditure ↑ by $\frac{50}{950}$. If initial consumption = 120, initial expenditure

10	11
120	135
8	9
80	99
80 × 50	120 × 50 = 950

Fruit Water Mass

fresh fruit 80% water, and dry fruit contains 20% water,
How much dry fruit obtain from 60kg of fresh fruit.

	W	P		W	P		W	P
F	80	20	=	4	1	× 4	16	4
D	20	80	=	1	4		1	4

② Remember make pulp weight same

$$5 \times 3 = 15 \text{ kg}$$

Q) A vessel has 60 liters of soln having acid & H_2O 4:1 respectively. How much H_2O must be added to make soln as 60% acid.

$$\begin{array}{ccccc}
 A & w & & A & w \\
 4 & 1 & \Rightarrow & 12 & 3 \\
 8 & 5 & & 12 & 8 \\
 3 & 2 & & & \xrightarrow{\text{5 (difference)}} \times 4 = 20 \text{ liter} \\
 & & & & 18 = 60 \\
 & & & & 1 = 4
 \end{array}$$

~~Star Star 8) (whoso) M)~~

Q) If the numerator ↑ 25% and deno ↑ 250% if the resultant fraction is ' $\frac{6}{5}$ ' What is original fraction.

Assum. $\rightarrow \frac{100x}{100y} \rightarrow \frac{75x}{350y} = \frac{6}{5} = \frac{x}{4} = \frac{\frac{6}{75} \times 350}{\frac{350}{75}} = \frac{28}{5}$

Q) In a village three people contested for the post of Village pradhan due to their own interest, no votes were invalid, losing candidate got 30% of the vote what could be minimum absolute margin of votes by which winning candidate led by nearest vital % if each candidate got integral %.

Vote. A [70%] B C

35% : 35% 30%

36 : 34 30
what is minimum difference.

1% v.

two numbers 'p' and 'q' are 20% and 28% less than number 'x'. What is the percentage the number 'q' is smaller than p.

p q x

$$80 \quad 72 \quad 100 \quad \frac{8}{80} \times 100\% = 10\%$$

Q12) A natural no when increased by 50% If gives a natural , when the value is reduced by 75% still it is natural no if no reduced by $66\frac{2}{3}$ then also natural no what is least possible no

$$\left\{ \begin{array}{l} 2 \\ 4 \\ 3 \end{array} \right. \left. \begin{array}{l} 1 \\ 1 \end{array} \right\} \text{In all cases it should be natural no}$$

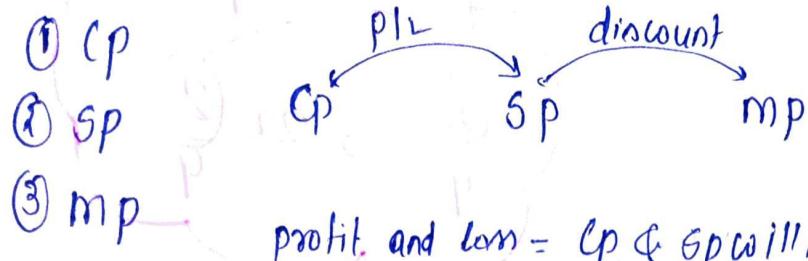
$\rightarrow \text{Lcm } 12$

LCM Calculation Trick

$$48, 64, 72 \quad \downarrow \frac{\circ}{\circ} 8 \text{ reduce to small no}$$

$$\overbrace{6; 8, 9}^{\cancel{72}} \xrightarrow{\times 8} \boxed{576}$$

Profit and Loss



- ④ profit or loss always calculated on "CP"
- ⑤ discount always calculated on "MP" MRP

Q) SP = 500
P = 10%
CP = ?

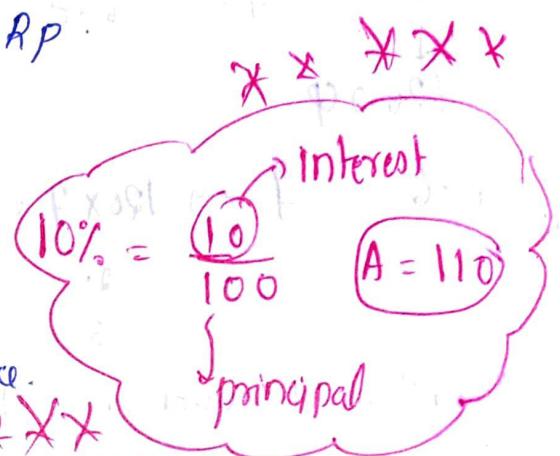
Method:- assume 100%.

$$100 \rightarrow CP$$

$$+x$$

$$\downarrow \rightarrow \text{profit \%}$$

$$100+x \rightarrow \text{Selling price.}$$



Q) SP = 1313
Profit = 44 4/9%.
Profit = ?
CP = ?

$$\frac{4}{9} \rightarrow CP \quad 9 \quad 13 \rightarrow 1313$$

$$CP \rightarrow 909 \quad 1313$$

Profit = 404

- Q) An article sold at ₹200/- gets 20% loss, at what price it should be sold to get 60%.

$$(80\% \ 720) \times 2$$

$$(60\% \ 1440)$$

$$SP = 1111$$

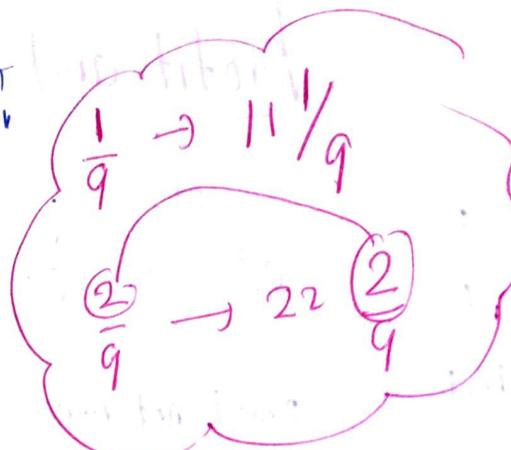
$$\text{Profit} = 22\frac{2}{9}\%$$

$$CP = ? \quad \text{Profit}$$

$$909, 202$$

$$\frac{2}{9}$$

$$9 \rightarrow 11 \rightarrow 1111$$



1.03

- (Q) An article sold at 630, it gets $12\frac{1}{2}\%$ loss
 $SP = ?$ to get $16\frac{2}{3}\%$ profit

$$CP \quad SP$$

$$8 \quad X \rightarrow 630$$

$$720 \rightarrow CP$$

$$720 \leftarrow 6 \quad 7 \rightarrow 120 \times 7 = 840$$

- (Q) CP of 12 articles equal to SP of 9 articles while discount on 1 article is equal to profit on 5 articles find differentiable profit% and discount%.

$$CP / SP \quad MP$$

$$9$$

$$2 \times 3$$

$$12$$

$$011$$

$$3$$

$$1 \times 2$$

$$6$$

$$2$$

$$8$$

$$9$$

$$1$$

$$CP \quad SP \quad MP$$

$$16$$

$$6$$

$$011$$

$$3$$

$$9$$

$$\text{Profit} = \frac{2}{6} (33\frac{1}{3}\%) \text{, discount} = \frac{1}{9} = 11\frac{1}{9}\%$$

$$\frac{12-4}{36} = \frac{8}{36} \times 100 = \frac{2}{9} \times 100$$

- (Q) A shopkeeper sells at 9% loss had it sold at 800 more find initial CP

$$100 \quad 91 \quad 107 \rightarrow 16 \rightarrow 800$$

$$(CP = 5000)$$

$\text{Profit} = \text{loss} + \text{profit}$

↓
add (+)

= profit + profit

↓

-ve subtract

sv

- Q) A shopkeeper sells good at 7% profit had it sold 4248 more he would gain 13% profit CP=?

$$6\% = \frac{708}{4248}$$

$$100\% = 70800$$

- Q) A shopkeeper sold an article at 25% profit if CP and SP ↓ by 900 the profit would be 5% more than initial CP=?

$$\begin{array}{rcl} \text{CP} & 4 & 1 \\ & 5 & x_3 \\ \text{SP} & 5 & 13 \end{array} \quad \rightarrow \text{Difference balancing}$$

$$\begin{array}{rcl} \text{SI:} & 12 & 10 \\ & 15 & 13 \\ & 3 & 2 \end{array} \quad \rightarrow 2 = 900 = 450$$

to if require I
balance =
 $\cancel{\times \times}$
 $(2 - 900) \times 6$
 $12 \quad 5400$

- Q) A shopkeeper sold at $37\frac{1}{2}\%$ if both CP and SP ↓ by 40 then now profit would be $\frac{2}{7}$ of "SP" then initial SP=?

$$\begin{array}{rcl} \text{CP} & 8 & x_2 \\ & 5 & x_3 \end{array} \rightarrow 11$$

$$\begin{array}{rcl} \text{Profit} & 2 & \\ \text{SP} & 7 & \\ \text{CP} & 5 & \end{array}$$

$$\begin{array}{rcl} 16 & 22 \\ 15 & 21 \end{array}$$

$$(1 \rightarrow 40 \times 16)$$

If SP of article decrease by rupees 780, but CP is decreased by 20%, the loss % changes from 10% to 20%. Find initial CP.

Assum.

GP	SP
100	$\xrightarrow{-10\%} 90$
80	$\xrightarrow{-20\%} 64$
$26 = 780$	
$18 = 340$	
$1 = 30$	
$(CP = 30 \times 1000)$	

$-10\% - 780 + 20\% - 4\%$
 $100 - 780 + 1600 + 16\%$
 $126\% = 780$
 $26\% = 60$
 $100 = 360$

A person sold an article at 25% profit if he had bought 600 less and sold it at 400 more. Then profit will be 35%. Find initial CP.

25% $\xrightarrow{10\%}$ 35%

10% profit = $600 + 400 + \frac{(600 \times 35)}{100}$ ~~= 180~~
~~30~~
~~210~~

10% = 1210
100% = 12100

A person sold at 15% profit if he had bought 200 less and sold at 100 less. Profit will be 25%. What is SP to get 20%.

10% = 200 + -100 + 50
10% = 150
100% = 1500

$120\% = 1800$

A person sold an article at 10% less if he had bought it at 20% less and sold it at 520 less than loss would be 20%. Find initial CP.

$-10\% = 20\% + 20\% - 520$ ~~4\%~~
 $-10\% = 16\% - 520 = 26\% = 520$

~~340~~ $\xrightarrow{-520}$

$100\% = 2000$
 $100\% = \frac{520}{26} \times 100\% = \frac{5200}{26} = 200$
 $100\% = \frac{520}{26} \times 8 = \frac{4160}{26} = 160$

Maths

5) A person sold article at 880 loss incurred will be equal to profit incurred when the article sold at 1280, $SP = ?$ to get 20% profit.

$$\begin{array}{ccc}
 1280 & 880 & 400 \\
 \text{Profit} & \text{Loss} & \\
 1 : -1 & & \\
 2 & & \\
 \end{array}$$

$1 = 200 \Rightarrow CP = 1280 - 200$
 $= 1080$
 20% profit
 $SP = 5 \rightarrow 1080$
 $6 \rightarrow 1296$

Q6) A person sold an article at rupees 970 loss incurred is 20% more than profit occurred when article sold at 1080, $SP = ?$ to get 30% profit.

$$\begin{array}{ccc}
 1080 & 970 & 1080 \\
 P & L & \\
 5 & -6 & \\
 \hline
 HO = 11 & & \\
 \boxed{1 = 10} & & \\
 \end{array}$$

Ratio = 110
 ~~$\therefore CP = 160 \rightarrow 10 \rightarrow 13$~~
 ~~$\therefore CP = 16 \times 13$~~
 ~~$7 \times 4 = 28 = 11$~~
 $\therefore CP = 160 \rightarrow 10 \rightarrow 13$

$\therefore \text{Profit} = 50 \therefore CP = 1030 \rightarrow 10 \rightarrow 13$

~~$\therefore SP \text{ for } 30\% \text{ profit} = 103 \times 13$~~

~~$\text{Ans: } 1331$~~

$C - 9 \quad 9 \times 4 = 16 = 7$

Q7) A man sells an article at 96 and gets percent profit equal to CP then $CP = ?$

~~$\text{difference} = 10$~~

$$\begin{array}{c}
 96 \\
 \swarrow \searrow \\
 16 \quad 6
 \end{array}$$

$\rightarrow \text{break such factor}$
 $\text{that difference is } 10$

Step 3: Just place zero in front of smaller no

(Q) A man sells an article for ₹21 and get percentage loss equal to CP then find CP = ?

21
7 3 → break such
that sum is 10
steps → add '0'
(70) (30) → both are CP.

loss = odd and

= 10

(Q) A person buys some articles @ 3 articles for rupees 5 and sells @ 5 articles for ₹7. If total loss would be '40' find

① Loss %.

② Total Investment

③ No of articles

~~* * * *~~

Step 1:- balance
no of articles

	articles	Price.
CP	3	5
SP	5	7

$$\frac{4}{4} \text{ ratio} = 40$$

$$\text{ratio} = 10$$

CP	15	25
SP	15	21

$$\text{Loss \%} = \frac{4}{25} \times 100 = 16\%$$

∴ no of articles = $15 \times 10 = 150$, ∴ Investment = $25 \times 10 = 250$.

A man buys some articles @ 4 articles for rupees '1' and some number of articles @ 5 articles for ₹1 and sold

@ 9 articles for ₹1 if he will get ₹20 loss find total articles

CP	articles	PN			
4	1	1	⇒	(20)	(5)
5	1	1	⇒	(20)	(4)

$$\begin{aligned} \text{CP} &= 40 \\ 5P &= 90 \\ 2 \times 40 &= 2 \times 90 \end{aligned}$$

	art	price
Cp	360	81
Sp	360	80

ratio = 20.

∴ total no of articles = 360×20

$$= 7200$$

* * Textbook

Q13 A person buys some articles @ 18 articles for 1. find how many articles should be sold to get 10% loss.

