

## Fractions &amp; Decimals

1. what will be the fraction form of  $0.\overline{3523}$  quick

$$35\overline{23} = 35.232323\dots$$

So simple way to solve this note down the count of number of digits under the bar and outside. Add that many 9's under the bar and a 0 for outside the bar.

Here 35 - outside - 2 - 00, and  $\overline{23}$  - inside bar - 23

N  $35\overline{23} - 35$  Subtract from number outside

D 9900 - outside

Inside

$$\underline{3}\overline{8}88$$

$$\underline{9900}$$

Outside - 0

$$0.\overline{45} = 0.45555\dots$$

$$\frac{45-4}{90} = \frac{41}{90}$$

90 - outside 00

Inside

$$0.\overline{25} \rightarrow 0.2525$$

$$\underline{25}$$

99 - Inside bar

/

2. What is the value of  $5.55 + 5 + 5.5 + 5.555 + 5.05 + 5.00$

Note the max decimal point is 3 so fill the rest places with 0

$$5.550$$

Scientific notation

$$5.000$$

mostly have

$$5.500$$

one decimal i.e.

$$5.555$$

$$\underline{6.253 \times 10^{-3}}$$

$$5.050$$

better multiplying  
all work

$$\underline{5.000}$$

$$\underline{31.633}$$

3.) what will be the value of  $\frac{24 \times 32 \times 45}{0.18 \times 0.06 \times 0.9} \times 3$

Simplify (convert them into fractions)

$$\frac{24}{10} \times \frac{32}{100} \times \frac{45}{10} \times 3 = \frac{16 \times 15}{100} = 2400$$

$$\frac{16}{100} \times \frac{6}{100} \times \frac{9}{10}$$

4.) what will be  $(0.\overline{15268} - 0.\overline{45804})$

Some rule

$$\begin{array}{rcl} \underline{15268} & = & \underline{15268} & \text{1st check for similarity} \\ \underline{99999} & & \underline{95804} & \text{may be try } \times \text{ with 3} \\ \underline{45804} & & & \text{we get the answer} \\ \underline{99999} & & & \frac{1}{3} \end{array}$$

5.) how much would be  $\frac{n-m}{n+m}$ , if  $2.5m = 0.055n$

$$2.5m = 0.055n \quad \frac{25m}{100} = \frac{35n}{1000} = \frac{250m}{500} = 35n$$

$$500m = 7n \quad \frac{n}{m} = \frac{500}{7}$$

ratio & Proportion  
rule

$$\frac{a}{b} : \frac{c}{d} = \frac{ad}{bc} = \frac{(a+d)}{(c+d)}$$

$$\frac{n+m}{n-m} = \frac{507}{493} \quad \text{we need} \quad \left[ \frac{n-m}{n+m} = \frac{493}{507} \right]$$

$$\frac{n-m}{n+m} = \frac{\frac{n}{m} - 1}{\frac{n}{m} + 1} = \frac{\frac{500}{7} - 1}{\frac{500}{7} + 1} = \frac{\frac{493}{7}}{\frac{507}{7}} = \frac{493}{507} = \frac{n-m}{n+m}$$

6) Add  $17.\overline{499} + 17.\overline{85} + 17.\overline{333}$

Simply Split

$$17 + 0.\overline{499} = 17 + \frac{495}{990} : \frac{17+1}{2} = 17.5 - ①$$

$$\Rightarrow 17.85 - ②$$

again

$$17 + 0.\overline{333} = 17 + \frac{332}{999} = \frac{17+1}{3} = 17.\overline{333} - ③$$

adding ① + ② + ③

$$52.\overline{666}$$

7) what will be value of  $1\cancel{00}\cdot\cancel{3} \times 0.\overset{1}{0} \times 0.\overset{0}{0}3$

Calculate all zeros - 1+2+3-6

so multiply those numbers

$$1 \times 3 \times 1 \times 3 = 9 =$$

now

$$0.\underline{00000}9$$

8) what will be value of  $\frac{1}{0.00061659} \text{ if } \frac{1}{1.659} = 0.2126$

$$\frac{1}{4.659 \times 10^4}$$

$$\frac{10^4}{4.659} = 0.2126$$

$$2126$$

$2.75$  and  $3.71$

$$-2 + (-3) + (0.71)(6)$$

$$-5 + 1.57$$

$$4.53$$

9.)  $4.142 + 100.8 + ? + 0.053 = 105.153$  ? stands for

$$? = 105.153 - 4.142 - 100.8 - 0.053$$

Separate

$$105.1 - 100.8 = 1$$

$$153 - 142 - 800 - 0.33 = -847$$

$$1 + (-0.847) = 0.153$$

10.)  $19.399 + 10.330 + 7.810 + 3.111$

Separate

$$\begin{array}{r}
 39 + 390 = 10.660 \\
 + 330 \\
 + 810 \\
 + 111 \\
 \hline
 660
 \end{array}$$

11.) what is the approximate value of  $0.459 \div 11.98 - 23.99 \div \frac{7}{100}$

$$\underbrace{\frac{8460}{12} - 24 \div \frac{7}{100}}_{\text{VBODMAS}}$$

just take off value for easy calculation

$$\frac{705 - 24}{7} = \frac{705 - 24 \times 20}{225} = \frac{705 - 480}{225}$$

12.) which of the following is the largest

$$\frac{5}{8}, \frac{3}{7}, \frac{2}{9}, \frac{4}{5}$$

Ratio Trick

$$\frac{a}{b} \times \frac{c}{d}$$

add > be

$\frac{a}{b} > \frac{c}{d}$  when one is  
longest, the value becomes the

$$① \frac{5}{8} \times \frac{3}{4} = 35 \text{ ?? }$$

$$\frac{5}{8} > \frac{2}{5} \text{ ?? } ②$$

$$10 < 8 - 4 = 11$$

$$\frac{5}{8} > \frac{2}{5} > \frac{4}{9} > \frac{1}{5}$$

Take all the high value and find longest

- Q3) The least of the following  $0.2, (0.2), 0\bar{2}, 1\frac{1}{2}$

$$0.2 = 0, (0.2) = 0.01 - 0, 0\bar{2} = 0.222\ldots, 1\frac{1}{2} = 0.5$$

base or square zeroes increases

- Q4) What is increasing order of fractions  $\frac{6}{7}, \frac{8}{9}, \frac{7}{8}, \frac{9}{10}$

If denominators > Numerator

D.N. of all has same value

Small w.r.t. Numerator = Smaller fraction

Trick

$$\frac{6}{7} > \frac{8}{9} > \frac{9}{10} - \text{order}$$

- Q5) What is the increasing order of fractions

$$\frac{14}{17}, \frac{10}{12}, \frac{6}{7}, \frac{8}{11}$$

$\frac{6}{7} \rightarrow 10 \rightarrow 14 \rightarrow 18$  if both numerators &  
 $\frac{14}{17} \rightarrow 10 \rightarrow 7 \rightarrow 11$  denominator is increasing by  
a value the small Numerator - smaller value

Large Denominator = Large value

$$\frac{6}{7} < \frac{10}{12} < \frac{14}{17} < \frac{18}{11}$$

16)  $\frac{1}{7} \text{ of } \frac{2}{3} \text{ of } \frac{5}{6} \text{ of } \frac{5}{8} \text{ of } 1000$

$$\frac{1}{7} \times \frac{2}{3} \times \frac{5}{6} \times \frac{5}{8} \times 1000 = 200$$

17.) If a fraction denominator is increased by 80% & numerator is increased by 300%, the fraction becomes  $\frac{2}{19}$ . What is the fraction?

$$a = \text{at } 300\% - \frac{\text{at } 300 \text{ pa}}{100} - a = 4a - ①$$

$$b = b + 80\% = b + \frac{80}{100} \times b = b + 0.8b$$

$$\frac{1a}{a+0.8b} = \frac{2}{19} = \frac{a}{b} = \frac{1}{9}$$

18.) In 3 fractions when the largest fraction is divided by smallest result =  $5/4$ , greater than middle fraction by  $1/2$ . If sum of all =  $2\frac{3}{12}$ , find difference b/w largest & smallest

Let A = Largest, B = middle, C = Smallest

$$\frac{A}{C} = \frac{5}{4}, \quad A = \frac{5}{4}C - ②$$

$$\frac{5}{4} : B + \frac{1}{2} = B = \frac{3}{4} - ③$$

$$\frac{2\frac{3}{12}}{12} = \frac{27}{12}$$

$$\frac{5}{4} + \frac{3}{4} + C = \frac{27}{12} \quad C = 2\frac{1}{3} - 3$$

$$A = \frac{5}{4}C = \frac{5}{4} \times \frac{2}{3} = \frac{5}{6}$$

$$A - C = \frac{5}{6} - \frac{2}{3} = \frac{1}{6}$$

19) Express  $\frac{2}{3} + \frac{1}{4}$  of Rs 25.20 as a fraction of  
 $\frac{1}{2}$  of Rs 36.

$$\frac{2}{3} \times \frac{1}{4} \times 25.20 = M \times \frac{1}{2} \times 36$$

$$\frac{1}{6} \times 25.20 = M \times \frac{9}{2} \times 36$$

$$M = \frac{25.20}{6 \times 36} = \frac{140}{18} = \frac{7}{9}$$

20)  $\underbrace{8 - 8 \times 2 \frac{1}{5} - 1 \frac{5}{7}}_{2 - 1}$  is equal to  
 $6 - \frac{1}{6}$

$$8 - 8 \times \frac{77 - 45}{35} = 8 - 8 \times \frac{32}{65}$$
$$= \frac{64}{65} = 8 - 8 \times \frac{1}{2} = 4$$

$$\frac{8}{6} + \frac{5}{8} + \frac{42}{5} ?$$

Simpl

$$8 + 5 + 9 = 17 \frac{23}{20}$$

$$\frac{1}{6} + \frac{1}{8} + \frac{2}{3} = \frac{23}{20}$$

# Simplification

Vedic Maths - Vinay (-) Brackets by of Division multiplication Addition Subtraction.