	A	P	
Cp	18	1	$100\% = \frac{1}{18} \rightarrow \text{cp of one article}$
Sp	?	1	$\downarrow \text{article}$

$$\text{Total CP} = 18 \times 1 = 18$$

$$\text{Total SP} = ?$$

$$90\% = \frac{1}{18} \times 90\% = \frac{1}{2} \times 90\% = 45$$

$$90\% = \left(\frac{1}{20}\right) \rightarrow \text{price}$$

$$\text{Profit} = \left(\frac{1}{20}\right) \rightarrow \text{article} \quad ; \quad @ 20 \text{ articles for } 12$$

A person sold 18 articles for rupees 20 he will get 20% loss
how many articles should he sell at Rs 15 to get 20% profit

$$\text{Sp} \quad 18 \quad 20 \quad \Rightarrow \quad 80\% = \frac{20}{18} = \frac{10}{9}$$

$$120\% = \frac{10}{9} \times 120\% = 15 \rightarrow \text{price}$$

Trick → averaging (same Cp)

A person buys two articles at Rs 1500 each on the first article he got 25% profit but on second article he got 25% profit but on second article he got loss of 20% find overall loss or profit.

$$\frac{+25\% - 20\%}{2 \rightarrow \text{total transaction}} = \left(\frac{5}{2}\right) = 2.5\%$$

Q1) A person sell five cows he sells first at 6% profit
 second at 2% loss third at 12% profit fourth on 8% profit
 What % should he sell fifth cow to gain overall 10% profit.

$$10\% = \frac{6 - 2 + 12 + 8 + x}{5}$$

$$x = 26\%$$

Q2) A shopkeeper sells $\frac{2}{3}$ part of his goods at 6% loss what % he should sell remaining ~~so that~~ that overall profit becomes 12%.

~~Always~~ $\frac{2}{3} \rightarrow$ goods sold at loss; $\frac{1}{3} \rightarrow$ sold at profit
 $\frac{1}{3} \rightarrow$ total goods

$$\frac{-12\% + x}{3} = 12\%$$

$$x = 48\% \text{ profit}$$

Q3) A person sold $\frac{2}{3}$ part at 30% profit and $\frac{1}{4}$ at 16% profit and remaining at 12%. If he gains 75, find cp of all.

amount all articles (12)

$$\frac{8 \times 30\% + 3 \times 16\% + 12\%}{12} = \frac{240\% + 48\% + 12\%}{12} = \frac{300\%}{12} = 25\% = \frac{75}{1\%} = 300$$

A trader purchases a watch and a wall clock for 390. He sells them making 10% profit on watch and 15% on wall clock. He earns profit of 51.50. The difference in original prices is=?

$$\begin{array}{c} 250 \quad 140 \\ \hline 390 \end{array}$$

16% \rightarrow 140
 \rightarrow 110 → Ans.
 $\frac{5\%}{20} \rightarrow 12.50$
 $100\% \rightarrow 250 \text{ Rs.}$

390 \rightarrow 39 → actual profit on CP considering common 10%
 but given 51.50
 $\frac{39.00}{12.50}$

Maths

(216) Profit or loss

A man purchased two watches for rupees 1500 each one at 10% profit and other at loss of 10% find profit or loss %



(Q) Sp same P%, loss% different

A person sold two articles at Rupees 1735 each, on the first article he got 25% loss but on second article he got 20% profit, find overall profit or loss

$$\begin{array}{r} \xrightarrow{\text{CP SP}} \\ \begin{array}{r} 4 \ 3 \\ 5 \ 6 \\ \hline 13 \ 12 \end{array} \end{array}$$

$$(15 - 9) \text{ is } 6 \text{ and } \frac{1}{13} \times 100 \approx 7\% \text{ loss,}$$

(Q) A person sold two articles at rupees 1840 each at first article he got 15% profit but he sold second article such away that no profit no loss incurred find difference in cp

$$\begin{array}{r} 20 \ 23 \\ 20 \ 23 \\ \hline 46 \end{array}$$

difference in CP is 0.9 rupee

~~$$\begin{array}{r} 46 \rightarrow 1840 \\ 25 \ \cancel{4} \rightarrow 920 \\ 1 \rightarrow 40 \end{array}$$~~

$$23 \rightarrow 1840$$

80

$$\therefore 6 \rightarrow 6 \times 80 = 480$$

Profit on selling price

P and Q sold an article at equal SP. P sold article at 10% profit and 'Q' sold it at 16 2/3% loss. P calculates profit % on selling price whereas 'Q' calculates it on cost price and thereby make overall loss of 1800 find avg cost price of P & Q's articles.

$$\begin{array}{r}
 \text{CP} \quad \text{SP} \\
 \text{P} \quad 9 \quad 10 \quad 10\% = \frac{1}{10} \\
 \text{Q} \quad 16 \quad 5x_2 \quad 12 \quad 10 \\
 \hline
 21 \quad 20 \quad 1 \rightarrow 1800
 \end{array}$$

6
 $\frac{1800 \times 21}{20} = 18900$ ✓✓

Same SP (% P = % L)

$$\text{loss/profit} = -\frac{x^2}{100}$$

$$SP = 150, P = 10, L = 10$$

$$L\% = -\frac{100}{100} = -1$$

Dishonest shopkeeper

A shopkeeper promise to sell his article at CP but uses 30% less weight, Find actual profit or loss %

$CP : SP$ $1 : 1$ $10 : 7 \therefore 10$ $7 : 10$ $\underline{7 : 10}$	$\text{Price} \propto \frac{1}{\text{article}}$ heat price and weight ratio is inverse $\therefore 100 : 70 \rightarrow \text{article}$ $7 : 10 \rightarrow \text{price}$
--	--

$$\frac{3}{7} \times 100 = (14\frac{2}{7}) \times 3 \cdot 1$$

Q) A shopkeeper promises to sell his article at 25% loss but uses 20% less weight find actual profit %.

$$CP : SP$$

$$4 : 3$$

$$4 : 0.75 \rightarrow \frac{1}{16} \times 100 \text{ loss}$$

$$16 : 15$$

Q) A shopkeeper promises to sell his article at 25% loss but uses 40% less weight and finally gets 25% profit. find the value of α .

$$CP : SP$$

$$\alpha : y$$

$$3 : 5$$

$$\cancel{4 : 5}$$

$$\alpha : y = 25\% : 15\%$$

$$4 : 3$$

Q) A person sold three articles at 3 successive discounts of 15%, 20%, 25%. If the final sp is ₹ 2550 find initial mp.

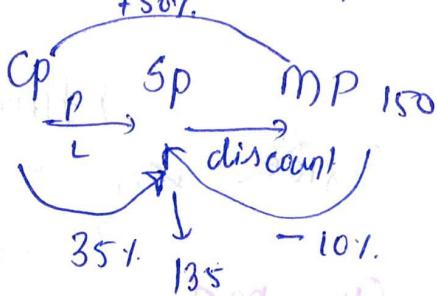
Successive Discount

$$\begin{array}{rcl} MP & : & SP \\ 20 & : & 17 \\ 5 & : & 4 \\ 4 & : & 3 \end{array}$$

$$100 : 51 \rightarrow 2550$$

$$MP = \frac{850}{475} \times 100 = 500$$

① no discount $\Rightarrow MP = SP$



mark + up \rightarrow increased value w.r.t CP

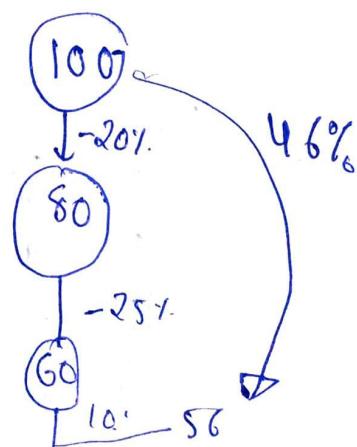
$$MP - CP$$

Successive discount \Rightarrow 20%, 25%, 10%

$$\begin{array}{rcl} SP & : & MP \\ 5 & : & 4 \\ 4 & : & 3 \\ 10 & : & 9 \end{array}$$

$$50 : 27$$

$$\frac{23}{50} \times 100 = 46\%$$



After giving two discount an article having cost of Rupees 350 is available at rupees 245 if second discount is 12.5%. Find first discount.

$$\begin{array}{r}
 x : y \\
 8 : 7 \quad 350 : 245 \\
 \hline
 10 : 7 \\
 \hline
 70 : 86 \\
 10 : 8 \\
 5 : 4
 \end{array}
 \quad \frac{1}{5} \times 100 = 20\% \text{ discount}$$

① After giving three successive discount article sold at Rs 280 if discounts are 20%, 80 rupees less, and Rs 10 less resp. find initial price

$$\begin{array}{c}
 5 : 4 | -80 | 8 : 7 \rightarrow 280 \\
 \text{W} \quad 500 \quad 400 \quad 320 \quad 40
 \end{array}$$

② A person gives 4 articles at s.p of 20 articles. find discount %.

$$\text{MP} > \text{SP} \quad \frac{24}{6} : 20 \rightarrow \frac{1}{6} \times 100 = 16\frac{2}{3}\%$$

③ A shopkeeper markup his cp by 50% but gives 20% discount, and gives 3 articles free on 9 articles. find overall profit or loss.

$$\begin{array}{l}
 \text{Cp : MP} \\
 2 : 3 \\
 4 : 5
 \end{array}
 \quad \cancel{\begin{array}{l}
 \text{MP} / \text{SP} \\
 3 : 2 \\
 5 : 4 \\
 12 : 8 \\
 3 : 2
 \end{array}}$$

$$\begin{array}{l}
 \text{Cp} \quad \text{MP} \\
 2 \quad 5 \\
 5 \quad 9 \\
 4 + 2 = 6 \quad 9 \\
 \hline
 10 \quad 9
 \end{array}
 \quad \frac{1}{10} \times 100 = 10\%$$

$$\begin{array}{l}
 \frac{3}{5} \times 20 = 60\% \\
 \text{final ratio we get of} \\
 \text{CP : SP}
 \end{array}$$

$$\begin{array}{l}
 \text{CP} \quad \text{MP} \\
 \text{MP} \quad \text{SP} \\
 \hline
 \text{CP : SP}
 \end{array}$$

$$\text{mark up} \rightarrow \frac{C.P.}{M.P.} = 2 : 3$$

↓ S.O.R.

$$\text{discount} \rightarrow \frac{S.P.}{M.P.} = 10 : 9$$

↓ 10%

$$\frac{C.P. : M.P. = 2 : 3}{S.P. : M.P. = 10 : 9}$$

$$\frac{C.P. : S.P. = 20 : 27}{}$$

Q) A shopkeeper marked up his article by 40% but gives 25% discount. He also uses 800 grams instead of 1kg. Find overall profit or loss.

$$C.P. : M.P. = 5 : 7$$

$$M.P. : S.P. = 4 : 3$$

$$M.P. : S.P. = 8 : 6$$

$$\frac{25 : 21}{25 : 21}$$

$$\frac{1800}{4 : 5} : \frac{1000}{5 : 4} = \frac{1000}{4 : 5} : \frac{800}{5 : 4}$$

Weight
4 : 5 → Weight
4 : 5 → Cost

$$\frac{4}{25} \times 100 = 16\%$$

$$\frac{(16)}{C.P.} : \frac{(21)}{S.P.} \rightarrow$$

$$\frac{5}{16} \times \frac{21}{4} = 6 \frac{1}{4} \times 4 = 25\%$$

$$= \frac{125}{4} = 31.25 = ①$$

$$(-9 \rightarrow 8 \times 7 = 56 = 2)$$

V-23 SEC

13) A shopkeeper markup price by 60% and gave 3 successive discounts 12.5%, 7%, 25%, and made loss 16%, $x\% = 2$

$$\begin{array}{r} x \\ 5 \\ 48 \\ \hline 5 : 3 \\ 25 : 21 \end{array}$$

$$\begin{array}{r} x \\ 82 \\ 7 \\ \hline 20 \\ 21 \\ \hline 25 : 21 \end{array}$$

$$\therefore x : y =$$

$$25 \times 21 : 20 \times 21$$

$$\therefore d = \frac{25 \times 21 - 20 \times 21}{25 \times 21} \times 100$$

$$= \frac{25 \times 21 - 20 \times 21}{7 \times 3} = \frac{5 \times 21}{7 \times 3} = \frac{35}{21} = 20\%$$

$$d = 525 : 420$$

$$\therefore d\% = \frac{105}{525} \times 100 = 20\%$$

(Q14) A person sold his article at 25% profit how many articles he has to give free at selling 36 articles, so that he gets 10% loss

$$\begin{array}{r} \text{price} \rightarrow x : y \\ & 4 : 5 \\ \hline & 10 \quad 9 \end{array}$$

$x : y$ ~~ratio~~ ~~proportion~~

$50 : 36 \rightarrow$ price.

$25 : 18 \rightarrow$ price

$18 : 25 \rightarrow$ articles.

\downarrow
 36
 \rightarrow 80 articles.
 \rightarrow 14 articles.

Small Value = SP
big Value = MP

~~Type 2~~
Scheduled time delay 30min speed ↑ by 250 km/h.

Q) A plane left 30 min later than its scheduled time to reach destination 1500km away in order to reach in time speed ↑ by 280 kmph. What is original speed.

$$\frac{1}{2} \rightarrow 250$$

$$1 \rightarrow 500$$

$$\begin{array}{l} \text{old time} \leftarrow 2.5 \rightarrow 500 \rightarrow \text{old speed} \\ \text{new time} \leftarrow 2 \rightarrow 100 \rightarrow \text{new speed} \end{array}$$

Simple interest

Simple Interest
↓
principal

$$ROI = \text{ROI}$$

$$SI = \frac{PRT}{100}$$

Compound Interest

Amount(A)



Sum of money = Principle → It is always same.

$$SI = P \text{ at } RT\%$$

$$(Q) P = 10,000, R = 10\%, T = 2/3 \quad SI = ?$$

$$\begin{array}{r} SI \\ \hline SI \\ \hline 2000 \\ 3000 \\ 1000 \times 20\% = 200 \\ 1000 \times 30\% = 300 \end{array}$$

$$(Q) \text{Principal} = 3375, \text{Rate} = 6 \frac{2}{3}\%, \text{Time} = 3 \text{ year } 4 \text{ months.}$$

$$\begin{array}{r} 3 \frac{2}{3} = 10 \frac{1}{3} \\ \downarrow \\ \frac{1}{6} \rightarrow 3375 \\ \frac{1}{8} \rightarrow 3375 \\ \frac{1}{2} = 1125 \quad I = \frac{1125}{2} \end{array}$$

$$\begin{array}{l} \text{effective rate} - RT\% = \frac{1}{15} \times \frac{10^2}{3} = \left(\frac{2}{9} \right) \rightarrow \text{Interest} \\ \therefore P = 3375 \\ 3 = 3375 \\ 1 = 3375 \times 2 = 750 \quad \text{Interest} \\ \hline \end{array}$$

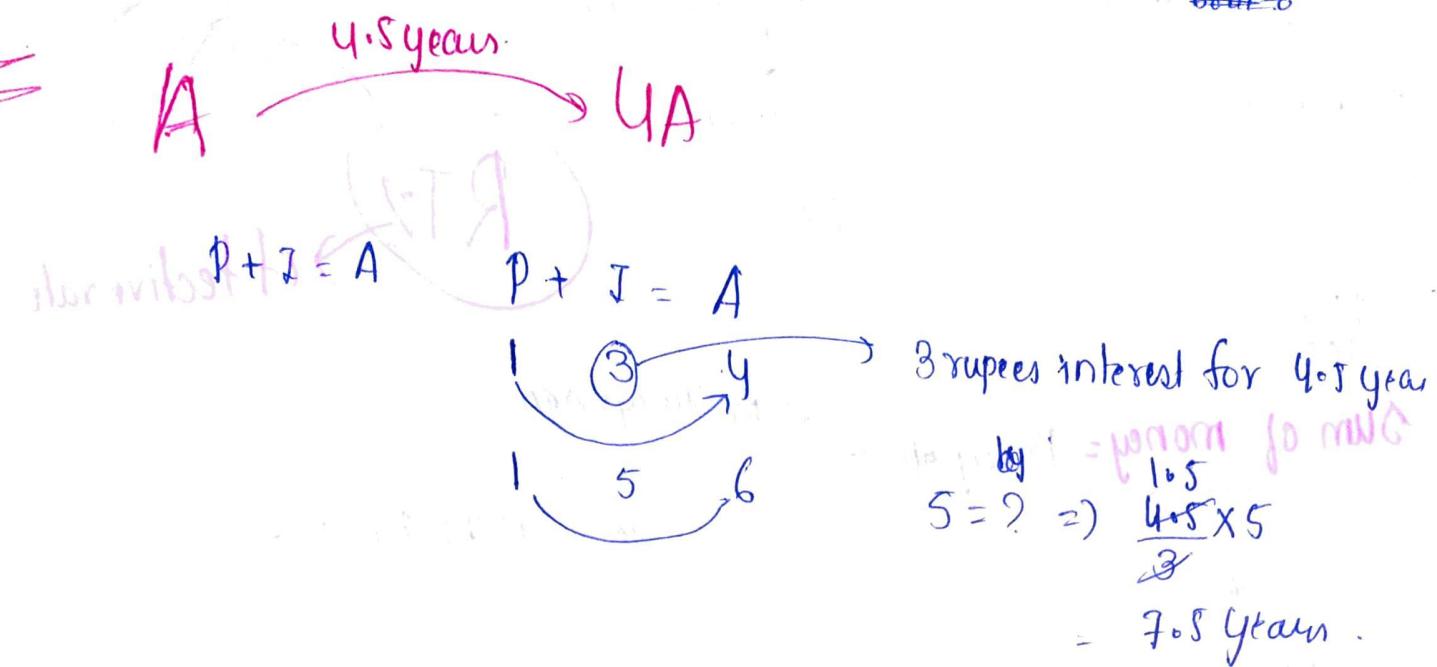
$$\text{Amount} = 1717, \text{Rate} = 6 \frac{2}{9}\%, \text{Time } 2 \text{ years.}$$

$$SI = ?$$

$$\begin{array}{l} \text{effective rate} - \left(\frac{10}{9} \right) \times \left(\frac{4}{9} \right) \times 2 = \left(\frac{8}{9} \right) \rightarrow 17 = \frac{1717}{101} \\ \hline \end{array}$$

$$\therefore 808$$

A sum of money becomes 4 times in 4.5 years then in how much time it will become 6 times.



Q) A sum of money becomes $\frac{13}{7}$ times in 12 years then how much time it will be 3 times.

$$7 + 6 = 13 \rightarrow 12\text{ years} \\ 7 + 14 = 21 \quad \therefore \underline{14\text{ years}}$$

Q) Rs 435 becomes Rs 555 in 3 years at certain rate of interest
so R is 2% less, what will be amount at end of 5 years.

$$120\text{ years} \rightarrow 3\text{ years} \\ 40\text{ years} \rightarrow 1\text{ year}$$

$$\therefore \text{end of 5 years} = 435 + \frac{200}{635} \rightarrow \text{at initial rat.}$$

$$\therefore \text{at reduced rate} \Rightarrow -2\%, -2\%, -2\%, -2\%, -2\% \\ -10\% \Rightarrow 435 \times \frac{10}{100} = 43.5\text{ years}$$

$$\therefore 635 - 43.5 \\ = 591.5 \text{ years}$$

(Q) A certain amount of money is given at a rate of interest for 5 years. If the rate is ↑ 5% more. 600 is received as interest find principal.

$$25\% = 600$$

$$100\% = \frac{600}{25} \times 100 = 2400.$$

Q At what rate percent per annum will the sum of money double in 16 years,

$$100 + \underline{100} = 200$$

$$\therefore R = \underline{200} \quad 100 = 100 \times 16 \times R\%$$

$$R\% = \left(\frac{1}{16}\right) \times 100 = 6\frac{1}{4}\%$$

Trick:-

Revision

$$R = \frac{100(x-1)}{t} = R = \frac{100(2-1)}{16} = 6\frac{1}{4}\%$$

short

(Q) The rate of SI of a bank increased from 3.5% to 5%. and time duration is also increased from 2.5 years to 3.5 years the total SI ↑ by 135 rupees. find initial SI.

Z	F
R	$3.5\% \quad 5\%, 2$
T	$\frac{2.5}{1} \quad \frac{3.5}{2}$
$\rightarrow 1 = 135$	

\therefore Initial interest = 135

With a given rate of SI the ratio of principal : Amount $4:5$

After 2.5 with same 'R'

$$P:A = (4:5) \times 5 \quad P:A = 5:7, \quad R=?$$

$$P:A = (5:7) \times 4 = \frac{20}{20} \quad \frac{25}{24}$$

$$3 \rightarrow 2.5 \text{ year} \quad R = \frac{3 \times 100}{20 \times 2.5}$$

$$1 \text{ year} \quad \frac{30}{2.5} = 6 \quad = 6\%$$

Q) Rajeev Borrowed some money @ 6% per annum for first three years
 9% per annum for next 5 years and 13% per annum for beyond 8 years.
 If he gave interest ₹140, amount borrowed by him for 11 years

R	T	RT%
6%	8	18%
9%	5	45%
13%	3	39%
		52 = 102%

$$102\% \text{ of } ₹140 \\ 1\% = ₹10 \\ \text{Amount} = ₹10 \times 100 = 100\%$$

5) A man invested rupees ₹500 @ 12% per annum and rupees ₹3000 @ 15% per annum for one year find total rate percent

Trick :- $P \rightarrow \frac{5}{500} + \frac{2}{3000} = \frac{7}{10500}$

$$\frac{12\%}{60\%} + \frac{15\%}{30\%} = \frac{R\%}{R\% \cdot 7}$$

$$R\% = \frac{90\%}{7} = 12\frac{6}{7}\%$$

Q) A man invested rupees ₹18000 in three parts in the ratio of 2:3:4 first part @ 6% per annum, second part at 8% per annum. Find "R%" of third part if man get 12% total rate.

$$12\% + 8\% + 4x\% = 108\%$$

36

$$4x\% = 18\%$$

Revision

Q9) Rs 26000, is invested in two parts in such a way that SI from first part @ 10% per annum for 5 years is equal to SI on second part the rate 9% per annum for 6 years. Find both parts.

$$P_1 : P_2 = \frac{1}{r_1 t_1} : \frac{1}{r_2 t_2} : \frac{1}{r_3 t_3} \quad \text{If interest is same}$$

$$\frac{P_1}{P_2} = 1 \quad P_1 : P_2 = \frac{1}{50} : \frac{1}{54} = 54 : 50$$

$$P_1 : P_2 = 54 : 50 \\ P_1 : P_2 = 27 : 25$$

If amount is same

$$P_1 : P_2 = \frac{1}{100+r_1 t_1} : \frac{1}{100+r_2 t_2}$$

Q10) Rupees 18750 is invested by man in the bank account of his two sons whose age are 12 years and 14 year respectively. In such a way that they will get equal amount at 18 years @ 5% per annum find share of younger child.

$$P_1 : P_2 = \frac{1}{130} : \frac{1}{120} \quad \text{Younger}$$

$$\frac{P_1}{P_2} = \frac{12}{13}$$

$$25 = \frac{18750}{3750}$$

$$1 = \frac{18750 \times 18}{25} = 3 \times 4 \times 4 \quad \textcircled{3}$$

$$P_1 = \frac{18750 \times 12}{25}$$

Q11) A person who pays income Tax @ 20% per rupee, finds that a fall of Rate of interest from 5% to 4.75%. Diminished net yearly income by 40 find his gross income

$$5\% \rightarrow 4.75\% = 0.25\% = 40 \rightarrow \text{Net Income}$$

$$100\% = 16000$$

$$80\% = 16000$$

$$100\% = 20000$$

$$20\% \rightarrow \text{Tax + Income}$$

(12) A person invested certain money in the bank @ 6% per annum S.I. at the end of second year. He withdraws Rupees 1600, bank gives 12.5%. On remaining amount at the end of 3rd year Total amount is 4500. Find Total Interest given by bank:

1st year and year.

$$6\% + 6\% = 12\% = \frac{12}{100} = \frac{3}{25}$$

P : A		P : A
25 : 28	- 1600	8 : 9
↓	↓	↓
5000	5600	4000
Interest = 600 + 500		

$$= 1100.$$

new

(13) A person deposited a certain sum of money at the starting of the year, if Bank gives 8% S.I., At the end of third year total amount will be Rupees 69600 find how much did he invested each year.

1st 2nd 3rd

$$I \rightarrow 100 + 8 + 8 + 8 = 124$$

$$II = 100 + 8 + 8 = 116$$

$$III = 100 + 8 = 108$$

$$348 \rightarrow 69600$$

$$I \rightarrow 200$$

$$\rightarrow 100 \times 1 = 200 \times 100$$

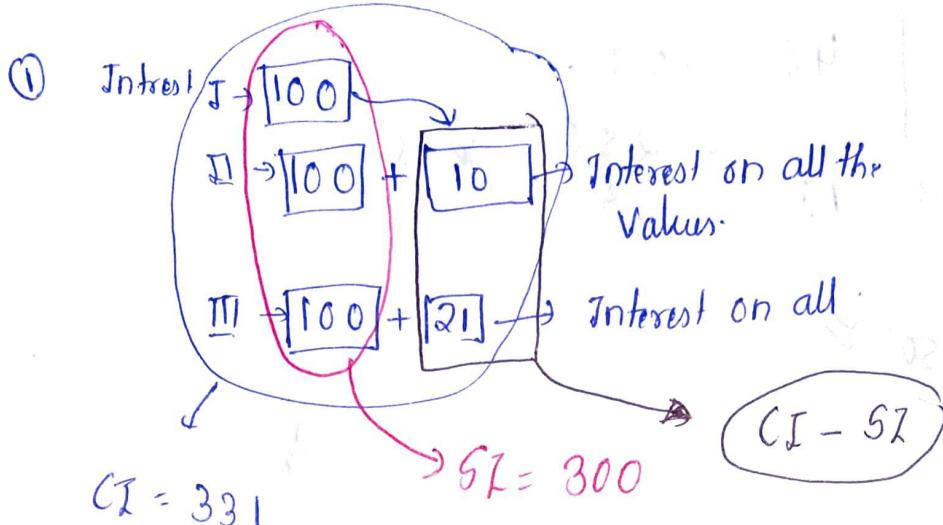
$$= 20,000$$

Compound Interest Interest

Q) $P = 1000$
 $R = 10\%$
 $T = 3 \text{ years} / 1 \text{ year} / 2 \text{ years}$.
 $CI = ?$

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

Block diagram & Ratio method



Ratio Method

$$10\% = \frac{1}{10}$$

Amount = 11
 Principal = 10

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

$$I \rightarrow 10 : 11 \rightarrow 1^{\text{st}} \text{ year}$$

$$I \rightarrow 10 : 11 \rightarrow 2^{\text{nd}} \text{ year}$$

$$\begin{array}{rcl} 10 & & 100 \rightarrow 1000 \\ \downarrow & & \downarrow \\ 10 & \rightarrow & 10 \\ & & 1 \rightarrow 10 \\ & & 21 \rightarrow \underline{\text{Interest } 21 \rightarrow 210} \end{array}$$

Half Yearly / Quarterly.

Rate will $R/2, 2T$

$R/4, 4T$

Principal 8375

Rate :- $6\frac{2}{3}\%$

Time = 2 years 4 months

C.I. = ?

Method used is simple direct

Block

$$I \rightarrow 225$$

$$II \rightarrow 225 \quad 15$$

$$III \rightarrow \underbrace{(225 \quad 15 \quad 15 \quad 1)}_{31} \quad \Rightarrow \quad \frac{286}{3} = 98.6$$

$$\therefore \begin{array}{r} 465 \\ 1.85 \\ \hline 550 \end{array}$$

$$(550) \approx$$

$$465 \rightarrow 2 \text{ years}$$

time in fraction

(Q3) CI = 6.80, Rate = 12.5% Time = 2 years. P = ?

P : A

$$I^{\text{st}} - 8 : 9$$

$$2^{\text{nd}} - 8 : 9$$

$$\overline{64 : 81}$$

$\times 17$

$$\rightarrow 6.80$$

$$\rightarrow 0.4$$

$$\therefore 64 \times 0.4$$

$$(25.6)$$

(Q4) C.I. on 2nd year = 702 Rate $11\frac{1}{9}\%$, t = 2 years, P = ?, A = ?

P : A

$$9 : 10$$

$$9 : 10$$

$$\overline{81 : 100}$$

$$P = 81, A = 100$$

$$15t = \frac{1}{9}$$

$$2^n = 9 + 1 = 10 = 9 \times 1$$

$$\therefore P = 567$$

$$A = 700$$

$$Q) CI - SI = 2.70$$

$$\text{Rate} = 15\%$$

$$\text{Time} = 2 \text{ years}$$

$$P = ?$$

$$15\% = \frac{3}{20}$$

P : A
20 : 23
20 : 23
400 : 529

$$I \rightarrow 60$$

$$I \rightarrow 60 \cdot (9) \xrightarrow[1 \rightarrow 0.3]{2.70}$$

$$\therefore 400 \times 0.3 = 120.$$

~~$$Q) CI - SI = 540$$~~

$$\text{Rate for 1st year} = 14\frac{2}{9}\%$$

$$\text{2nd year} = 11\frac{1}{9}\% \quad P = ?$$

$$\text{3rd year} = 10\%$$

$$I = \frac{1}{7} : \frac{1}{9} : \frac{1}{10}$$

$$P : A$$

$$F : 8$$

$$9 : 10$$

$$10 : 11$$

$$\underline{630 : 880}$$

$$630$$

$$1\text{st} = 90$$

$$2\text{nd} = 70, 10$$

$$3\text{rd} = 63, 9, 7, 1$$

$$27 \rightarrow 540$$

$$1 \rightarrow 20$$

$$\therefore 630 \times 20$$

$$12600$$

Q) If a certain sum of money becomes $\frac{16}{15}$ times itself in 2 years
find R%, CI.

$$P : A$$

$$16 : 25$$

$$2 \text{ years}$$

Interest

$$P : A$$

$$16 : 25$$

reduced form

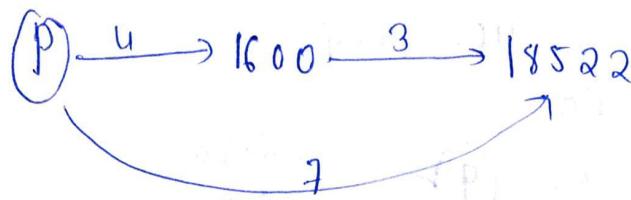
$$\sqrt{16} : \sqrt{25}$$

$$4 : 5$$

$$\left(\frac{1}{4}\right) \rightarrow 25\%$$

$$(I - SI) = P \left(\frac{R}{100} \right)^2$$

(Q) If certain amount becomes Rs 16000 in 4 years and it becomes Rs 18522 in 7 years find Rate =?