Rationalization - Squaring by changing the sign

$$\frac{1}{\sqrt{28} - \sqrt{24}} = \frac{1}{\sqrt{28} - \sqrt{24}} \times \frac{\sqrt{28} + \sqrt{24}}{\sqrt{28} + \sqrt{24}} = \frac{\sqrt{28} + \sqrt{24}}{(\sqrt{28})^2 - (\sqrt{24})^2} = \frac{\sqrt{28} + \sqrt{24}}{4}$$

Squares & cubes

$$a^b = a^3 \times a^2$$

$$a^{-b} = \frac{1}{a^3 \times a^2}$$

Trick for square no.

1 - 1

$$1 - 100, \\ \text{eg. } (34)$$

if single digit write as 01, 02

2 - 9

Then multiply all digits.

3 - 16

$$0916$$

we get 12

4 - 25

$$\underline{24} -$$

$$3 \times 9 \times 1 = 27$$

5 - 36

$$\underline{1} \quad \underline{36}$$

6 - 49

$$7^2$$

7 - 64

$$A904$$

8 - 81

$$\begin{array}{r} 28 \\ \hline 5184 \end{array}$$

for 3 digits

$$(100) - A^2 \quad \downarrow +a \quad A$$

add +9 and -9 so it become  
100 and 5, ~

$$\begin{array}{r} 100 \times 118 \mid 81 \\ 100 \end{array}$$

outside bar  
take out of 9

$$1181$$

(212)  
12  
~~200~~  
224 | 124

If remainder is zero just divide by 100

1 - 22

338

↓ + 2 -

100 × 356 | 484

147 884

12 1

1 3 3 1

1 4 6 4 1

(95)

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

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

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

$$(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3 \quad (a^3 + b^3) + 3ab(a+b)$$

$$a^3 + (a-b)^3 = a^3 - 3a^2b + 3ab^2 - b^3 \quad a^3 - b^3 + 3ab(a-b)$$

$$a^3 + b^3 = (a+b)^3 - 3ab(a+b) \text{ or } (a+b)(a^2 - ab + b^2)$$

$$a^3 - b^3 = (a-b)^3 + 3ab(a-b) \text{ or } (a-b)(a^2 + ab + b^2)$$

$$(a+b+1)^2 = a^2 + b^2 + 1^2 + 2ab + 2b + 2a$$

$$a^3 + b^3 + 1^3 - 3ab = (a+b+1)(a^2 + b^2 + 1^2 - ab - b - a)$$

$$\left(\frac{a+1}{a}\right)^2 = a^2 + \frac{1}{a^2} + 2 = \left(a - \frac{1}{a}\right)^2 + 4$$

$$\left(\frac{a-1}{a}\right)^2 = a^2 - 2 + \frac{1}{a^2} = \left(\frac{a+1}{a}\right)^2 - 4$$

$$\left(\frac{a+1}{a}\right)^3 = a^3 + \frac{1}{a^3} + 3a^2 \cdot \frac{1}{a^3} \left(\frac{a+1}{a}\right)^2 = a^3 + \frac{1}{a^3} + 3\left(\frac{a+1}{a}\right)^2$$

$$\frac{a-1}{a} = a + \frac{1}{a^2} - 3\left(\frac{a+1}{a}\right)$$

1) find the value of  $M - \frac{1}{N}$ , if  $M + \frac{1}{N} = 4$

$$\left(M + \frac{1}{N}\right)^2 = \left(M - \frac{1}{N}\right) + 2$$
$$\left(\frac{M+1}{N}\right)^2 = \left(\frac{M-1}{N}\right) + 2$$

$$16 = \left(\frac{M+1}{N}\right)^2 + 2$$

$$\frac{M+1}{N} = 14$$

$$\frac{M-1}{N}$$
$$\left(\frac{M-1}{N}\right) + 2$$

$$14 - 2$$

$$12 = 2\sqrt{3} = M - \frac{1}{N}$$

2) find the value of  $\frac{a^2 + 2ab}{a^3 - 2a^2}$  if  $a+b^2 = 2$

$$a^2 + b^2 = 2a \quad \text{---(1)}$$

$$a^2 - 2a = -b^2 \quad \text{---(2)}$$

$$\frac{2a + 2a}{a(a^2 - 2a)} = \frac{4a}{a(-b^2)} = \frac{4}{-b^2}$$

3) find the value of  $a^3 + b^3 + 3ab$ , when value  $a+b=1$

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

$$1 = a^3 + b^3 + 3ab(a+b)$$

L

4) what is the value of  $[(3 \times 3 \times 3 \times 3 \times 3)^6 : (3 \times 3 \times 3)^{10}]^3$ ?

$$A^m \times A^n = A^{m+n}$$

$$(3^6) : (3^4) \times 3^7$$

$$\begin{array}{r} 36 \\ - 34 \\ \hline 28 \end{array} +$$

$$\begin{array}{r} 3 \\ \times 3 \\ \hline 9 \end{array}$$

$$\begin{array}{r} 3 \\ \times 3 \\ \hline 9 \end{array} = 3^{12}$$

$$=$$

5) what will be value of  $\frac{\sqrt{0.0016} \times \sqrt[3]{8000000}}{\sqrt[3]{0.000512} \times \sqrt[3]{0.064}}$

If  $\sqrt{}$  has a value at square will have 2 self explanatory

~~$$\frac{0.04 \times \sqrt[2]{1000000}}{0.08 \times 0.4}$$~~

$$\begin{array}{r} 9 \\ 16 \\ \times 100 \\ \hline 150 \\ 160 \\ \hline 200 \end{array}$$

$$\begin{array}{r} 0.04 \times 200 = 200 \\ \hline 0.08 \times 0.4 \\ 0.04 \end{array}$$

6) what will be the value of c if  $a(a+b+c)=85$ ;  $b(b+c)=96$ ;  $c(c+a)=108$

Simply add things in these scenario

$$a(a+b+c) + b(b+c) + c(c+a) = 85 + 96 + 108$$

$$(a+b+c)(a+b+c) = 289$$

$$(a+b+c)^2 = 17^2$$

$$a+b+c = 17$$

$$c = 108$$

7.) What is the value of  $(13.8 \times 1.9 \div 5.7 + 0.7) \text{ of } \frac{1}{16} - \frac{1}{20}$

V.BODMAS

$$13.8 \times 1.9 \div 5.7 + 0.7 - \frac{1}{20}$$

$$13.8 \times \frac{1}{3} + 0.7 - 0.05$$

$$4.6 + 0.7 - 0.05$$

$$5.25$$

✓

8.) What will be value of  $(m+n)$  if we know  
 $\sqrt{28-6\sqrt{3}} = \sqrt{3m+n}$

$$28-6\sqrt{3} = (\sqrt{3m+n})^2$$

$$a^2 + 2ab + b^2$$

$$a^2 + b^2 = 28$$

$$ab = 3\sqrt{3}$$

$$a=3 \quad b=\sqrt{3}$$

$$b=3\sqrt{3} \quad b=1 \quad \checkmark$$

$$(\sqrt{3m+n})^2 = a^2 - 3\sqrt{3} + b^2$$

$$(\sqrt{3m+n})^2 = (a-b)^2$$

$$(\sqrt{3m+n})^2 = (3\sqrt{3}-1)$$

$$m=3 \quad n=1$$

✓

9) On simplification of following, the result will be

$$\left(1 - \frac{1}{2}\right) \left(1 - \frac{1}{3}\right) \cdots \left(1 - \frac{1}{100}\right)$$

$$\frac{1}{2} \times \frac{2}{3} \times \frac{99}{100} = \frac{1}{100} = 0.01$$

10)  $1^{61} + 4^{62} + 4^{65}$  is divisible by

$$1^{61} (1^1 + 4^2 + 4^3 + 4^4 + 4^5)$$

$$1^{61} \overline{(341)} \quad -$$

11) If  $a = 1.36$ ,  $b = 2.39$  ( $\approx 1.97$ ), then value of

$$a^3 - b^3 - c^3 - 3abc$$

$$(b)^3 = -b^3$$

$$a^3 + (-b)^3 + (-c)^3 - 3abc = (a+b+c)(a^2+b^2+c^2 - ab - bc - ca)$$

Now this of the form

$\begin{smallmatrix} 0 \\ \swarrow \end{smallmatrix}$

12) If  $a^*b = 2a + 3b$ , then value of  $2^*3 + 3^*4$  is?