P : A

$$16000 : 18522$$

$$\sqrt[3]{8000} = \sqrt[3]{9261}$$

$$20:21 \Rightarrow 5\%$$

Revision

(Q) A money lender borrows money @ 5% per annum and pays interest at the end of the year. He lends it at 8% per annum compound half yearly and receives interest at the end of the year, he gains 158 a year amount of money he borrows.

~~$R_1 \rightarrow 5\%$~~

~~$R_2 \rightarrow 8\% \text{ per annum}$~~

~~$R_2 \rightarrow 9\% \text{ after compounding}$~~

~~$\therefore 4\% = 158$~~

~~$\therefore 100\% = 3700$~~

~~$R_2 \rightarrow 4\% \text{ 2 year} \Rightarrow$~~

~~$R_2 \rightarrow 8.16\%$~~

~~$3.16\% = 518$~~

~~$(100\% = \frac{518 \times 100}{3.16} = 5000)$~~

Half Yearly

$$\rightarrow R_{1/2}$$

$$\rightarrow 27$$

~~$\therefore 1st \text{ year} = 4\%$~~

$$2nd = 4\% \cdot 1\%$$

~~$R = 9\%$~~

$$1st \quad 4\%$$

$$2nd \quad \frac{4\% \cdot 0.16\%}{}$$

$$\therefore 8.16\%$$

11) Rupees 3903 is invested in two parts @ 4% compounded annually for 7 years and 9 years if amount received is equal find both investment

$$\text{H.L.} = \frac{1}{28} \quad (25)^2 : (26)^2$$

$$9-7+ = (2) \quad 625 : 676 \quad \therefore \quad 2028 : 1875$$

$$436$$

$$24$$

$$676$$

will reach target soon.

Q) A man wants to invest Rs 6100 in the bank account of his two sons whose ages are 12 years & 14 years in such a way that they will get equal amount at age of 18 at the rate of 20%. Find share of younger

$$5 : 6$$

$$25 : 36$$

$$(12 \text{ yrs}) \quad (14 \text{ yrs})$$

$$(2500) =$$

⑩) A sum of money doubles itself in 5 years how many years to become 8 times.

$$N_2 = N_1 \cdot T_2 / T_1$$

$$2 \rightarrow 15$$

$$8 \rightarrow 23$$

(45 years)

Multiply

$$2 \rightarrow 15$$

$$4 \rightarrow 15 + 15 = 30$$

$$8 \rightarrow 30 + 15 = 45$$

Add

A Rupees 1600 becomes rupees 2400 at a certain rate of interest compounded annually in 3 years find the amount after 9 years.

P: A

2 : 3

2 : 3

2 : 3

8 : 27

$$\frac{3}{2} \longrightarrow 3 \text{ year}$$

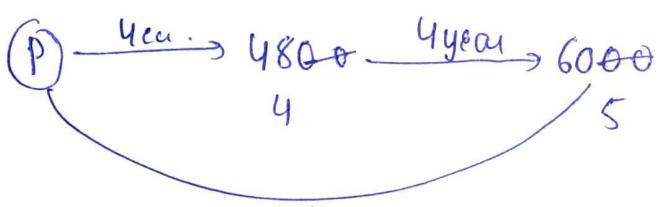
$$\frac{9}{4} \longrightarrow 6 \text{ year}$$

$$\frac{27}{8} \longrightarrow 9 \text{ year}$$

$$\therefore 8 \rightarrow 1600 \\ 200$$

$$\therefore 27 \rightarrow 27 \times 200 = 5400$$

(3) If a certain sum of money amounts to 4800 in 4 years and 6000 in 8 years. find principal.



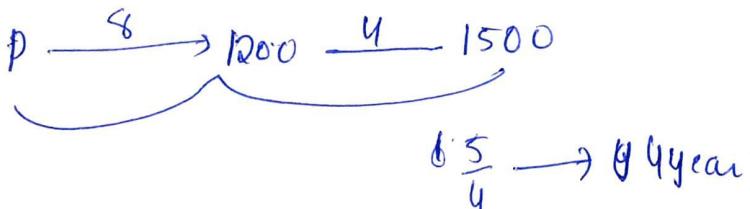
4 : 5 \rightarrow 4 years

$$\left(\frac{5}{4}\right) \longrightarrow 4 \text{ year.}$$

$$\therefore P \times \frac{5}{4} = 4800$$

$$\boxed{P = 3840}$$

(1) If certain sum of money amounts to Rupees 1200 in 8 years and Rupees 1500 in 12 years. Find principal.



$$P \times \frac{25}{16} = 1200 = 768$$

(Q5) If certain sum of money amounts to 8000 in 2 years and 27000 in 5 years at certain rate, find principal.

$$P \xrightarrow{2} 8000 \xrightarrow{3 \text{ year}} 27000$$

$$\frac{27}{8} \longrightarrow 3 \text{ year}$$

$$P \times \frac{9}{4} = 8000$$

In general

$$\frac{3}{2} \rightarrow 1 \text{ year.}$$

$$\frac{9}{4} \longrightarrow 2 \text{ year.}$$

$$\frac{9}{4} \rightarrow 2 \text{ year}$$

$$\frac{3}{2} \longrightarrow 1 \text{ year.}$$

$$\boxed{P = \left(\frac{32000}{9} \right)}$$

$$\frac{27}{8} \rightarrow 3 \text{ year.}$$

$$\frac{81}{16} \rightarrow 4 \text{ year.}$$

(Q6) Rs 3200 becomes 4000 at certain Rate in 1.5 years
then how many years Rs 12800 become 25000 at some Rate %.

$$3200 \xrightarrow{(1.5)} 4000$$

4

5

$$\frac{5}{4} \longrightarrow 1.5$$

$$\frac{25}{16} \longrightarrow 3 \text{ ye.}$$

$$\frac{125}{64} \longrightarrow 4.5 \text{ year.}$$

$$128 \longrightarrow 250$$

$$64 \longrightarrow 125$$

$$\frac{125}{64} = ?$$

$$\begin{array}{c} 4000 \xrightarrow{3.5} 5000 \\ (5)^2 \times \frac{5}{4} \times 5 \xrightarrow{1.5} 12500 \end{array}$$

77) Rs 2700 becomes Rs 4800 at a certain Rate of interest compounded annually in 3 years find amount at the end of 4.5 years.

$$\frac{16}{9} \rightarrow 3$$

$$\frac{4^2}{3^2} \rightarrow 1.5 + 1.5$$

$$\frac{4^3}{3^3} \rightarrow 1.5 + 1.5 + 1.5$$

$$\therefore 27 \rightarrow 2700$$

$$64 \times 100$$

$$= 6400$$

Topic 7

Q8) Difference b/w S.I and CI Rs 40 in 2 years but difference b/w SI and CI is 125 in 3 years. find principal



$$40$$

$$320$$

$$320$$

$$40$$

$$40$$

$$40$$

$$5$$

$\rightarrow 52$ directly we can calculate.

$$320 \times 8 = 2560 \text{ Ans}$$

$$12\frac{1}{2}\%$$

$$\left(\frac{1}{8}\right)$$

$$\frac{5}{40} = \left(\frac{1}{8}\right) 12.5\%$$

Q9) Simple interest on certain sum of money is Rs 100 in 2.5 years at a certain rate of interest but the compound interest on the same sum of money at same rate interest is $85\frac{7}{8}$ for two years find principal.

$$\begin{array}{l} \text{1 year} \rightarrow 40 \quad \therefore 57 \quad 40 \\ \qquad \qquad \qquad 57 \quad 40 \\ \qquad \qquad \qquad 52 \quad 20 \end{array}$$

$$\begin{array}{l} \text{CI} \rightarrow 40 \xrightarrow{\times 8} 320 \text{ Ans.} \\ \qquad \qquad \qquad 40 \xrightarrow{\times 4} 160 \\ \qquad \qquad \qquad 40 \qquad 5 \end{array}$$

The difference in C and S₂ of 2 years is ₹ 35, but in 3rd year ₹ 77. Find simple interest for 205 years.

₹ 175

35

35

35

35

35

35

35

35

35

35

35

35

35

35

35

35

35

35

35

35

35

35

35

35

35

35

35

∴ 1 year → ₹ 175

2.5 years → $\frac{4}{5} \times 175$

= ₹ 140

year

2^{n-1}

year

Average

Avg & sum

$$\text{avg} \propto \frac{1}{\text{no of terms}}$$

Q 1 2 ③ 4 5
↓ always avg.

case 1:- if 1 is removed

$$\text{avg} = 3.5$$

case 2:- if 5 is removed

$$\text{avg} = 2.5$$

(Concept)

If smaller than avg no is removed avg is increased

If greater than avg no is removed avg is decreased

Q) The avg of 15 numbers is 45. The avg of first 8 no is 40, and avg of last 8 numbers is $\frac{25}{20}$ more than the first 8 no. What is 8th no?

$$\begin{matrix} 15 \rightarrow 45 \\ \underbrace{8}_{40} \quad \underbrace{8}_{50} \end{matrix} \Rightarrow 40 < 45 \text{ by } -5$$

$$-5 \times 8 = -40$$

$$50 > 45 \text{ by } +5 \quad \left. \begin{array}{l} -40 + 40 = 0 \\ 5 \times 8 = +40 \end{array} \right\} \text{Means } 45 \text{ is avg.}$$

$$5 \times 8 = +40$$

Q) In a class of 40 students 60% are girls. The avg of girls marks is 72 and that of boys is 54. What is avg of whole class.

$$\begin{matrix} 2 \\ B \\ 72 \end{matrix} \quad \begin{matrix} 3 \\ G \\ 54 \end{matrix}$$

$$x = 324$$

$$5$$

$$x: 64.8$$

$$\begin{matrix} 40 \\ 72 \\ (x) \\ 54 \end{matrix} \quad \begin{matrix} 60 \\ x \\ 54 \end{matrix} \quad \begin{matrix} 6x = 40 \\ x = 72 \end{matrix}$$

$$\begin{matrix} 3 : 2 \\ B : G \\ 72 : 54 \end{matrix} \quad \begin{matrix} 72 - x = 3(54) \\ 2 \\ 2 \\ 72 - x = 3(54) \end{matrix} \quad \begin{matrix} \frac{72 - x}{2} = \frac{3(54)}{3} \\ 72 - x = 2x - 108 \\ 54 = 216 + 108 \end{matrix}$$

Boats and Streams

Down stream : upstream

$x \rightarrow$ speed of boat in still water,

$y \rightarrow$ speed of stream,

$$x+y \quad \text{Down stream} \quad | \quad x-y \quad \text{upstream} \quad x > y$$

$$x = \frac{D+U}{T}, \quad y = \frac{D-U}{T}$$

$$x:y = D+U:D-U$$

$$D:U = (x+y):(x-y)$$

(Q) Ram goes downstream with boat to some destination and returns to original place in 6 hrs if the speed of boat in still water and stream 12 km/hr & 5 km/hr then find distance of destination from origin.

$$6 = \frac{d}{17} + \frac{d}{7}$$

$$d = \frac{8 \times 119}{244} = 29.7$$

→ always predict by options.

(Q) A boat travels downstream for 14 km and upstream for 9 km if the boat took total 5 hr for journey what is stream speed if boat speed is 5 km/hr

$$\frac{14}{5+x} + \frac{9}{5-x} = 5 \Rightarrow 70 - 14x + 45 + 9x = 5(25 - x^2)$$

$$115 - 5x = 125 - 5x^2$$

$$8x^2 - 5x - 10 = 0$$

- A) 8 km/hr B) 5 km/hr C) 6 km/hr D) 4 km/hr

A boat goes 6km in still water, it takes 9 times as much time in going the same distance against the current compared to with the flow of stream.

$$\begin{array}{ll}
 \text{Time ratio} & D:U \\
 & 1:3 \\
 & \leftarrow D:U \rightarrow \text{Speed ratio} \\
 & 3:1 \\
 & \leftarrow D:x \rightarrow 6 \text{ km/hr} \\
 & y:x \\
 & 3 \text{ km/hr} \quad 3
 \end{array}$$

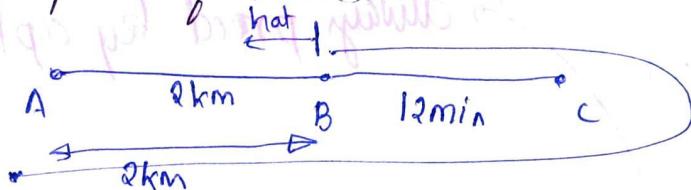
There are two places separated by 100km both the boats starts at same time towards each other one boat is going downstream and another going upstream, speed of A & B are 12km/hr, 13km/hr find the time after they meet.

$$\frac{100}{2x} = 4 \text{ hr} - \quad \begin{array}{c} \rightarrow \\ 2x \\ 12+x \\ 13-x \end{array}$$

Stream speed is cancelled.

$$\frac{100}{12+y+13-y}$$

A girl was travelling in a boat suddenly wind start blowing and blows her hat and started floating back down stream. She caught her hat as soon as she reached the starting point. If her hat flew off exactly 2km from where she started what is speed of water?



time taken by hat to reach offshore is equal to 12min + time taken by boat to go from C to A.

$$\therefore BC = 12(x-y)$$

$$CA = t(x+y)$$

$$AB = (12+t)(y)$$

$$AB + BC = CA$$

$$12y + ty + 12x - 12y = tx + ty$$

$$t = 12.$$

$$\therefore \text{speed of hat} = \text{speed of water} = \frac{2}{\frac{24}{60}} \text{ kmph}$$