$$a^*b \neq ab$$

$$2(2) + 3(3) + 2(3) + 3(4)$$

$$13 + 18$$

$$31$$

13) If  $1^2 + 2^2 + 3^2 + \dots + 10^2 = 385$ , then  $3^2 + 6^2 + \dots + 30^2$  equals

$$3^2(1^2 + 2^2 + \dots + 10^2)$$

$$3^2(385)$$

$$9(385) = 3465$$

14) Simplify

$$\frac{0.72 \times 0.72 \times 0.72 - 0.39 \times 0.39 \times 0.39}{0.72 \times 0.72 + 0.72 \times 0.39 + 0.39 \times 0.39}$$

$$\frac{a^3 - b^3}{a^2 + ab + b^2} = \frac{(a-b)(a^2 + ab + b^2)}{a^2 + ab + b^2}$$

$$0.33$$

15) for what value of  $\star$ , the statement  $\frac{\star \times \star}{15 \times 135} =$

$$\star^2 = 15 \times 135$$

$$\star^2 = 2025$$

$$\star = 45$$

16) The value of

$$\frac{1}{1+\sqrt{2}} + \frac{1}{2+\sqrt{3}} + \dots + \frac{1}{\sqrt{15}+\sqrt{16}}$$

$$\frac{1}{1+\sqrt{2}} \times \frac{1-\sqrt{2}}{1-\sqrt{2}} + \frac{1}{2+\sqrt{3}} \times \frac{1-\sqrt{3}}{1-\sqrt{3}} + \dots + \frac{1}{\sqrt{15}+\sqrt{16}} \times \frac{\sqrt{15}-\sqrt{16}}{\sqrt{15}-\sqrt{16}}$$

$$\frac{1-\sqrt{2}}{1-2} + \frac{\sqrt{2}-\sqrt{3}}{2-3} + \dots + \frac{\sqrt{15}-\sqrt{16}}{15-16}$$

$$-(1-\sqrt{2}) + (\sqrt{2}-\sqrt{3}) + \dots + \sqrt{15}-\sqrt{16}$$

$$-1 + \sqrt{2} - \sqrt{2} + \sqrt{3} + \sqrt{16}$$

$$-1 + 4 = 3$$

17) The value of  $25.25 - 23.23 + 29.19 ; , 7$

Take values before and after decimal & add

$$\begin{array}{r} 25 \\ - 23 \\ \hline 2 \end{array} \quad \begin{array}{r} 26.16 \\ - 23.23 \\ \hline 2 \end{array}$$

# Surds & Indices

b - Index  
a - base

$$\sqrt[3]{8} \quad \text{Surd}$$

$$p^{\frac{m}{n}} = p^{\frac{(m+n)}{n}}$$

$$\frac{p^m}{p^n} = p^{\frac{(m-n)}{n}}$$

$$(p^m)^n = p^{mn}$$

$$p^{\frac{m}{n}} = p^{\frac{1}{n}} \cdot p^m \quad p^0 = 1$$

$$\left(\frac{a}{b}\right)^{\frac{p}{q}} = \frac{a^p}{b^q}$$

$$p^{\frac{m}{n}} = \frac{a}{b^{\frac{m}{n}}}$$

$$p = a\sqrt{b}$$

$$p = a - \sqrt{b}$$

Indices tips

$$\left(\frac{x^a}{x^b}\right)^c \times \left(\frac{x^b}{x^c}\right)^a \times \left(\frac{x^c}{x^d}\right)^b = 1$$

$$\left(\frac{x^a}{x^b}\right)^{(a+b)} \times \left(\frac{x^b}{x^c}\right)^{(b+c)} \times \left(\frac{x^c}{x^d}\right)^{(c+d)} = 1$$

$$\left(\frac{x^a}{x^b}\right)^{(a+b+c)} \times \left(\frac{x^b}{x^c}\right)^{(b+c+d)} \times \left(\frac{x^c}{x^d}\right)^{(c+d+e)} = 1$$

Surd tips

$$\sqrt[m]{p} = p^{\frac{1}{m}}$$

$$\sqrt[m]{ab} = \sqrt[m]{a} \times \sqrt[m]{b}$$

$$\sqrt{ab} = \sqrt{b} \times \sqrt{a} = \sqrt{b \times a}$$

$$\sqrt[m]{\frac{a}{b}} = \frac{\sqrt[m]{a}}{\sqrt[m]{b}}$$

$$\left(\frac{a}{b}\right)^{\frac{1}{m}} = \frac{a^{\frac{1}{m}}}{b^{\frac{1}{m}}} \quad (ab)^{\frac{1}{m}} = a^{\frac{1}{m}} b^{\frac{1}{m}}$$

$$(\sqrt[m]{a})^n = a$$

$$(\sqrt[m]{a})^n = (a^{\frac{1}{m}})^n = a^{\frac{n}{m}}$$

$$a^{\frac{1}{m} \cdot n}$$
$$\sqrt[n]{a^n}$$

1) what will be the product of  $\sqrt{2}, \sqrt[3]{9}, \sqrt[5]{5}$

$$2^{\frac{1}{2}}, 3^{\frac{1}{3}}, 5^{\frac{1}{5}}$$

$$\sqrt{a} + \sqrt{b} \neq \sqrt{a+b}$$

$$\frac{1}{2} + \frac{1}{3} + \frac{1}{5}$$

$$\frac{3}{6}, \frac{2}{6}, \frac{1}{6}$$

$$2^{\frac{3}{6}}, 3^{\frac{2}{6}}, 5^{\frac{1}{6}}$$

$$(2^3)^{\frac{1}{6}}, (3^2)^{\frac{1}{6}}, (5^1)^{\frac{1}{6}}$$

$$(360)^{\frac{1}{6}}$$

1

2) Solve for m in  $17^{65} \times 17^{59} \times 17^{37} \times 17^{11.3} = 17^m$   
 $(65+59+37+11.3)$

17

$$29.4 = 2m$$

$$17 = 17$$

$$m = 13.7$$

3) if  $m = 1$ , what is the value of  $b$

$$1 = 1$$

$$\begin{array}{r} 3b+b \\ m \quad \quad m \\ \hline 3b+2b = 0 \end{array}$$

$$\begin{array}{rcl} b = -b & = & b = -2 \\ \hline & 2 & 2 \end{array}$$

4.)  $10^{65982} \div 10^{65979} : 1000 ?$

$$\begin{array}{r} 10^{65982} \\ \hline 10^{65979} \\ \hline 10^3 \end{array} =$$

$$\begin{array}{r} 10^3 \\ \hline 10^3 \\ \hline 1 \end{array} = 1000$$

$$(1000) : 1000$$

$$? = 1$$

5) find  $(m^2 + m^{-2})$ , when it is given that  $m = 9 + \sqrt{43}$

$$\left( \frac{m^2 + 1}{m^2} \right)$$

$$\left( m + \frac{1}{m} \right) = \cancel{9 + \sqrt{43}} \quad \frac{m^2 + 1 + 2m}{m^2}$$

$$\left( 9 + \sqrt{43} + 9 - \sqrt{43} \right)^2 = m^2 + \frac{1}{m^2} + 2$$

$$364 = m^2 + m^{-2}$$

$$364 = m^2 + m^{-2}$$

6) which is the smallest amongst  $\sqrt{3}$ ,  $\sqrt[3]{2}$ ,  $\sqrt[5]{5}$ ,  $\sqrt[4]{9}$

$$\frac{\sqrt{2}}{3}, \frac{\sqrt[3]{3}}{2}, \frac{\sqrt[5]{5}}{1}, \frac{\sqrt[4]{9}}{4}$$

~~b~~

$$\frac{b}{12} = \frac{4}{12}, \frac{2}{12}, \frac{3}{12}$$

$$= \frac{3}{3}, \frac{2}{2}, \frac{5}{5}, \frac{9}{9}$$

$$(3)^{1/2}, (2)^{1/2}, (5)^{1/2}, (9)^{1/2}$$

$$(729)^{1/12}, (76)^{1/12}, (25)^{1/12}, (4+1)^{1/12}$$

$$\begin{array}{r} 2 | 2364 \\ 2 | 1332 \\ 3 | 1372 \\ 3 | 1112 \\ 1, 1, 1, \end{array}$$

smallest = smallest value

$(16)^{1/12}$

7) what will be the value  $\sqrt{1+m} + \sqrt{1-m}$   $m=4/25$

$$(\sqrt{1+m} + \sqrt{1-m})^2 = 1+m+1-m + 2\sqrt{1+m}\sqrt{1-m}$$

$$2+2\sqrt{1-m^2}$$

$$2+2\sqrt{1-\frac{16}{25}}$$

$$2+2\sqrt{\frac{9}{25}} = 2+\frac{6}{5} = \frac{16}{5} \text{ so } t = \frac{4}{\sqrt{5}}$$

8) Find the value of  $m^{\frac{23}{5}q}$ , if  $3^m + 3^{-m} = 10$

$$P = m^{\frac{23}{5}q}$$

$$3P + \frac{3}{P} = 10$$

$$\frac{S - 10}{6} = \frac{5}{3}$$

$$3P^2 + 3 = 10P$$

$$P = 1$$

$$3P^2 - 10P + 3 = 0$$

$$\left(\frac{5}{6} - 2\right) \left(\frac{5}{6} + 1\right)$$

$$3P^2 - 9P - P + 3 = 0$$

$$3P(P-1)$$

$$P = 3$$

$$\begin{array}{c} 9 \\ \diagdown \\ -10 \\ \diagup \end{array}$$

$$\frac{25}{36} - x^2 = 1$$

$$3P^2 + 1$$

$$P = \frac{1}{3}$$

$$x^2 = \frac{25}{36} - 1$$

$$-\frac{x}{36} = \frac{3}{12}$$

$$\left( \frac{9}{9-10} \right) x^2 = \frac{3}{12}$$

9)  $\sqrt{3\sqrt{3\sqrt{5}}} = ?$

$$\sqrt[2-1]{3\sqrt{3\sqrt{5}}} \cdot \varphi = A$$

$$\sqrt[2-1]{3\sqrt{3\sqrt{5}}} = A^{\frac{1}{2^n}}$$

$$A^{\frac{1}{2^n}}$$

$$\frac{8-1}{3-1} = 3^{7/8}$$

10) which of the expression is not so.

$$6^{\frac{3}{2}} \cdot (6^{\frac{3}{2}}) = 2^{\frac{3}{2} + \frac{3}{2}} = 6^{\frac{3}{2} + \frac{3}{2}} = 6^{\frac{3}{2} + \frac{3}{2}} = 6^{\frac{3}{2} + \frac{3}{2}}$$

$$216 = 6^{\frac{1+3}{2}} = 6^{\frac{4}{2}} = 6^2 = 36$$

11) value of  $2^{k^2}$

$$2^{(-2)^2} = 2^4 = 16$$

12) what is the value of  $2^{\frac{2(1-2)}{2}}$

$$2^{-2} = \frac{1}{2^2} = \frac{1}{2^{\frac{2}{2}}} = \frac{1}{2^{\frac{1}{2}}} = 2^{\frac{1}{4}} = \sqrt[4]{2}$$

13) Value of M in  $(\frac{P}{q})^{2m+n} = \left(\frac{q}{p}\right)^{n-m}$

$$\frac{a}{a^2} = \frac{1}{a^2}$$

$$\left(\frac{q}{p}\right)^{(a \cdot n)} = \left(\frac{q}{p}\right)^{m \cdot q} \cdot \left(\frac{P}{q}\right)^{2m+n}$$

$$mrq = 2m+n$$

$$m-n = 2^m$$

$$n = m$$

$$m = -11$$

$$n = 11$$

14.) what is the value of  $(36)^{1/6}$

$$\begin{array}{r} (6)^{1/6} \\ \times \frac{1}{3} \\ \hline 6 \end{array}$$

$$\sqrt[3]{6}$$

15.) How many zeros are there in  $2000^{10}$

$$2 \times 1000^3 = 3 \times 10^2 \quad 30$$

12

~~14~~  
288

~~1090~~

~~147~~

16.) what will come in place of?

$$\begin{array}{r} 72 = ?^{7/15} \\ \times 815 \quad 21 \end{array}$$

$$72 \times 21 = ?^{8/15} ?^{7/15}$$

$$72 \times 21 = \frac{8}{5} + \frac{7}{5} = \frac{15}{5} = 3$$

$$72 + 21 = ?^3$$

$$? = 12$$

Permutation

E

Combination

Things can be linearly arranged -  $n!$

Things can be arranged circularly -  $(n-1)!$

PGL

C- Select

P- Select & arrange

$$P_r = \frac{n!}{r!(n-r)!} \quad nPr = \frac{n!}{r!(n-r)!} = \frac{n!}{(n-r)!}$$

- 1) In Danya's bag there are 3 books History, 4 books Science and 2 book Math. In how many ways she can arrange so that same subject are together?

make them into 3 group

$$\begin{array}{ccc} H & M & S \\ \diagdown & \diagup & \diagup \\ 3! & 2! & 1! \end{array} \cdot 3! \text{ - They can be arranged in } 3!$$

So everything can be arranged.

$$3! \cdot (3! \times 2! \times 1!) = 1728 \text{ ways}$$

2.) In how many ways can we arrange the word 'FIZZTONE' so that vowels remain together

FIZZTN - 5

VOE - 3 - grouped into 1 - 3!

5! × 3!

$6! \times 3!$

$\frac{6! \times 3!}{2!} = 2160$  ways

- we have duplication of Z

n - 1 duplication

$\frac{n}{1}$

3.) If Suraj doesn't want vowels together. Then in how many ways they can arrange 'MARKER'

MRKR - 4

A·E - 2 - grouped 1 - 2!

Total ways = Together + not together

Not together = Totalways - together

There are 6 in total with aduplication

$\frac{6}{2!}$  - together

for together

A·fig. 1(2)

$\frac{5! \times 1!}{2!} = 120$

not together = 120 ways

A) without repetition, using digits 2, 3, 4, 5, 6, 8, 0  
 how many numbers can be made between 500 &  
 1000  
 by logic

They won't more than 500 so there only 3 available  
 options 5, 6, 8 3

Since no repetition | reducing value for  
 Subsequent digits -  $3 \times 2 \times 1 = 6$

by formula

$$3! \times 6! \times 3! = 90 \text{ ways}$$

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

Q) 4 members form a group out of total 6 members

i) how many ways we can make a group if 2 particular  
 members to be included

ii) 2 members must not be included

We have to make group of 4 which is divided by  
 2 already we can select from remaining 4 - 6  
 $6C_2 = \frac{6!}{2! \cdot 4!} = 15 \text{ ways}$

ii.) They ain't included So we have  $B \cdot 2 \cdot 6$  we have  
to side from this if

$$6C_4 = \frac{6!}{4!2!} \times 15 \text{ ways}$$

6.) There are 8 routes from London to Delhi. There  
are 6 from Delhi to Tokyo. How many different  
ways he can reach

8 different options for Delhi:  
6 for Tokyo.

$$8 \times 6 = 48 \text{ choices}$$

7.) There are 35 people in grp containing  
12 girls, 10 boys, 55 citizens & babies.  
organizers want to select school girl or boy  
as leaders. In how many ways he can select

We'll eventually want only girl and  
boy so  $12 + 10 = 22$ , we need 1 leader so

$$22C_1 = \frac{22!}{1! \times 21!} \approx 22$$

by logic

$$10+11 = 22 \text{ ways}$$

we need 1 lead.

So

8) In a class of 15 students. During a Christmas party each shook hands with each other. find total number of handshakes

We need 2 people for handshake

Total n = 15

$$15 = \frac{15!}{2 \cdot 14!} = 105$$

9) A bank has 6 digit account number with no repetition. first and last digit are 0 and 9. how many total numbers are possible.

No repetition, already 2 given total of 10  
 $10 - 2 = 8$

$$\text{So } 8 \times 7 \times 6 \times 5 = 1680$$

10) A trekking group is to be formed 6 members. They are to selected 3 girls, 4 boys and 3 teachers. In how many ways, group can be formed with 3 teachers and 3 boys or 2 girls and 4 teachers

3T & 3B (or) 2g & 4T

$$\frac{6!}{3! \cdot 3!} = \frac{6!}{2! \cdot 1!} = 90$$

Select 3T and 3B from available

$$\frac{5}{3! \cdot 2!} \times \frac{4}{3! \cdot 1!} + \frac{3}{2! \times 1!} \times \frac{5}{1! \times 1!} = 55 \text{ ways}$$

11.) On a railway line 20 stops. A ticket is needed to travel between 2 stops. How many different tickets does one need to buy?

we need tickets for 2 stops out of 20

$$20C_2 = \frac{20!}{2!(18)!} = 190\text{ tickets}$$

$$\begin{aligned} &\text{going back } \frac{21 \times 18!}{190C_2} \\ &190C_2 = 380 \text{ tickets} \end{aligned}$$

12.) 17 students are present in a class. In how many ways can they be made to stand in 2 rows of 8 and 9?

out of 17 we are selecting 9  
remaining will be left so - 8

They can be arranged.

$$17 C_9 \times 8! \times 7!$$

$$n! - -$$

$$(8-1)! = 0$$

13.) A London in bank has 3 digit lock.  
Mohit forgot his password. He found 6 seconds for each try. The problem was each digit must be 0 or 9. How much time is needed?