Trick \rightarrow speed of boat = $\frac{2 \text{ km}}{2 \times (\text{time})}$ $\Rightarrow \frac{2 \text{ km}}{\frac{2 \times 24}{60} \text{ hr}} = 5 \text{ km/hr}$

A ship sails 30km of river towards upstream in 6hr, how long will it take to cover the same distance downstream. If the speed of the current is $\frac{1}{4}$ of speed of the boat in still water.

$$U = 5 \text{ km/hr}$$

$$\frac{1}{4} = \frac{D-U}{D+U} \Rightarrow D+U = 4D-2U \\ D+8 = 4D-20 \Rightarrow 3D = 28 =$$

$$\therefore t = \frac{30 \times 3}{5 \times 8} = \left(\frac{18}{5}\right) = 3.6 \text{ hr.}$$

$\frac{D}{U} = \frac{x+y}{x-y}$ $= \frac{5}{3} \Rightarrow \text{time ratio} = \frac{3}{5} \rightarrow 6 \text{ hr}$

$$\therefore \frac{6 \times 3}{5} = \frac{18}{5} = 3.6 \text{ hr.}$$

A man can row 6km/hr in still water if the speed of current is 2kmph. It takes 4hr more to in upstream than in downstream for the same distance find distance.

$$\begin{array}{l} x:y \Rightarrow D:U \text{ time } 1:2 \\ 6:2 \\ 3:1 \end{array} \quad \begin{array}{l} 4:2 \\ 2:1 \end{array} \quad \begin{array}{l} 1:4 \\ 1 \rightarrow 4 \\ \downarrow U \text{ km} \end{array} \quad \begin{array}{l} \therefore \text{distance} = 4 \times 2 \\ = 1 \times 2 \times \end{array}$$

distance = 32 kmph

The speed of motor boat is that of current of water is 36:5
the boat goes along with current 5hr 10min How much time.
will it take to come back.

$$\text{time} \rightarrow 41:31 \rightarrow \frac{31}{6}$$

$$\left(\frac{41}{6}\right) \rightarrow \text{required time}$$

In a fixed time a boy swims double the distance along the current than he swims against the current if the speed of current is 3kmph then what is speed of boy in still water.

time fixed

distance $2 : 1$

speed $2 : 1 \Rightarrow D : U$

$$x:y = 3:1$$

Ams. 9kmph

$\frac{3}{2} \text{ kmph}$

A man can row 40 kmph in still water and the river is running at 10kmph if the man takes 2hr to row to a place and back how far is the place.

Speed $\rightarrow 5 : 3$

Time $\rightarrow 3 : 5$ $8 = 2\text{hr}$

$$1 = ?$$

$$\therefore \frac{3}{4} \times 80 = [3 \times 12.5 = 87.5]$$

per 3

A boat takes 26 hrs for travelling down stream from point A to point B and coming back to point 'C' mid way b/w 'A' & 'B' if speed of the stream is 4kmph, if speed of boat = 10kmph. distance b/w 'A' and 'B'

Speed $14 : 6$
Time $7 : 3$
 $\sqrt{3 : 7}$
 12hr

$$3+9.5 = 66.5 = 260 \\ 8 = 26 \text{ hr} \\ = 12\text{hr} \times 14 \\ = \underline{\underline{168\text{km}}}$$

A boat covers 24 km upstream and 36 km downstream in 6 hrs.
 It covers 36 km upstream and 24 km downstream in 6.5 hrs.

$$\frac{24}{x-y} + \frac{36}{x+y} = 6$$

(hit and trial method)

$$\frac{36}{x-y} + \frac{24}{x+y} = 6.5$$

$$x-y = \frac{2x}{4} \rightarrow x+y = 18$$

$$6 \rightarrow 4+2=6$$

$$\therefore x-y = 8 \\ x+y = 12 \quad \text{F}$$

$$x = 10$$

$$x = 18$$

$$\begin{array}{r} 8 \\ - 2 \\ \hline 6 \end{array} \quad \begin{array}{r} 12 \\ - 10 \\ \hline 2 \end{array} \quad \text{Boat satisfies} \quad \begin{array}{r} 6+ \\ 3+3=6 \\ \hline 6 \end{array}$$

$$\begin{array}{r} 8 \\ - 12 \\ \hline - \end{array}$$

$$x-y = 8, x+y = 12$$

$$\frac{36}{8} + \frac{18}{12} = 4.5 + 2 = 6.5$$

P, O, R are three towns on river which flows uniformly. O is equidistant from P & R. A rows P to O and back in 10 hrs, he can row 'P to O' in 4 hr, ratio of speed of man in still water to speed of current:

$$D : U = 4 : 1$$

$$x : y = 5 : 3$$

D7 Avges

Q) The avg age of eleven player is 27 years if two more players are included the avg becomes 26 years then avg age of players is.

$$+2 \left(\begin{array}{l} 11 \rightarrow 27 \\ 13 \rightarrow 26 \end{array} \right) -1$$

if avg need to consider then addint a sub needs to be / (no)

$$\therefore \Sigma 2 = 54 \rightarrow \text{should be}$$

$$27 - \frac{13}{2}$$

$$\Sigma 2 = \frac{-13}{41} \rightarrow$$

$$\boxed{\frac{41}{2} = 20.5}$$

XX

The avg marks of 20 students in a test is 75 later it was found that three marks 53, 60, 76 were wrongly entered as 93, 64, 86, the avg marks after mistakes were rectified. is

$$20 \text{ students} = 75$$

$$53 \rightarrow 93 \rightarrow 40$$

$$60 \rightarrow 64 \rightarrow 4$$

$$76 \rightarrow 86 \rightarrow 10$$

$$\frac{54}{20} = (20.7) \rightarrow \text{avg was } \uparrow$$

$$\therefore \text{original avg} = 72.3.$$

The avg of 7 numbers is 30 the avg of first '3' is 23 last three 42, then 4th no is

$$30 + \frac{21 - 36}{(1)} = \frac{15}{3} \rightarrow (30)$$

only one member def $\frac{23}{r_2} \rightarrow 7 \times 3 = -21$ $\rightarrow 12 \times 3 = 36 \rightarrow 4.15 \rightarrow$ avg will be less by 15.

$\rightarrow 15 \rightarrow$

In a showroom the avg price of bike is 60,000, avg price of scooter is 55000, the total avg price of 2 wheeler is 58000 no of scooter in showroom is 20 find total two wheelers.

$$\begin{array}{r}
 13 \\
 60 \\
 \hline
 58
 \end{array}$$

$$\begin{array}{r}
 3 \\
 \xrightarrow{30} \\
 \hline
 2 \rightarrow 00 \\
 \xrightarrow{50=}
 \end{array}$$

The avg marks obtain by group of 25 students was '29', one student left the group average rose to 29.5, one student added avg fall to 28.8 what is avg of 2 student who left and joined.

$$\begin{array}{r}
 25 \rightarrow 29 \\
 24 \rightarrow 29.5 \\
 \hline
 \end{array}$$

$$\begin{array}{r}
 29 \\
 -12 \\
 \hline
 17
 \end{array}$$

$$\begin{array}{r}
 25 \rightarrow 28.8 \\
 \xrightarrow{\cancel{28.8}} 29.5 \\
 \hline
 17.5
 \end{array}$$

$$0.7 \times 25$$

$$\therefore \frac{17+12}{2} = \frac{29}{2} = \underline{\underline{14.5}} \quad \frac{12.0}{}$$

Profit and Loss (Dishonest Shopkeeper)

A dishonest shopkeeper makes cheating of 10% at the time of selling and as well as buying. find overall profit or loss.

$$\begin{array}{r}
 \text{CP} & \text{SP} \\
 10 & 11 \\
 \cancel{10} & 10 \\
 \hline
 9 & 11
 \end{array}
 \quad \left(\frac{2}{9} \right) = \boxed{22\frac{2}{9}\%}$$

A dishonest shopkeeper makes cheating of 25% at the time of buying. 37.5% at the time of selling. He promises to sell the goods at 15% loss. find overall profit.

$$\begin{array}{r}
 \frac{1}{4} 25\% \rightarrow \\
 \cancel{10} \quad \cancel{15} \\
 \cancel{8} \quad \cancel{12} \\
 \cancel{5} \quad \cancel{10} \\
 \hline
 45.136
 \end{array}
 \quad
 \begin{array}{r}
 \text{CP} & \text{SP} \\
 4 & 8 \\
 8 & 8 \\
 \hline
 10 & 17
 \end{array}
 \quad
 \frac{7}{10} \times 100 = 70\%$$

Q) A dishonest shopkeeper marked the price of 1kg 50% above its CP. while buying he got 1250 instead of 1kg. while selling he uses false weight and gave 1176 instead of 1000gm. and also allows 20% discount. find profit or loss

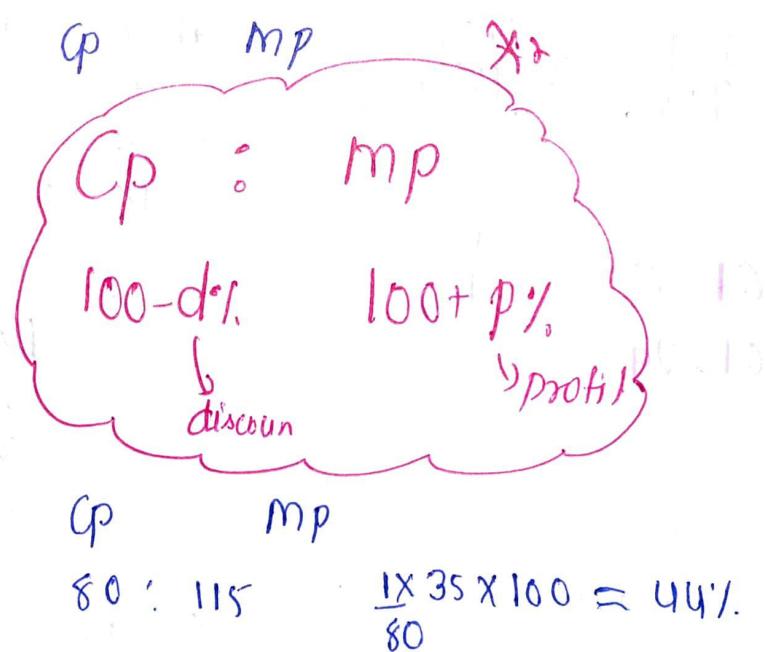
$$\begin{array}{r}
 \text{CP} & \text{SP} \\
 \cancel{2} & \cancel{3} \\
 \cancel{1000} & \cancel{1250} \\
 \hline
 1176 & 1000
 \end{array}
 \quad
 \begin{array}{r}
 250 \\
 \hline
 5 \quad 4
 \end{array}
 \quad
 \begin{array}{l}
 \frac{108}{392} \times 100 \\
 = 27.5\% \text{ profit}
 \end{array}$$

A dishonest shopkeeper defrauds his customer in two ways by measuring weight incorrectly and by mixing impurities. He sells his goods at 'CP' he use weight which is 80% of original weight also added 20% impurities find profit.

$$\begin{array}{r}
 \text{CP} \quad \text{SP} \\
 16 \quad 80 + 100\% \text{ CP} \\
 \hline
 4 \quad 8 \\
 \hline
 16 : 25
 \end{array}
 \quad \frac{1}{5} = \frac{1}{16} \times 100 = \frac{25}{16} = 55\%$$

Discount

How much percent above the cost price should a dealer mark his goods so that after allowing a discount of 20% on MP he gain 15%.



Mixture and allegation

(equate the sum)

$$\boxed{5:2}$$

$$\boxed{3:4}$$

$$\boxed{\begin{matrix} 6:4 \\ 3:2 \end{matrix}}$$

$$\boxed{7:3}$$

$$\frac{3}{5} + \frac{7}{5}$$

$$\frac{(5+3) \cdot 2}{7+7} = \frac{8}{14} = \frac{4}{7}$$

$$\boxed{13:7}$$

→ If sum equal always add directly

If not equal add make them equal

inversely?

Three Container

$$\boxed{\begin{matrix} 18:12 \\ 9:6 \\ 3:2 \end{matrix}}$$

$$\boxed{21:9}$$

$$\boxed{7:3}$$

$$\boxed{\begin{matrix} 22:9 \\ 11:4 \end{matrix}}$$

$$\boxed{61:23}$$

$$61:29$$

$$\begin{array}{r} 10 \\ 30 \\ \hline 18:12 \\ 18:12 \\ \hline 0:0 \end{array}$$

$$\boxed{3:2}$$

$$\boxed{\begin{matrix} 42:18 \\ 21:9 \\ 7:3 \end{matrix}}$$

$$\boxed{\begin{matrix} 66:24 \\ 22:8 \\ 11:4 \end{matrix}}$$

$$\begin{array}{l} \text{split} \\ \text{1x3} : 2x3 : 3x2 \\ \hline \boxed{M:W= ?} \end{array}$$

$$126:54$$

$$63:27$$

$$21:9$$

$$21:9$$

$$\boxed{M:W}$$

$$\boxed{7:5}$$

$$\boxed{4:11}$$

$$\begin{array}{l} 24 \\ 72 \\ \hline 96 \end{array}$$

$$72:48$$

$$105:75$$

$$16:44$$

$$193:167$$

$$5 \quad 12 \quad 15 \quad 60$$

$$\begin{array}{l} 2 \times 12 \\ | \\ 3 \times 5 \end{array}$$

$$\begin{array}{l} 1 \times 4 \\ | \end{array}$$

$$\begin{array}{l} 2 \times 12 \\ | \\ 72 \end{array}$$

In a chemistry lab two beaker A and B contains 62.5%, 87.5% of spirit respectively. If two liters of A and 4 liters of B, ratio of water and spirit in the mixture.

$5:3$

$7:1$

$$2 : 4 \\ 1 : 2$$

$$\begin{array}{r} 5:3 \\ 14:2 \\ \hline 19:5 \end{array}$$

There are three container having the same volume. These containers are full of mixture of milk and honey. % of milk is 20%, 25%, 40%. When mixture is mixed % of milk in fourth container.