There are 10 possibilities with 3 digits per

$$10 \times 10 \times 10$$

$$1000 \times 6sec = 6000sec = 60\text{ minutes}$$

- 14) In a room there are 2 green chairs, 3 yellow chairs and 4 blue chairs. In how many ways Ray choose 3 chairs so that atleast one chair is yellow.

Total ways = choosing yellow + not choosing yellow

Total ways - not choosing = choosing yellow  
out 9 chairs needed,

$$9C_3 - 6C_3 = \text{choosing yellow}$$

$$8A - 20$$

$$6A = \text{choosing yellow}$$

- 15) How many combinations are possible while selecting 4 letters from 'SmashJunk' with condition J must appear

J is already occupied so

J \_ \_ \_

There are 7 ways which include

J K K - 6!, from left 6 ways total

J K \_ - 6!

J \_ \_ - 6!

$$6! + 6! + 6! = 48$$

# Probability

P = what I want

Total

AND - X - OR - +

Total Probability = 1

$$P + \bar{P} = 1$$

Selecting / not Selecting

- 1) Divesh keeps all his socks in a single drawer. He has a 24 pairs W, 18 Pairs Grey. He picks 3 randomly. Possibility of matching pair

The thing is total socks =  $24 \times 2 + 18 \times 2$   
Ans = 36 for boy

If he picks white we will be left with 23, even if he picks green he will complete the task, even if it is white he does  
So Probability = 1

- 2.) What will be the possibility of drawing a Jack or a Spade from a well shuffled deck of cards

J or Spade J + S

Since J is also in spade we need to remove that

$$\frac{1}{52} + \frac{13}{52} - \frac{1}{52} = \frac{12}{52} = \frac{9}{13}$$

3) A box has 6 black, 2 red, 2 white and 3 blue shirts. When 2 shirts are picked randomly, what is the probability both are white or both are blue.

Choosing 2 shirts we will have one in our hand then chose next so count will reduce.

We need both white or blue

Total shirts = 15

$$\frac{2}{15} \times \frac{1}{15} + \frac{3}{15} \times \frac{2}{15} = \frac{1}{105} + \frac{3}{105} = \frac{1}{105}$$

4) A pot has 2 white, 6 black, 4 gray and 8 green balls. If one ball is picked randomly from the pot, what is the probability of being black or gray

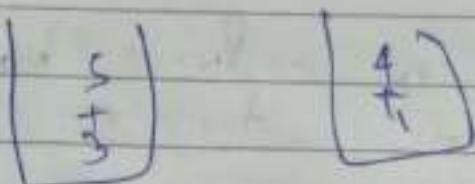
$$\text{Total ball } 2+6+9+1=20$$

B(0.1) + G

$$\frac{8}{20} + \frac{6}{20} = \frac{14}{20} = \frac{7}{10}$$

5.)

There are 2 pots. One pot has 5 red and 3 green. Other has 4 red and 2 green marbles. What is the possibility of drawing red marble?



See they have given 2 Pots so we have to consider the probability of that too.

$$\frac{1}{2} \times \frac{5}{8} + \frac{1}{2} \times \frac{4}{6} = \frac{31}{48}$$

6.)

In a set of 30 game cards. 17 are white, 9 are green, 1 white and 5 green are marked important. If a card is chosen randomly, probability of choosing a green or important card.

double 67 = 13 also Imp. Card has Green  
Counting

$$\frac{13}{30} + \frac{9}{30} - \frac{5}{30}$$

$$\frac{17}{30}$$

- 7.) A box has 6 black, 4 red, 2 white and 3 blue shirts. Find the probability of drawing 2 black.

Same rule If I had to pick 2 I will pick 1 and Then 2

$$\frac{6}{15} \times \frac{5}{14} = \frac{30}{210} = \frac{1}{7}$$

- 8.) A box has 6 black, 4 red, 2 white and 3 blue shirts. What is the probability that 2 red shirts and 1 blue shirt get chosen during a random selection of 3 shirts?

We need 2R & 1 Blue randomly  
Positive Probabilities,

$$R \times R \neq B + R \times B \times R + B \times R \neq R$$

$$\frac{4}{15} \times \frac{3}{14} \times \frac{3}{13} + \frac{4}{15} \times \frac{3}{14} \times \frac{3}{13} + \frac{3}{15} \times \frac{9}{14} \times \frac{3}{13}$$

$$\frac{36}{15 \times 14 \times 13} = \frac{18}{135}$$

Q.) A box has 6 black, 1 red, 2 white and 3 blue shirts. what is probability of atleast 1 red shirt in 4 shirts that are randomly picked

$$4 - 1 \text{ or } 2 \text{ or } 3 \text{ or } 4$$

It says atleast one Red So we can have 1x or 2x ... 4x

Remember  $1 = \text{Probability of red} + \text{Probability of not red}$

remove all those  
red shirts

$$\frac{11}{15} \times \frac{10}{14} \times \frac{9}{13} \times \frac{8}{12} = \frac{22}{91}$$

$$1 - \frac{22}{91} = \frac{69}{91} - \text{Probability of red}$$

Q.) on rolling a dice 2 times; the sum of 2 no. is 8. what is the probability that first thrown die yields 4

$$2 \text{ dice} = 6 \times 6 = 36$$

which gives sum

$$(2,6) (3,5) (4,4) (5,3) (6,2) = \frac{1}{36}$$

↑ only

ii) A box has 5 black and 3 green. One shirt is picked up and put in another box. The second box has 3 black and 5 green. Now a shirt from second box, what is the probability of black shirt?

We have 2 case of 2 scenario

- Pick  
1.) Picking one black now and adding the  
Picking 2.) Picking green adding there and then

$$\begin{bmatrix} 5 \\ 3 \end{bmatrix} + \begin{bmatrix} 3 \\ 5 \end{bmatrix}$$

$$\frac{5}{8} * \frac{4}{9} = \frac{20}{72} \quad \textcircled{1}$$

$$\frac{3}{8} * \frac{3}{9} = \frac{9}{72} \quad \textcircled{2} \quad \frac{20}{72} + \frac{9}{72} = \frac{29}{72}$$

Q) What is the possibility of having 53 Thursday in a non-leap year

There will be 52 weeks the rest could be any day <sup>out of</sup> so

$$\frac{1}{7}$$

13.) In a drawer there are 4 white socks  
3 blue socks, 5 grey socks. Two socks are  
picked randomly both are same color?

2w or 2B or 2G

$$\frac{4}{12} \times \frac{3}{11} + \frac{3}{12} \times \frac{2}{11} + \frac{5}{12} \times \frac{4}{11}$$

$$\frac{1}{11} + \frac{1}{2} \times \frac{5}{33} = \frac{19}{66}$$

14.) what is probability of picking  
2 clubs from a well shuffled pack  
of 52 cards

Probability of picking 13

$$\frac{13}{52} \times \frac{12}{51} = \frac{1}{17}$$

15.) what are the chances that no 2 boys  
are sitting together for a photograph  
there are 5 girls and 2 boys.

use Permutation & combination

$$2 \text{ boys} - 2! - 1 \text{ group}$$

Total +

so we can have  
7! ways

5 girls + 2 boys - 6 girls

$$n = n_1 + n_2$$

classmate

Date \_\_\_\_\_

Page \_\_\_\_\_

$$7! = 6! \times 1! + n$$

$$7! = 6! \times 2^1 \quad \text{Ans}$$

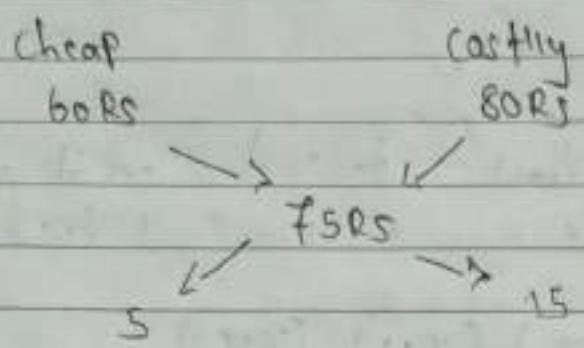
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Q) When a coin is tossed, what are the chances of getting at least one head?

(H, H) (H, T) (T, H) (T, T)  
at least 1

$$P = \frac{w}{T} = \frac{3}{4}$$

## Mixtures g Alligation



$$\text{B:Corty} = 5:15$$

$$\text{Share of A} = \frac{A}{A+B}$$

$$\text{Share of B} = \frac{B}{A+B}$$

one can is completely contains 100% water another  
contains 50% water & 50% wine when emptied in  
vessel find the ratio

100L - Cap 1

SolWine + SolWater - Can 2

when all of them are added

$$100 + 50L - 150 \text{ water} = 50L \text{ water}$$

5.1

2) Resultant price of mixture of golden rice, Rs 480/kg. made from 2 varieties of rice A20f & 580/- respectively. what are the quantities of both rice.

Cheap. Costly

A20      520

480

40 : 60

$4:6 = 2:3$

3) A mixture consist of some amount of sandal wood & 240 litres of water. priced at 275/litre. Sandal wood oil is priced 7325/litre. How much is oil there

~~0 - 275~~      0      325

~~275~~

$50 : 275$

2 : 11

$$\frac{2}{11} : \frac{240}{\text{oil}} = 1320 \text{ litres oil}$$

4) How much milk should be added in a milk solution to make milk quantity 75%, if 10L of milk solution has 45% milk in it?

$$80 \text{ L} = \frac{45}{55} \times 80 \text{ L}_{\text{milk}} = 36 \text{ L}_{\text{milk}}$$

$$36 \text{ L}_{\text{milk}} + x \text{ L}_{\text{milk}} = 80 \text{ L}_{\text{milk}} + (x) \text{ L}_{\text{milk}}$$

$$(36+x) = \frac{75}{100} \times 80 + x = 60 \text{ litres milk}$$

5)

A pot contains 40 litres of juice. How much juice will be there in the pot if 4 litres of juice was removed and was replaced by water and repeated twice.

Initially we had 40 litres  
we remove 4

$$40l - 4l = 36l$$

Ratio of J: water

9:1

further this process is repeated twice

removed

$$\frac{36}{36+4} \times 4 = 3.6$$

$\frac{36+4}{36}$   
Juice water

$$36 - 3.6 = 32.4$$

32.4:7.6

$$\frac{32.4}{32.4+7.6} = \frac{32.4}{40} \times 4 = 3.19$$

So totally  $40 - 3.6 - 3.19 = 29.16$

6.)

one glass has juice & water in the ratio 5:2 while other glass has 7:1 in the ratio.  
If both glasses poured in a vessel, then what will be final ratio of w:j

Given

$$5:2$$

$$\frac{5}{7} - J$$

$$\frac{2}{7} w$$

WJy

$$\frac{7}{11} - J$$

$$\frac{4}{11} - w$$

Total add

$$J = \frac{5}{7} + \frac{7}{11} = \frac{55+49}{77} = \frac{104}{77}$$

$$w = \frac{2}{7} + \frac{9}{11} = \frac{21+29}{77} = \frac{50}{77} = 25.97$$

W:J

- 7) Ramesh mixes 60 litres of Type 1 and 32 litres of Type 2 acid. Type 1 acid is ₹32/litre. Ramesh sells this acid at ₹77/litre. How much Type 2 acid he needs?

Type 1	Type 2
60 l	x
32 ₹	28 ₹

$$60 \times 32 + 28x = 28(60+x)$$

$$S = 48 \text{ litres}$$

- 8) In a mixture of 90 l the ratio of acid & water is 2:1. If the ratio of acid & water is 1:2 then amount of water

$$A:W = 90 \quad A:W = \frac{2}{3} \times 90 = 60 \quad W = 30$$

$$2:1 = 90 \quad 3$$

So in order to make it add 90 litres of water

2:1

9.) 3 types of sugar got mixed by accident. First was Jaggery second is Muscovy. Quantities of sugar 2:11:3 be sold all of them for 180/kg. Cost of Jaggery

$$145 + 163 + ? = 180 \times 6K$$

$$2K \propto 3K$$

$$290 + 165 + 3? = 1080$$

$$\frac{?}{3} = \frac{525}{2} = 175 \text{ kg}$$

10.) A mixture of two food salt to sugar Jaggery, Industrial - 2:11 & 5:21 in what proportions are they mixed

Let's take salt then calculate sugar

$$\frac{2}{13}, \frac{5}{26}$$

$$\frac{1}{13} \rightarrow \frac{3}{39}$$

$$\text{Value of quantity} \rightarrow \frac{5}{26} - \frac{1}{39} = \frac{1}{78} \quad \frac{2}{13} - \frac{1}{39} = \frac{1}{39}$$

$$\frac{1}{78} : \frac{1}{39} = 2:1 \quad 1:2$$

11) A solution of honey and water is initially with honey & water 1:3. To this 21 litres honey water solution is added that has honey to water ratio 2:1. Again a 51 litre honey-water mix has honey to water as 9:8 is added to it. After 10 litres of solution is replaced with pure honey. What is ratio of water to honey.

28 litre

$$H = \frac{4}{7} \times 28 = 16$$

$$W = 12$$

211 litre

$$H = \frac{2}{3} \times 211 = 141 \text{ lit.}$$

$$W = 77 \text{ lit.}$$

51

$$\frac{9}{17} \times 51 = 27$$

$$W = 24$$

$$\text{Total} = 100 \text{ lit.} - 57 \text{ lit. honey} = 43 \text{ lit. water}$$

$$\frac{57 \times 10}{100} = 5.7 \text{ - Honey removed} \quad 4.3 \text{ - water...}$$

$$\therefore 57 - 5.7 + 10 = 61.3 \text{ - Honey}$$

$$43 - 4.3 = 38.7 \text{ water}$$

$$61.3 : 38.7$$

12) Rohit buys some rice at ₹ 10/kg. He mixes it with rice having ₹ 8/kg. final mixture 15kg with total ₹ 140.4. What is quantity of rice priced at ₹ 10/kg

$$\begin{array}{r} 8.8 \\ \downarrow \\ 0.64 \end{array} \quad \begin{array}{r} 10.1 \\ \downarrow \\ 0.96 \end{array}$$

↓

$$2:3$$

$$\frac{116.9}{13} = 8.9$$

$$\frac{11.28}{4.5} = 3.3$$

$$2x + 3k = 15 \text{ M}$$

$$k=3$$

26.6 Key

- (B.) Sunil started a juice counter. Initially he had 140 litres juice which had 30% water in it. He sold 20 litres of juice. Then he added equal amount of lemon syrup and water. Now syrup is 1/2. How much water was added?

30 l. water for 1 l. in 140 l. juice  
the ratio is 20

So in 120 l. juice

$$\frac{30}{100} \times 120 = 36 \text{ litres water}$$

84 litres Syrup

$$\frac{84}{36} = \frac{1}{2}$$

A = M : N

- 14) A milkman had water & milk mixture in a can with water to milk ratio 5:7. He accidentally spills  $\frac{1}{12}$  of mixture. He then fills the can with cow's milk having 2:3 ratio. This makes water to milk ratio 9:7. How much it had initially?

$$5K \text{ } 7K$$

$$\frac{5}{12} \times q = 3.75 \text{ litres - water}$$

$$\frac{7}{12} \times q = 5.25$$

$$5K - 3.75 + q = 5K + 5.25$$

$$M = 7K - 5.25$$

$$\frac{q}{7} = \frac{5K + 5.25}{7K - 5.25} \approx K = 3$$

$$7(?) \quad 21 \text{ litres}$$

## Ratio & Proportion

When we compare 2 quantities we do it  
in ratios

$$\text{Say } P = 50$$

$$10 = 50 \text{ kmph}$$

$$P : 9$$

$$50 : 1$$

$$5 : 1$$

$$a:b \rightarrow \frac{a}{b}, \quad b:a \rightarrow \frac{b}{a}$$

When we compare and equate we call it  
Proportion -

$$\frac{a}{b} = \frac{c}{d} \quad \text{or} \quad ad = bc$$

Tip:

$$\frac{a}{b} > \frac{c}{d} \Rightarrow ad > bc$$

$$\frac{a}{b} > \frac{c}{d} \Rightarrow ad > bc \Rightarrow \frac{a}{b} \text{ is greater than } \frac{c}{d}$$

$$\frac{a}{b} > \frac{c}{d} \Rightarrow \frac{ad}{b} > \frac{cd}{d}$$

$$\frac{a}{b} > \frac{c}{d} \Rightarrow \frac{a-b}{b} = \frac{c-d}{d} - \text{Dividend}$$

$$\frac{a+b}{b} = \frac{c+d}{d}$$

$$\frac{a+b}{a+b} = \frac{c+d}{c+d}$$

$$\frac{a+d}{b+d} = \frac{b+d}{a+c}$$

$$a:b::c:d \Rightarrow \frac{a}{b} = \frac{c}{d}$$

To get actual values,

$$\frac{5}{6} = 5:6 \quad 5K:6K$$



~~a:b::c:d~~

Actual  
ratio  
is  
not  
proportional

- 1) which of the following two ratios are greater  
17:18 E.P.O.I.I.

$$a:b::c:d \Rightarrow \frac{a}{b} > \frac{c}{d}$$

$$\frac{17}{18} : \frac{10}{11} = 17 \times 11 :: 10 \times 18$$

$$187 > 180$$

17:18 is greater

- 2) The 3rd Proportional to 18 & 54 is?

$$a:18 \quad b:54 \quad c:?$$

$$a:b::b:c$$

$$\frac{a}{b} = \frac{b}{c} \Rightarrow b^2 = ac$$

$$54 \times 54 = 18(c)$$

$$c = 162$$

3) What is the 1<sup>st</sup> proportion in 9, 13, 9, 153

$$a:b::c:d$$

$$\frac{a}{b} = \frac{c}{d} = \frac{a}{13} = \frac{c}{d}$$

$$d = \frac{bc}{a} = \frac{13 \times 153}{9} = 221$$

4) Find the mean proportion between 7 & 63

$$a:b::b:c$$

$$\frac{a}{b} = \frac{b}{c} = b^2 : ac \quad b^2 : 763 = b = 21$$

$$5) \frac{10}{10} = \frac{11}{28} = \frac{21}{11} = \frac{12}{6} = K$$

$$\frac{10+11+21+12}{10+28+11+6} = K = \frac{54}{63} = \frac{6}{7}$$

6) Income ratio of Ramesh & Singh is 5:6.  
Their spending ratio is 7:9. Ramesh saves  
4000. Singh saves 3000. Income & spending  
are?