$1:4$

$1:3$

$2:3$

$4:16$

$5:15$

$8:12$

$\underline{17:43}$

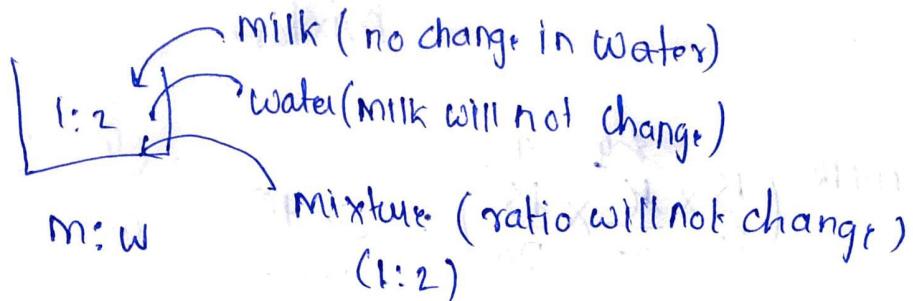
$$\frac{17}{43} \times 100 = \frac{85}{3} \approx 28\frac{1}{3}\%$$

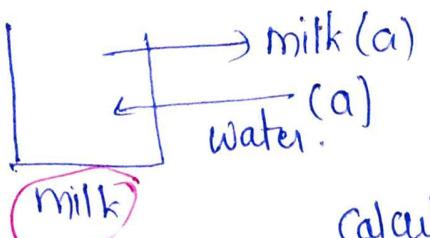
Replacement of Mixture

$10 - 14$



Pure milk





replace ke oppo

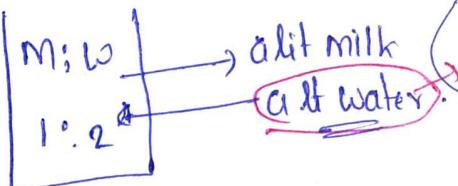
If milk is removed and water is added

calculate 'Conc' of "milk"

$$\text{Conc of milk} = \frac{(x-a)}{x} \cdot \frac{(x-b)}{x} \cdot \frac{(x-c)}{x} \dots$$

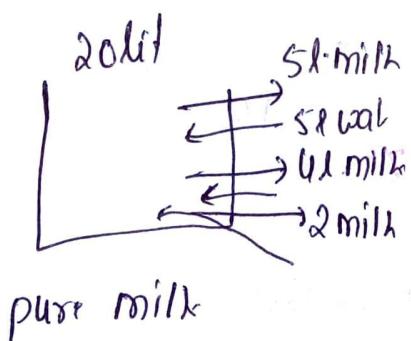
$$\left(\frac{m}{m+w}\right) = \frac{\text{Milk}}{\text{Total}} = \frac{\left(\frac{x-a}{x}\right) \left(\frac{x-b}{x}\right) \left(\frac{x-c}{x}\right)}{x}$$

If Replacement in mixture



Replace ke oppo

$$\text{Conc of milk} = \left[\frac{(x-a)}{x} \cdot \frac{(x-b)}{x} \cdot \frac{(x-c)}{x} \right] \times \text{Initial Conc of milk.}$$



mixture

$$\begin{aligned} \text{Conc of milk} &= \left(\frac{15}{20} \times \frac{16}{20} \times \frac{18}{20} \right) = \frac{540}{1000} \\ &= \frac{54}{100} \left(\frac{27}{50} \right) \\ &\quad \begin{array}{r} 36 \\ 15 \\ \hline 90 \\ 45 \\ \hline 540 \end{array} \end{aligned}$$

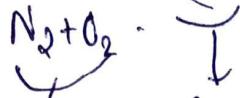
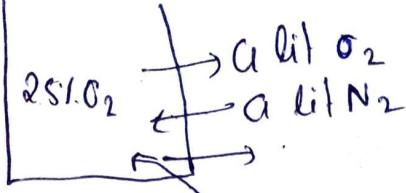
$$① M:w = 27:23$$

$$② \text{Quantity of milk} \rightarrow 27 \times \frac{2}{5}$$

$$③ \rightarrow 1L \text{ water} \rightarrow 23 \times \frac{2}{5}$$

$$④ \% \text{ of milk} = 44\%$$

$$⑤ \rightarrow 1L \text{ water} = 46\%$$



$O_2 \rightarrow 9\text{ l. after transaction}$

$$2\text{ liter } O_2 \quad a = ?$$

Initially 25% was already present.

$$\text{Conc of } O_2 = \left(\frac{20-a}{20} \right) \times \left(\frac{20-a}{20} \right)$$

~~$$\frac{9}{100} = \left(\frac{20-a}{20} \right)^2$$~~

~~$$20-a = 6$$~~

$$a = 14$$

~~$$\text{Conc of } O_2 = \left(\frac{5-a}{5} \right) \left(\frac{5-a}{5} \right) = \frac{9}{100}$$~~

~~$$5-a = \frac{3}{5}$$~~

~~$$a = 5 - \frac{3}{5} = \frac{12}{5}$$~~

Conc $O_2 = \text{Initial conc} \times () () ()$

$$\text{Conc } O_2 = \left(\frac{25}{100} \right) \left(\frac{25-a}{25} \right) \left(\frac{25-a}{25} \right) \Rightarrow \frac{O_2}{N_2 + O_2} = \frac{1}{4} \left(\frac{25-a}{25} \right)^2 = \frac{9}{100}$$

$$\frac{25-a}{25} = \frac{36}{100} = \frac{9}{25} = \frac{3}{5}$$

$$25-a = 15$$

$$a = 10$$

In a mixture the quantity of milk and water is in ratio 5:1

60% mixture taken out and same amount of milk added, now
milk is 80 liter find amount of mixture taken out.

$$\rightarrow M : W$$

$$5 : 1 \rightarrow 100\%$$

$$\downarrow \rightarrow 60\%$$

$$5 : 1 \rightarrow 40\%$$

$$\frac{5}{8} \times 40 + 60\% = 84$$

$$\frac{100\%}{3} + 60\% = 84 \text{ liter}$$

$$\frac{1}{3} + \frac{8}{5} = 84 \text{ liter}$$

$$\frac{14}{15}x = 84$$

$$x = 90$$

$$100\% = 90$$

60%
40%

$$\frac{90 \times 60}{100}$$

= 54 liter

In a 60 liter mixture of 'M+W' the ratio of $M+W = 15:1$
 When 24 lt mixture removed and 8 liter milk and 8 liter water
 added the difference in quantity of milk and water in final mixture.

$$15:1 \rightarrow 64$$



$$15:1 \rightarrow 40$$

$$16 \rightarrow 40$$

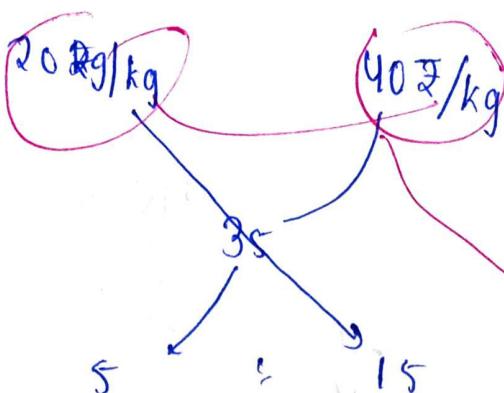
$$1 \text{ unit} = \frac{10}{16} \times 14 = 3.5 \text{ liter}$$

difference does not change by adding mixture.

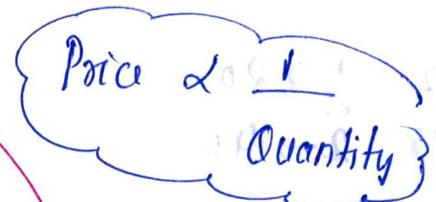
A jar of 84 lt juice, 18 liters of juice taken out and replaced with pure water, again 28 lt mixture taken out and replace by 20 liters.
 find the ratio of juice & water in final mixture.

$$\text{Juice} = \left(\frac{66}{84} \right) \left(\frac{56}{36} \right) \times 1 = \frac{11}{19} \quad 11 : 8$$

Alligation :-



price \rightarrow Ratio \rightarrow Quantity



ratio of quantities.

always this ratio belongs to inverse of these quantity.

$$\text{Price} \times \text{Quantity} = k \Rightarrow \text{Price} \propto \frac{1}{\text{Quantity}}$$

$$\text{Speed} \times \text{Time} = k \Rightarrow \text{Speed} \propto \frac{1}{\text{Time}}$$

$$5 \rightarrow \frac{90}{x} \quad \frac{90}{16} \rightarrow x = 16$$

The average age of 30 students is 18, 5 new students were admitted the avg decreased by 0.2 what is avg age of new student.

$$\begin{array}{rcl} 18 & & \\ \frac{1.4}{16.6 \text{ years}} & & \\ \hline 16.6 \text{ years} & & \end{array}$$

$$\begin{array}{rcl} 30 & & 18 \\ \hline 18.8 & & x \end{array}$$

$$17.8$$

$$\frac{17.8 - x}{6} : \frac{0.2}{1}$$

$$\begin{aligned} 17.8 - x &= 1.2 \\ \hline 16.6 &= x \end{aligned}$$

In a factory the avg age of men worker is 32 year, while that of woman is 28 year. women workers are twice the men workers. if new men worker of age 58 join factory avg age of men becomes 33 year. A women worker leaves the factory due to which their avg becomes 27. what is age of left women worker.

$$\begin{array}{l}
 \text{M} \rightarrow 32 \quad 1 \rightarrow 20 \\
 \text{W} \rightarrow 28 \quad 2 \rightarrow 40 \\
 \\
 \text{X} \quad 1 \\
 32 \quad 53 \\
 \\
 10 \xrightarrow{28} 27 \\
 24 \xrightarrow{32} x \\
 \text{pink group: } 20 \text{ (left) } 27-x \\
 \end{array}
 \qquad
 \begin{array}{l}
 \text{ALT} \\
 32 \rightarrow 33 \\
 1 \rightarrow 53 \\
 (x+1)(1) \\
 327 \\
 3(x+1)(1) \\
 33+x = \frac{53}{3} \\
 x = 67 \\
 x = 26
 \end{array}$$

In a class $83\frac{1}{3}\%$ of the number of students are girls and rest are boys. If 60% of the number of boys and 80% of girls are present then % student absent.

$$\begin{array}{l}
 \frac{5}{6} \quad \frac{1}{6} \\
 B \quad G \\
 1 : 5 \\
 60\% \quad 80\% \\
 x \\
 \\
 \frac{80-x}{1} = \frac{x-60}{5}
 \end{array}
 \qquad
 \begin{array}{l}
 400 - 5x = x - 60 \\
 460 = 6x \\
 \frac{230}{3} = x \\
 x = 76\frac{2}{3} \\
 \therefore \text{absent} \\
 25\frac{1}{3}.
 \end{array}$$

A man spends 72% of his income. If his income ↑ by 28%, and his expenditure ↑ 25%. then what %, ↑ or ↓ in savings.

Alligation on Income

$$\text{Income} = E + S$$

$$100 = \frac{72 + 28}{90 + 38}$$

$$100 = \frac{120}{128}$$

$$100 = \frac{15}{16}$$

$$100 = \frac{75}{88}$$

$$100 : 72 \quad 28 : 18 \rightarrow 72 - 196 = 54$$

$$100 : 18 \quad 28 : 7$$

$$125 : x \quad 35 : 7 \rightarrow x = \frac{250}{7}$$

$$\frac{x-28}{18} = \frac{3}{7}$$

$$x = 35 + 7\% \uparrow$$

Alligation of speed

Anuj covers a distance of 850km in 8.5 hr. distance is partially covered by Bus and partially by train. speed of train is 8 kmph more than double of bus. speed of bus is 30 kmph. find distance covered by bus.

B	T	
30×17	$68 \times 11 = 1156$	$\frac{350}{85} = \frac{700}{17}$
510		

$$\begin{array}{r} 136 \\ 102 \\ \hline 238 \\ 156 \\ \hline 456 \end{array}$$

$$\begin{array}{r} 24 \\ 176 \\ \hline 456 \\ 300 \\ \hline 156 \\ 102 \\ \hline 54 \\ 27 \\ \hline 18 \\ 12 \\ \hline 6 \end{array}$$

$$17 \rightarrow 0.5$$

$$1 \rightarrow 0.5$$

Ans

150km

$$12 : 5$$

Allegation on C.I S2

Ram give 1500, some amount he gave at 8% at S2, remaining at 10% per annum. after two years he got '268' as interest amount given at 8% and 10% are.

$$\begin{array}{l} \text{8%} \\ \text{10%} \\ \hline 1120 \quad 150 \end{array}$$

$$1120 : 150 \times 268 = 134$$

$$\begin{array}{l} 16 : 14 \\ 8 : 7 \end{array}$$

$$\boxed{800 : 700}$$

Amount to be paid

T

Time and work

10 Monkey \rightarrow 10 banana \rightarrow 10 day

5 M \rightarrow 5 b \rightarrow ?

$$\frac{M_1 D_1 H_1}{W_1} = \frac{M_2 D_2 H_2}{W_2}$$

No of person $\propto \frac{1}{\text{no of day}}$ $\star \star$

efficiency $\propto \frac{1}{\text{no of days}}$ $\star \star$

A \rightarrow 20 days

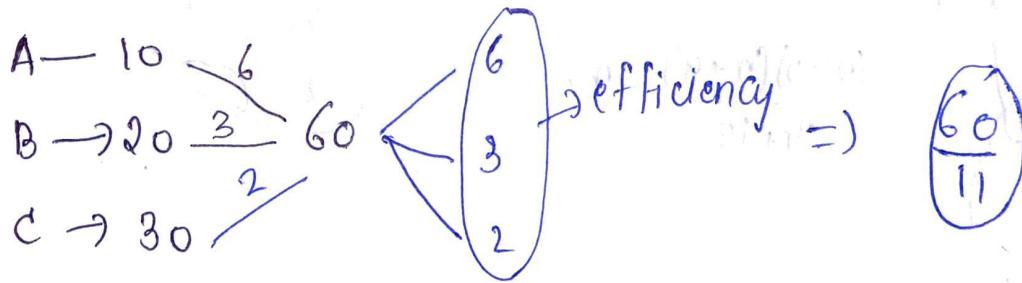
B \rightarrow 30 days

Time ratio \rightarrow efficiency

2 : 3

3 : 2

Time of completn $\propto \frac{1}{\text{efficiency}}$



A can finish a job in 20 days. B can finish work in 30. A & B worked for 5 days. Afterward C joins and all of them complete work in 2.5 days. C can finish work in?

$$\frac{20}{30} = \frac{60}{2}$$

$$5 \times 5 = 25 \rightarrow 60 - 25$$

$$\frac{25}{5+x} = \frac{30.5}{x} = \frac{10}{5+x}$$

$$x = 5$$

$$\frac{60}{8} = 12$$

$x-3$ men can paint a wall in x days, and $x-6$ men can do 50% of the same work in $(x-3)$ days. In how many days $(x+8)$ men will paint the wall.

$$\frac{(x-3)(x)6}{21} = \frac{(x-6)(x-3)}{12}$$

$$x^2 - 3x = (x^2 - 9x + 18)/2$$

$$x = 2x - 12$$

$$\boxed{x = 12}$$

$$\text{Total} = (12-3)(12) = 9 \times 12$$

$$\text{Total work} = 9x12 = 108$$

$$\therefore x+8 = 20 = \frac{108}{20} \frac{27}{5} \text{ days}$$

$(A+B)$, A and B can do piece of work in $x, (x+9), x+4$, A and B start work together. How many days they completed days.

$$A \rightarrow x+9$$

$$B \rightarrow x+4$$

$$(x+4)(x+9) = x$$

$$\frac{(x+4)(x+9)}{2x+13} = x$$

$$x^2 + 13x + 36 = 2x^2 + 13x$$

$$36 = x^2$$

$$\boxed{x=6}$$

$$x = \sqrt{9 \times 4}$$

$$= 6$$

25 men can complete work in 13 days one man start the work after every day. One more man joins the work and this continues till work is completed in how many days will work be completed

$$TW = 25 \times 13$$

$$1+2+3+4 \dots \dots n = 25 \times 13 = \frac{n(n+1)}{2} = 25 \times 13$$

~~n²~~: $n = 25, \left(\frac{n+1}{2}\right) = 26. n =$

A and B work on alternate day with 'A' starting the work

A does 12.5% of the total work on last day and finishes the work

If A alone can do the work in 6 days than B alone can do the work in.