We take k as

$$5k:6k$$

$$\text{Income} = \text{Spend} + \text{Save}$$

$$\text{Spending} = \frac{\text{Income}}{5k+6k} - \frac{\text{Save}}{5k+6k}$$

$$\frac{I}{a} = \frac{5K - 1000}{6K - 2000} = \frac{42K - 21000}{K - 3000}$$

Subtract K

$$25000 - 4000 = 21000$$

$$50000 - 29000 = 21000$$

- 7.)  $a:b = 3:7$  &  $b:c = 9:5$  what are a,b,c  
make B values same

$$a:b:3:7:9:5$$

$$3 \times 9 : 7 \times 9 :: 9 \times 7 : 5 \times 1$$

$$27:63::63:35$$

$$27:63:35$$

- 8.) How to Divide 3395 in ratio of 42:32:23  
Method 1

$$42 \times 3395 = 1470 \quad 47K + 32K + 23K = 3395$$

$$42+32+23$$

$$32 \times 3395 = 1120$$

$$97$$

add and subtract

$$1470 + 1120 = 3390$$

$$0.603$$

$$97K = 3390$$

$$K = 35$$

$$42(35) = 1470$$

$$32(35) = 1120$$

- 9) 285 is summation of 3 numbers. Ratio between 2nd and 3rd numbers 6:5, ratio between 1st & 2nd is 3:7. The 3rd number is

$$3:7 :: 6:5$$

b is not same make it 10

$$3 \times 6 : 7 \times 6 :: 6 \times 7 : 5 \times 7$$

$$18:42 :: 42:35$$

$$18:42:35$$

we need only 35

$$\frac{35}{18+42+35} = \frac{105}{115}$$

- 10) Ratio of two numbers is 3:8 - on adding 5 to both numbers, the ratio becomes 2:5, which is the smaller out of 2

$$A:B = 3:8$$

$$3K:8K$$

$$\frac{3K+5}{8K+5} = \frac{2}{5}$$

$$15K+25 = 16K+10$$

$$K = 15$$

for smallest value

$$3K = 45$$

11) find A:B:C:D when A:B = 2:3, B:C = 7:9, C:D = 3:2

$$\frac{2}{3} \times \frac{7}{9} \times \frac{3}{2}$$

for first number multiply all numerators

$$2 \times 7 \times 3 = 42 \quad \text{--- (1)}$$

for last number multiply all denominators

$$3 \times 9 \times 2 = 54 \quad \text{--- (2)}$$

for B follow that P.M.

$$3 \times 7 \times 5 = 105$$

for D follow that P.M.

$$3 \times 9 \times 5 = 135$$

$$A:B = a:b \quad B:C = c:d \quad C:D = e:f$$

$$A:B:C:D = acd : bce : bde : bdf$$

D.) Price of each article of type P, Q, R is ₹ 300, ₹ 180 and ₹ 120 respectively. Suresh buys each type in ratio 3:2:3 in ₹ 6480. How many articles did he purchase?

$$\text{₹ } 300 = 3k \quad \text{₹ } 120 = 3k$$

$$\text{₹ } 180 = 2k$$

So total cost

$$300k + 180k + 120k = 6480 \quad \text{--- (1)} \quad 600k = 6480 \quad \text{--- (2)}$$

$$600k = 6480$$

$$k = \frac{6480}{600}$$

$$k = 10.8$$

13)

Ajay & Ray together have Rs 1050. out of which  
 If 150 rupees from Ajay, Ajay will have same  
 amount as what Ray had earlier. find  
 the ratio of amounts of their initially.

$$A+R = 1050 \quad \text{---} \textcircled{1}$$

$$A-150=R$$

$$A-R=150 \quad \text{---} \textcircled{2}$$

Adding  $\textcircled{1}$  &  $\textcircled{2}$

$$A+A+R=1050+150$$

$$2A = 1200$$

$$A = 600$$

$$R = 450$$

$$A : R = 600 : 450$$

$$4 : 3$$

14.) If  $xy = 3 \cdot 4$  then  $(x+y) : (x-y)$

Short cut

$$x=3 \quad \text{and} \quad y=4$$

$$\frac{7(3)+3(4)}{7(3)-3(4)} = \frac{33}{9} = \frac{11}{3}$$

(or)

$$\frac{7x}{9} = \frac{21}{4} \quad \text{---} \textcircled{1}$$

$$\frac{7x+2y}{7x-2y} = \frac{21}{9}$$

$$\frac{7x}{3y} = \frac{21}{21} \quad \text{---} \textcircled{2}$$

15) If  $a:b = 5:7$  and  $c:d = 2a:3b$  and

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

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

$$\frac{10a}{21b} = \frac{10a}{\cancel{21b}} = \frac{10 \times 5}{\cancel{21} \times 7} = \frac{50}{147}$$

16) The three numbers are in the ratio  $\frac{1}{2} : \frac{2}{3} : \frac{3}{4}$   
the difference between greatest & smaller is  $\frac{1}{2}$   
is 36 find number

$$\frac{1}{2} : \frac{2}{3} : \frac{3}{4} \quad \text{small} \quad ?$$

$$K \cdot \frac{2k}{2} \cdot \frac{3k}{3} = 0.5k : 0.6k : 0.75k$$

$$\frac{3k}{1} - \frac{k}{2} = 36 \quad \cancel{4k} = k = 36 \times 4$$

Now substitute in

$$\frac{K}{2} = \frac{36 \times 4}{2} = 72 \quad \frac{2k}{3} = \frac{36}{3} = 12$$

17) The ratio of market price of wheat & Paddy 2:3 and the ratio of quantities 5:4 find ratio on extension.

W.P. 2:3

2K:3K

Consumption = 5P:4P

rate  $\times$  consumption (expansion)

$$\frac{2K \times 5P}{3K \times 4P} = \frac{5}{6}$$

18) Rs 8400 is divided among A, B, C and D in such a way shares are A and B, B and C, C and D of ratios 2:3, 4:5, 5:7 respectively.

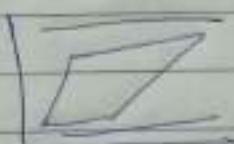
$$A:B = 2:3 \quad B:C = 4:5 \quad C:D = 5:7$$

That like ratio

$$4 : B : C : D \text{ (and)}$$

$$48 \quad 72 \quad 90 \quad 105$$

num (and) Share of \*



$$\frac{48}{48+72+90+105} \times 8400 = 1280$$

- 19) In a library, the ratio of number of story books to that of non-story was 4:3 and total number was 1248 when some more story books were bought ratio became 5:3 find the number of story book is how.

$$\frac{S}{NS} = \frac{4}{3}$$

$$\frac{1248}{NS} = \frac{4}{3}$$

$$NS = 936$$

M - books were added

$$\frac{1248+M}{936} = \frac{4}{3}$$

$$M = 312$$

HCF G

GCD

$$6 \rightarrow 1 \times 6$$

$$2 \times 3$$

$$3 \times 2$$

$$\textcircled{6} \rightarrow \text{GCD}/\text{HCF}$$

find HCF 42 54 36

$$2 \mid 42 \quad 54 \quad 36 \quad \text{Start from}$$

$$3 \mid 21 \quad 27 \quad 18$$

$$7 \mid 7 \quad 9 \quad \text{They cannot be further divided}$$

$$\text{GCD} = 2 \times 3 = 6 //$$

LCM

$$2 - 2, 4, \textcircled{6}, 8, 10, 12, 14, 16, 18, 20, 22, 24$$

$$3 - 3, 6, 9, 12, 15, 18, 21, 24,$$

$$\text{LCM}(2,3) = 6 // \text{ least multiple}$$

LCM

$$\begin{array}{c|ccc} 5 & 250 & 100 & 125 \\ 5 & 50 & 20 & 25 \\ 5 & 10 & 4 & 5 \\ 2 & 2 & 4 & 1 \\ 2 & 1 & 2 & \\ & 1 & 1 & \end{array}$$

$$\text{LCM} = 5 \times 5 \times 5 \times 2 \times 2 = 500 //$$

## Tips

$16, 144, 30, 6$  - Just through observation

LCM

$12, 24, 36, 72, 144$

if they are multiple the consider  
equivalent as the LCM

$144$   
 $24, 36, 72 - 72$

pls note every thing should be a  
multiple

not a multiple

$12 \ 36 \ 48$

$$\begin{array}{r} 12 \ 12 \ 36 \ 48 \\ \hline 3 \mid 134 \\ 3 \quad \quad \quad 110 \\ \hline 144 \end{array}$$