Go by option

$$\begin{array}{ccc}
 & 6 & 4 \\
 & \swarrow 24 \quad \searrow 3 & \\
 8 & & 3 \\
 & 2 \text{ day} \rightarrow 7 & \\
 & \times 3 & \times 3 \\
 & 6 \rightarrow 21 & \\
 & & \frac{1}{8} \Rightarrow \frac{1 \times 3}{8 \times 3} = \frac{3}{24} \\
 & & \text{(3) remaining work} \\
 & & \text{done on last day.}
 \end{array}$$

A contractor employs 25 men to complete a job in 18 days, but finds half finished after 10 days how many minimum additional men will have to be engaged to complete job

$$\frac{25 \times 18}{25 \times 10} = \frac{x \times 8}{x \times 5} \quad ? \Rightarrow \frac{125}{4} = 31.25$$

$\therefore \approx 7$ people extra needed

$25 \times 18 =$
 rough . rough
 $25 \times 10 = x \times 5$
 $25 \times 10 =$

A contract a building a building in 30 days, he hires 30 men so that work completed on time but 5 men kept leaving after 10 days in how many days will be job completed.

$$1m \rightarrow 1 \text{ unit - 1 day} \quad 30 \times 30 = \frac{700}{900}$$

\therefore 40 days required for completing the work

$$\begin{array}{l}
 30 \times 10 = 300 \\
 25 \times 10 = 250 \\
 20 \times 10 = 200 \\
 15 \times 10 = 150 \\
 \hline
 & 900
 \end{array}$$

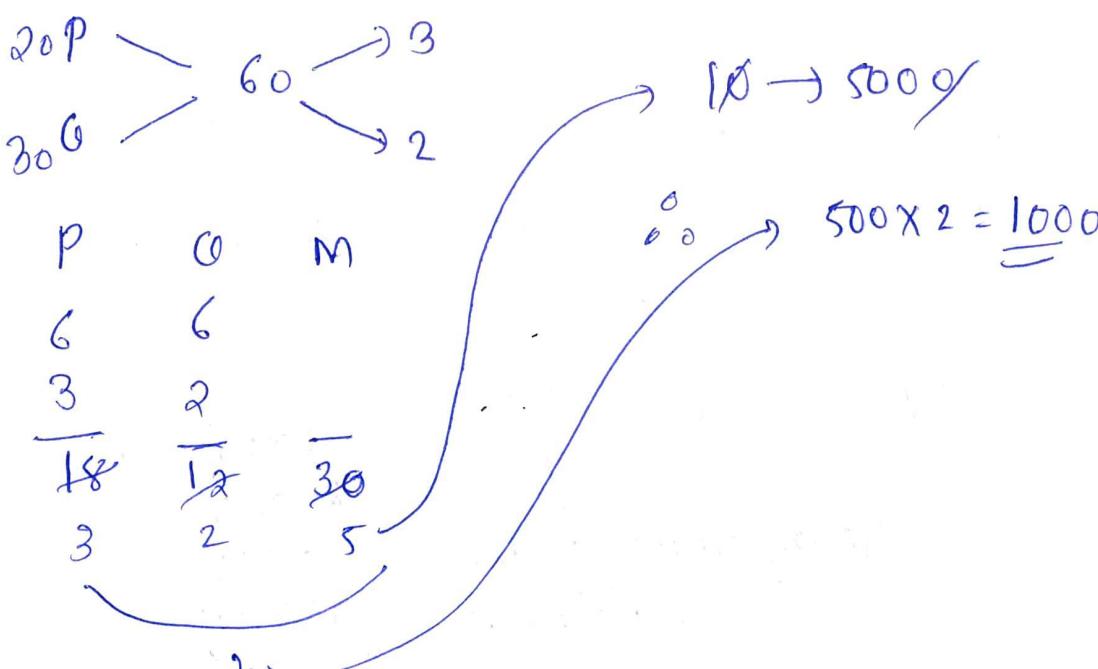
56 workers can construct a house completely in 24 days. Contractor has decided to complete construction in 24 days however due to cash shortage contractor relieved 8 workers after 6 days work is done. Now the remaining work have to be finished & by how much days will be the dead line missed

$$\begin{aligned} 56 \rightarrow 24 \\ 56 \times \cancel{6} \rightarrow \cancel{6} \\ 56 \rightarrow 18 \end{aligned} \quad \Rightarrow 56 \times 18 = 48 \times x \\ 7 \quad 6 \\ x = 21 \end{math>$$

Wages - Work

(Money will be distributed in Efficiency)

P and Q alone can complete a work in 20 days and 30 days. Together they worked for 6 days and remaining working completed by 'M'. Difference in the share of P & M, if they get 5000 for work.



A and B can do a work alone in 12 days and 8 days, they undertook the work to work together. but 'B' left after '2' days and remaining work completed by A & C in 3 days, if C gets ₹600 what is total cash received.

$$\begin{array}{r} A \ 12 \\ B \ 8 \end{array}$$

~~$\frac{24}{12+8}$~~

24 → 2
3 → 3

A	B	C
2	3	3
5	2	3
10	6	8
	5	3
		4

$\therefore 4 \rightarrow 600$
 $12 \rightarrow 150$

$150 \times 12 = 1800$

The work done by man and woman is in ratio 1:3 there are 40 men and 30 women, their weekly wages are ₹440. Which is divided in the same ratio of work done by men and women. Total wages of 10 men and 15 women weekly.

$$\begin{array}{l} M \quad W \\ \text{efficiency} \ 1 : 3 \\ 40 : 30 \\ \hline \end{array}$$

work

$40 : 90$ → 420

$18 \rightarrow 1440$

$1 \rightarrow 80$

$$\begin{array}{l} \therefore 40 \rightarrow 320 \\ \text{men} \ 1 \rightarrow 80 \\ \hline \end{array}$$

$90 \rightarrow 720$

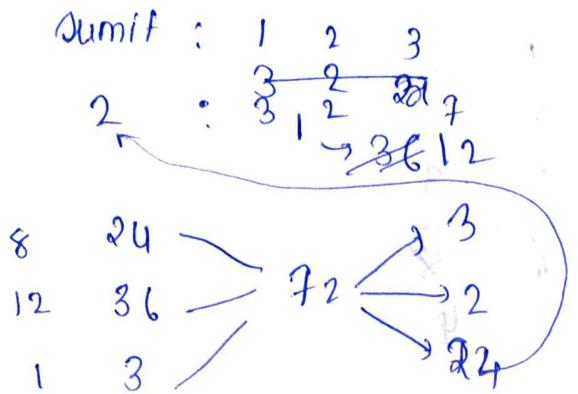
$1 \rightarrow \frac{72}{3} = 24$

$\therefore \frac{420}{80} = 5.25$

360

440 ✓ Ans.

Sumit has 3 sons. Sumit can do twice work as his sons do
 first and second can complete in 24, 36 and sumit completes in 3 days.
 All four completed work in and sumit distributed total of 600 among
 8 sons. find share of third son.

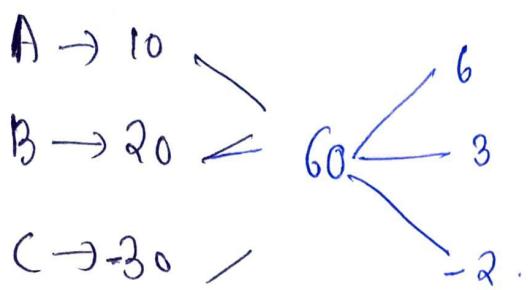


$$\begin{aligned} 26 &= 600 \\ 13 &= \cancel{\frac{300}{13}} \times 21 \end{aligned}$$

$$\begin{aligned} 12 &= 600 \\ 1 &\rightarrow 50 \\ 2 &\rightarrow 24 \\ 1 &\rightarrow 12 \end{aligned}$$

\therefore 3rd son's share = $7 \times 50 = 350$

Pipe - Cistern



Pipe A can fill a tank in 8 hr and B empty in 20 hr.
initially pipe A was opened for 2 hours, later pipe B also opened
how much more time it will take to fill the tank.

$$A \rightarrow 8 \xrightarrow{40} \quad \therefore \quad \begin{array}{l} 2 \text{ hr} \\ \uparrow \\ 10 + \frac{30}{10} \end{array} \xrightarrow{3} \begin{array}{l} 10 \text{ hr} \rightarrow \text{more required} \\ \uparrow \end{array}$$

B $\rightarrow 20 \xrightarrow{-2}$

two pipes can fill the cistern in 12 min and 24 min pipes are opened simultaneously and it is found that due to leakage in the both pipes it took 2 min more to fill the tank. When tank is completely filled in what time it will be emptied

$$\begin{array}{c} 12 \xrightarrow{2} \\ 24 \xrightarrow{24} \end{array} \rightarrow \frac{24}{3} \quad \begin{array}{l} 8 \text{ min} \\ \downarrow \\ 40 \end{array} \quad \begin{array}{l} 5 \\ \downarrow \\ 4 \end{array} \quad A + B + C = 4$$

$\therefore C = -1$

$\therefore 12 \text{ min required}$
to empty

Pipe A can fill the tank 6 times faster than pipe B when both pipes are opened simultaneously, when tank is already $\frac{2}{9}$ filled the tank is filled in 1hr. In how much time can pipe A fill the empty tank alone.

$$\begin{array}{c} A \\ 6 \\ \hline B \\ 1 \end{array}$$

$$\frac{7}{9} = 1\text{ hr}$$

$$1 = \left(\frac{9}{7}\right)\text{ hr.} \Rightarrow \text{Capacity} = \frac{9}{7} \times 7$$

$$\therefore \frac{9}{6} = 1.5\text{ hr.}$$

$$= 9.$$

Simple Interest

$$SI = \frac{PRT}{100}$$

$$\text{Amount} = P + I$$

A man borrowed Rs X at simple interest of 20% for 6 years and y at ~~at 10% per annum~~ 10% per annum at 6 years. He would have paid same interest. Find ratio of X and y , $X+y = 16\%$ interest.

$$(x+0000) \quad \begin{matrix} y \\ 10\% \\ x \\ 20\% \\ 16x \end{matrix}$$

$$x : y = 6 : 3$$

A sum of money is divided into two parts in the ratio 3:5. Both parts are invested in different schemes working on "SI" for 3 years. The rate of interest on smaller part is 15% while interest earned on second part is 12%. Is 2250 more than first part. what was total sum of money?

$$\begin{array}{r}
 3 \quad 5 \\
 3 \quad 3 \\
 15 \quad 12 \\
 \hline
 45 \times 3 \quad 60 \times 3
 \end{array}$$

60 100
 3 5] X 20
 3 3
 15 12
 9 100
 $\frac{45 \times 60}{100} = 27$
 27 36

~~450~~ → ~~450~~ 45000

$3(15) = 2250$
 $3 \rightarrow 450$
 $1 \rightarrow 50$
 $\frac{100}{100} \rightarrow 40,000$

A sum of 100000 is lent out in two parts, 1st part is 5% per annum and second part at 6%. If SI received on sum given at 5% is 768 more than the SI on the sum given at 6% at in 1 year. find sum which is lent at 6%.

$$11\% = 768 + 6000$$

$$11 = \frac{768}{x} 615$$

Trick

$$(\text{sum})\% = \text{differen} + (\text{base}\%)$$

$$\text{SI. } \frac{100\%}{= 61500} \rightarrow 6\% \quad \text{38,500}$$

v $\frac{8}{x}$ $\frac{5}{5\%}$ $\frac{6}{6\%}$

$(10000-x)$

amount corresponding

Q) A bank offers the personal loan at SI. rate of interest for 2 years is 6% for next four years it is 8% and for period more than 6 years it is 10%. If a personal loan of 201 taken and paid 32.81 find the years after which it was repaid.

$$2 \text{ year} \rightarrow 6\% \rightarrow 12\%$$

$$4 \text{ year} \rightarrow 8\% \rightarrow 32\%$$

$$x \text{ year} \quad 10\% \rightarrow 20\%$$

$$\frac{12.8}{20} x + 5 \\ 64.0\% \\ 44$$

8 years

Ans

A sum of money is divided into three parts, first part is $\frac{1000}{1000+2000} = \frac{1}{3}$ more than second and 2000 more than third. Total interest generated in three years when first, second and third part are invested at 20%, 15%, 10% per annum in SI. is 7050 what was amount invested.

$$\begin{array}{ccccccc}
 & \uparrow 1000 & & \uparrow 2000 & & & \\
 & x - 1000 & & x - 2000 & & & \\
 20\% & 15\% & & 10\% & & = 7050 & \\
 \hline
 3 & 3 & & 3 & & & \\
 \hline
 60\% & 45\% & & 30\% & & 450 & \\
 6000 & 5000 & & 4000 & & \cancel{8100} & \\
 & & & 8\% & & 8100 & \\
 & & & & & 9.60 & \\
 & & & & & \cancel{9.60} & \\
 & & & & & = 486 & \\
 \end{array}$$

$15000 \rightarrow A.M.$

$$135 = 8100$$

$$15 \quad 900$$

$$1 \rightarrow 60$$

$$\boxed{100 \rightarrow \underline{6000}}$$



Compound interest

$$P \rightarrow 10000 \quad 11000 \quad 1 \text{ year}$$

$$P \rightarrow 10000 \quad 11000 \quad 1 \text{ year}$$

$$R = 10\%, \quad 12100 \quad 2 \text{ years}$$

$$P \rightarrow 10000 \quad 11000 \quad 1 \text{ year}$$

$$13310 \quad 3 \text{ years}$$

$$P \rightarrow 10000 \quad 11000 \quad 1 \text{ year}$$

$$A_1 \quad A_2$$

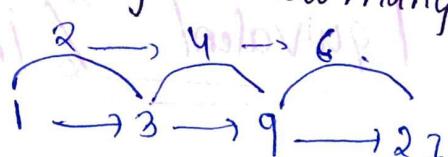
$$10 \quad 11$$

$$A_2 \quad A_3$$

$$10 \quad 11$$

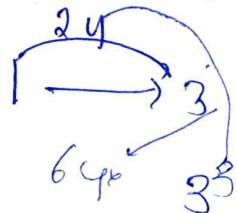
A sum of money becomes 8 times in 2 years how many years if will become 27 times?

$$9 \rightarrow 4, \quad 27 \rightarrow 6.$$



$$27 = 3^3$$

$$2 \times 3 = 6 \text{ years}$$



A person invested Rs 46875 at some Rate of CI for 3 years, at the end of 3 years he receives Rs 12174 as interest. Find 'R'

$$\begin{array}{r}
 46875 \\
 12174 \\
 \hline
 59049
 \end{array}
 \quad P = \sqrt[3]{46875} = 359049 \\
 \quad 46875 : 59049 \\
 \quad \cancel{3} \cancel{5} \cancel{9} : \cancel{3} \cancel{9} \\
 \quad 15625 : 19683$$

$$\begin{aligned}
 \left(\frac{A}{P}\right)^{\frac{1}{n}} &= \left(1 + \frac{R}{100}\right)^n \\
 \left(\frac{A}{P}\right)^{\frac{1}{n}} - 1 &= R.
 \end{aligned}$$

$$25 : 27 \rightarrow \frac{27}{25} \times 100 = 8\%$$

After how many years will the interest compounded annually on sum of Rs 40000 at a rate of 25% per annum is Rs 1875 less than the sum.

$$\begin{array}{r}
 40000 \\
 38125 \\
 \hline
 1875 \\
 1600 \\
 800 \\
 320 \\
 160 \\
 64 \\
 \hline
 \end{array}
 \quad \text{cube relation}$$

A man invested some money in the bank at the rate of 20% compounded annually and after 2 years received at Rs 6600. If man invested twice initial principle at 10% find CI after 2 years. Equivalent % in CI

$$\begin{array}{l}
 \text{2 years } 20\% \rightarrow 44\% \rightarrow 66000 \\
 \quad 4\% \rightarrow 600 \\
 \quad 1\% \rightarrow 150 \\
 \quad 100\% = 30000
 \end{array}
 \quad \left. \begin{array}{l}
 \text{2 years } 10\% = 21\% \\
 30000 \times 21\% = 6300
 \end{array} \right\}$$

Trick to calculate squares.

$$25 - \cancel{5} 75$$

$$\begin{array}{r} \\ \downarrow \\ \text{(47)} \xrightarrow{\substack{\text{near to } 50 \\ +3}} \end{array}$$

$$\begin{array}{r} 25-3 \\ \hline 22 \end{array}$$

$$22 \quad \underline{0} \quad 49$$

$$(18)^2 =$$

$$23 \quad \underline{04}$$

$$(12)^2$$

$$1764$$

$$75 \text{ to } 100 \quad 125$$

$$\begin{array}{r} 52 \\ \hline +2 \\ \hline 54 \end{array}$$

$$\begin{array}{r} 88 \\ \hline +2 \\ \hline 90 \end{array}$$

$$\cancel{27} \quad \underline{04}$$

$$63^2 =$$

$$(72)^2 =$$

$$39 \quad \underline{69}$$

$$\begin{array}{r} 51 \quad 84 \\ \hline 51 \quad 84 \\ \hline \end{array}$$

$$\begin{array}{r} 25 \\ +13 \\ \hline 38 \end{array}$$

↑ carry.

~~13/13~~

F(5)1

near to 100

$$\begin{array}{r} (96)^2 \\ \hline +4 \\ \hline 9216 \end{array}$$

$$\begin{array}{r} (97)^2 \\ \hline +3 \\ \hline 9409 \end{array}$$

$$(94)^2 = \underline{88} \quad \underline{86}$$

$$(88)^2 =$$

$$\begin{array}{r} 88 \\ \hline +12 \\ \hline 76 \end{array}$$

$$\begin{array}{r} 77 \quad 44 \\ \hline 77 \quad 44 \\ \hline \end{array}$$

$$\begin{array}{r} (102)^2 = \\ \hline 104 \quad \underline{04} \end{array}$$

$$(112)^2 = 12544$$

$$(104)^2 = 10816$$

Cube calculation

$$(13)^3 = 1 \ 3 \ 9 \ 27 \\ , \ 6 \ 18 \ 12 \\ \hline 2 \ 1 \ 9 \ 7$$

$$(31)^3 = 27 \ 9 \ 3 \ 1 \\ , \ 18 \ 6 \ 2 \\ \hline 29 \ 7 \ 9 \ 1$$

$$(22)^3$$

$$8 \ 8 \ 8 \ 8 \\ , \ 16 \ 16 \ 16 \\ \hline 10 \ 6 \ 4 \ 8$$

$$27 \ 27 \ 27 \ 27 \\ , \ 54 \ 54 \ 54 \ 54 \\ , \ 18 \ 18 \ 18 \ 18 \\ \hline 35 \ 9 \ 3 \ 7$$

2nd meth

$$(16)^3 \\ 1 \times 6 \times 3 \\ 18 \times 16 \\ = 788$$

$$1/216 \\ , \ 88 \\ \hline 4096$$

Number Series

$$\frac{a}{b} > \frac{c}{d}$$

① $ad > cd$

$$\frac{a}{b} > \frac{c}{d}$$

$$ad < cd$$

$$\frac{a}{b} < \frac{c}{d}$$

factors of Quadratic

$$x^2 - 85x + 1806 \rightarrow axb = 6 \\ a+b = 8 \\ +43 +42 \\ 40 \times 40 = 1600$$

$$x^2 - 89x + 1980 \rightarrow \\ +44 +45 \quad 4 \times 5$$

$$x^2 - 87x + 1886 \quad 6 \times 1 \quad \text{cause } 8$$

+41 (not 46 since 87 is odd)

$$x^2 - 179x + 7968$$

$$+ (88 \cancel{x} + 91) \quad 6 \times 3$$

↑ increase by 1 with
↓ this number pointing below it and

96	83
----	----

Percentage

④ If a% ↑ and than decrease by q%, then net effect is always decrease of $\left(\frac{a^2}{100}\right)\%$.

⑤ If a quantity is first ↑ or decreased by a% and then changed by b%, then net change.

$$\pm a \pm b \pm \frac{ab}{100}$$

Number Series

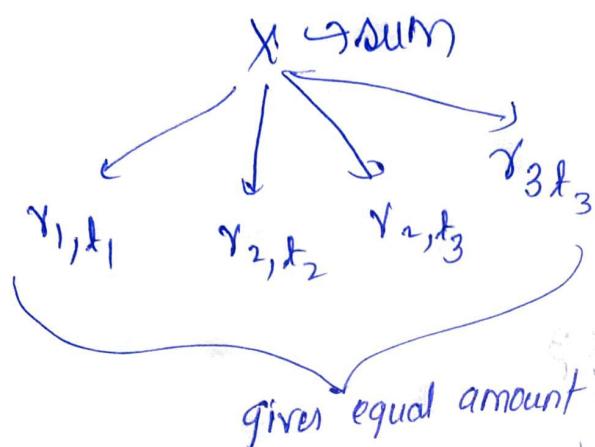
Q) 5184 3993 x 2187 1536, 1029

$$7^3 \times 3 = 1029$$

$$8^3 \times 3 = 1836$$

$$9^3 \times 3 = 2187$$

CI and SI



then divided parts of sum will be.

$$\frac{1A}{\left(1 + \frac{Y_1}{100}\right)^{t_1}} : \frac{1A}{\left(1 + \frac{Y_2}{100}\right)^{t_2}} : \frac{1A}{\left(1 + \frac{Y_3}{100}\right)^{t_3}}$$

$$1 + \frac{Y_1}{100} = \left(\frac{A}{P}\right)^{\frac{1}{t_1}}$$

$$\begin{array}{cccc} 1 & 2 & 3 & 4 \\ 1 & 2 & 3 & 4 \\ 1 & 2 & 3 & 5 \\ 1 & 2 & 3 & 4 \\ 1 & 2 & 3 & 5 \end{array}$$

parts ratio $\frac{1}{t_1}, \frac{1}{t_2}, \frac{1}{t_3}$

$$\frac{1}{100+Y_1}, \frac{1}{100+Y_2}, \frac{1}{100+Y_3}$$

for simple interest

Averages

Average of 'n' natural no : $\frac{(n+1)}{2}$

Average of n even no = $(n+1)$

Average of n odd no = 'n'

Average of 'n' consecutive natural no = $\left[\frac{F+l}{2} \right]$

Average of sum of squares of first n natural no = $\frac{(n+1)(2n+1)}{6}$

① Number \rightarrow average
 $x \rightarrow a$
 $y \rightarrow b$

$$\text{avg} \rightarrow (x+y) = \frac{xa+yb}{x+y}$$

② If avg of 'n' quantity is 'x' when quantity removed avg becomes 'y'
then value of removed quantity

$$[n(x-y)+y]$$

③ Average of marks obtain by 'n' students is 'm' if avg of passed students is 'P' and that of failed students is 'F' the no of student failed in exam.

$$\frac{n(P-m)}{(P-F)}$$

④ A bats man scores 'S' in nth inntings thereby avg by 't' then avg of 'n' inntings = $S - t(n-1)$

$$+ a \\ + b \\ + y \\ \hline z$$

$$\left(\frac{by + ax}{a+b} \right)$$

Speed time distance

$$ST = D \quad (\text{distance} = \text{speed} \times \text{time})$$

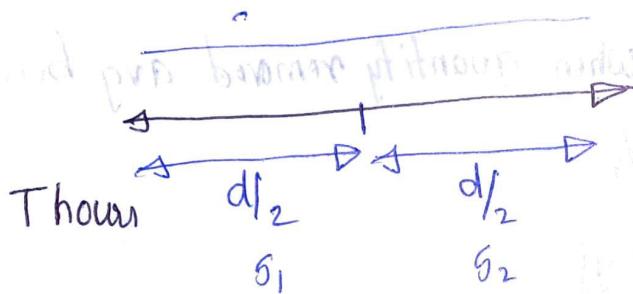
$$\frac{\text{km}}{\text{hr}} \times \frac{5}{18} = \text{m/s}$$

Average speed:

$$\frac{d}{x} + \frac{d}{y}$$

$$A.S = \frac{2xy}{x+y}$$

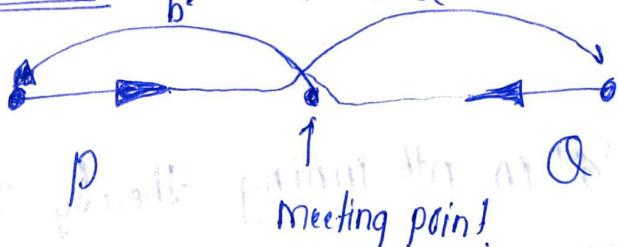
C2:



$$d = 2T \times \frac{s_1 \times s_2}{s_1 + s_2}$$

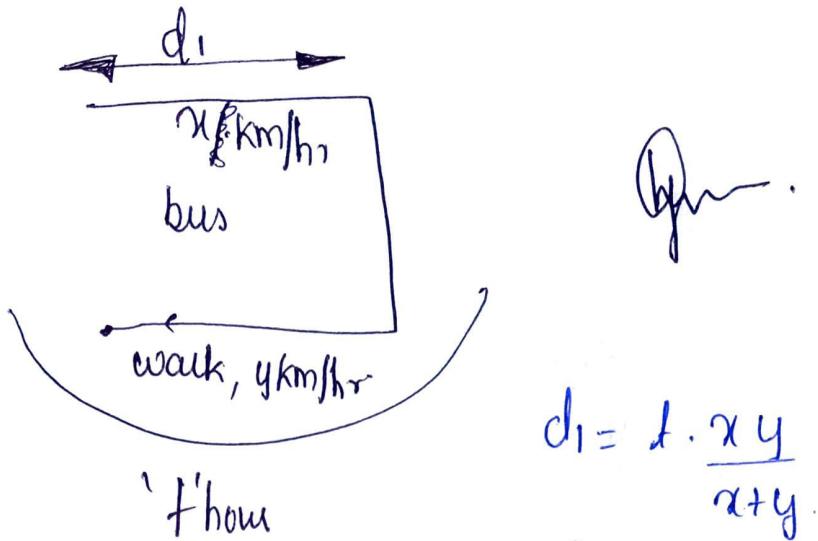
C2:

8:00 AM \rightarrow A.m (hour) \rightarrow after meeting (hours)



$$\frac{P\text{ speed}}{Q\text{ speed}} = \frac{\sqrt{b}}{\sqrt{a}} \Rightarrow (\sqrt{a} \cdot) P\text{ speed} = (\sqrt{b})(Q\text{ speed})$$

(4)



$$d_1 = t \cdot \frac{xy}{x+y}$$

$$d_1 = \frac{t}{\left(\frac{1}{x} + \frac{1}{y}\right)}$$

C-5

if change of $\left(\frac{a}{b}\right)$ of its usual speed
and late by 'T' min then usual time taken by him is

$$\frac{T}{\left(\frac{b}{a}-1\right)} \quad \left(\frac{a}{b}>1\right) \rightarrow \frac{T}{1-\frac{b}{a}}$$

G-7 When train passes a pole or any object the distance covered by train is equal to length of train.

④ If train passes bridge then distance travelled is equal to train
(length + bridge length)

C-9

Pune
 x kmph

Qune
 y kmph

When they meet it is found that one train has travelled D km more than the other distance b/w 'P & Q'

Sum of difference \times difference of distance,

$$\left(\frac{x+y}{x-y}\right) \times D.$$

x y
 t_1 t_2

$$Z = \frac{xt_1 + yt_2}{x+y}$$

T

Boat and Stream

speed of boat is 'x', speed of stream is 'y'
time taken to go and come back is 'T' distance b/w point is

$$\frac{T(x^2 - y^2)}{2x} \text{ km}$$

d_1

u_1

d_1

T

(II) : If a man can row d_1 km upstream and d_2 km downstream.

In T_1 hours also he can row d_2 km upstream and d_1 km downstream in T_2 hours then upstream speed of man.

$$U = \left(\frac{\frac{u_1}{e_1} e_2 - \frac{u_2}{e_2} e_1}{e_2 T_1 - e_1 T_2} \right) \quad D = \left(\frac{d_1 e_2 - d_2 e_1}{d_1 T_2 - d_2 T_1} \right)$$

d_1 e_1 T_1

u_1

d_2 e_2 T_2