$48 \times 2 = 96$

$48 \times 3 = 144$  — can be a  
multiple

classic method

$$\frac{1}{30} - \frac{1}{45} = \frac{45-30}{30 \times 45} = \frac{1}{90}$$

1) What is LCM of  $\frac{36}{225}$ ,  $\frac{48}{150}$ ,  $\frac{72}{65}$

\*\*

LCM fraction =  $\frac{\text{LCM Numerator}}{\text{HCF Denom.}}$

36 48 72

$$\frac{144}{5} \cancel{\times}$$

LCM = 144

$$\text{HCF} = 12 \mid \underline{225, 150} \\ 45 \quad 36$$

2) What is HCF of  $\frac{36}{75}$ ,  $\frac{48}{150}$ ,  $\frac{72}{135}$

HCF fraction =  $\frac{\text{HCF Num.}}{\text{LCM Denominator}}$

$$\text{HCF} = 12$$

$$\text{LCM} = 4350$$

$$\frac{12}{4350} \cancel{\times}$$

If greatest = HCF  
If sum / least = LCM

3.) what is the greatest number that divides 17, 41 and 93 and leaves 4, 3 and 5 respectively?

$$\frac{17}{x} = 4 - 0$$

$$\frac{41}{x} = 3 - 0 \quad \frac{93}{x} = 15$$

$$17 - 4 = \frac{13}{x} - 0 \quad \frac{39}{x} = 0 \quad \frac{71}{x} = 0$$

L.C.D of 4, 56

$$\frac{17}{13} = 1 - 0$$

So on

$$\begin{array}{r} 13 & 39 & 71 \\ \times & & \\ 13 & 39 & 71 \\ \hline 0 & 0 & 0 \end{array}$$

→ can it fit  
don't go  
further

4.) what least number when divided by 36, 24, 16 leaves 11 remainder in each case.

first take L.C.M

$$\begin{array}{c|ccc} 1 & 36 & 24 & 16 \\ 3 & 9 & 8 & 5 \\ 2 & 3 & 4 & 4 \\ \hline & 3 & 1 & 0 \end{array}$$

L.C.M = 144 but 104 divide perfectly

$$144 + 11 = \underline{\underline{155}}$$

- 5) What least number when divided by 20, 49  
 & 36 leaves remainder 13, 41, 89

Take LCM

$$\begin{array}{r} 20, 49, 36 \\ \hline 3 \mid 5 \quad 12 \quad 9 \\ \quad \quad 5 \quad 4 \quad 3 \end{array}$$

$$20-13=7 \quad 49-41=8$$

$$36-89=7$$

LCM

$$720 - 7 = 713$$

- 6) What least possible 4-digit number when divided by 12, 16, 18, 20 leaves 21 as remainder

$$\begin{array}{r} 12 \quad 16 \quad 18 \quad 20 \\ \hline 2 \mid 6 \quad 8 \quad 9 \quad 10 \\ \quad \quad 3 \mid 3 \quad 4 \quad 9 \quad 5 \\ \quad \quad \quad 9 \quad 3 \end{array}$$

LCM = 720

Since they want 4-dgt  
 take multiple

$$1440 + 21$$

$$1461$$



7.) The ratio of two numbers is 5:5 and LCM is 450.  
HCF = ?

$$AB = HCF \times LCM$$

$$5K \times 6K = 30K^2$$

$$30K = 450$$

$$K = 10 - \text{HCF}$$

$$15 \times 10 = 300 = an$$

$$\text{HCF} = 5$$

$$LCM = 60$$

$$15 \times 4 = 60 - \text{an}$$

8.) HCF and LCM of two numbers is 8 and 96.  
Sum of those numbers is 56. Then what is  
numbers?

$$AB = HCF \times LCM$$

$$A=8 \quad B=96$$

$$\frac{1}{8} + \frac{1}{96} = \frac{56}{8 \times 96} = \frac{7}{96}$$

9.) What largest number will divide 47, 35 & 27  
leaving remainder in each case what will be  
common remainder

47, 35, 27

3st subtract

$$47 - 35 = 12$$

$$35 - 27 = 8$$

$$27 - 12 = 15 \quad \text{gcd} = 4$$

$$\begin{array}{r} 47 \\ 35 \\ 27 \\ \hline 12 \end{array} \quad \begin{array}{r} 47 \\ 35 \\ 27 \\ \hline 12 \end{array}$$

Now divide on

$$\begin{array}{r} 47 \\ 35 \\ 27 \\ \hline 12 \end{array} \quad \begin{array}{r} 47 \\ 35 \\ 27 \\ \hline 12 \end{array} \quad \text{so on}$$

- 10.) There are 3 equilateral triangles with sides 114 cm, 76 cm and 152 cm. what maximum size can measure them

$$\begin{array}{r|ccc} 2 & 152 & 114 & 76 \\ \hline 19 & 57 & 38 & 76 \\ & 3 & 2 & 4 \end{array}$$

$$\text{GCD} = 38$$

Now it can be placed perfectly

- 11.) If  $(x-a)$  is the HCF of  $x^2-8x+15$  &  $x^2-Kx-1$  then what is  $k$

If says when  $x=a$  answer is zero

$$x=a$$

$$x^2 - 8x + 15 = 0$$

$$x^2 - Kx - 1 = 0$$

$$x^2 - 8x + 15 = x^2 - Kx - 1 = 0$$

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

$$\text{Sub } x=a \text{ in eqn}$$

$$x^2 - 8x + 15 = x^2 - Kx - 1$$

$$K=8$$

future can be only found using LCM  
It shows future accuracy

- Q.) 5 clocks ring automatically at intervals of 12 minutes, 8 minutes, 3 minutes, 4 minutes and 10 minutes. In 2 hours from moment they start, how many times will they ring?

2	12	8	3	4	10
2	6	4			5
	3	2			5

$$\text{LCM} = 12 \times 8 \times 3 = 240 \text{ min}$$

$$\frac{240}{2} = 120 \text{ hours}$$

- Q.) 3 cyclist along the circumference of a jungle. They complete one round in 27 minutes, 45 minutes and 63 minutes. Since they start together, when will they meet?

9	27	45	63
	3	5	7

$$\text{LCM} = 9 \times 5 \times 7 = 315 \text{ min}$$

14.)

Many wants to paste wall paper on wall.  
 The wall is 4metres and 50cm in length  
 3metres and 50cm in height. Wall needs to be  
 covered completely by square pieces of wall paper  
 having same size. What is the number of  
 minimum sized wall paper.

$$\begin{array}{r} 50 \\ \sqrt{150 \quad 350} \\ \quad 25 \end{array}$$

$$\begin{array}{r} 180 \text{ cm} \\ \sqrt{350 \quad 50} \\ \quad 180 \end{array}$$

$$\text{HCF} = 50$$

To Inorder to find total wall paper

$$\frac{150 \times 350}{50 \times 50} = 63$$

15.) The sum of 2 numbers is 156 and HCF is 13.  
 The number of such numbers pairs :-

If it has 13 then HCF it needs to be  
 13 multiples so

$$13 \quad 26 \quad 39 \quad 52 \quad 65 \quad 78 \quad 91 \quad 104 \quad 117 \quad 130 \quad 143$$

$$\text{HCF}(13, 156) = 13$$

$$\text{HCF}(26, 156) = 26$$

$$\text{HCF}(39, 117) = 13$$

$$\text{HCF}(52, 91) = 13$$

So only 2

16) What is the least number when divided by  
3, 5, 6, 11, 13 leaves remainder 2 and  
when divided by 13 remained 8.

$$\text{a) } 312 \quad \text{b) } 962 \quad \text{c) } 1562 \quad \text{d) } 1991$$
$$+ 13$$

$$1566 - 2 \neq 210 \quad 312 - 310 \neq 8 \quad \text{So } 962 \cancel{\equiv}$$

Work  
E.  
Wages

## Tips

- 1) More work more money      4.)  $\uparrow$  work  $\uparrow$  money

$\uparrow$  work  $\uparrow$  money

A - 2D      B - 3D } were invented

- 2) Less days more money

A - 2 Days

B - 3 Days

$$A = \frac{1}{2}, B = \frac{1}{3}$$

$$A:B = \frac{1}{2} : \frac{1}{3} = 3:2$$

Income of  $\frac{1}{\text{Days}}$

5.) Invert

Ratio of Days = 2:3      Inverted

Ratio of Income = 3:2

If A days  $\frac{1}{8}$  hour  
day, he took = 8 days

- 3.) Share of money

$$B = \frac{2}{3+2} \times \text{Total} \quad A = \frac{3}{3+2} \times \text{Total}$$



1) Ramesh can do a work in 5 days. Suresh can do a work in 7 days. Total amount is ₹ 480. If both work together what will be share of each.

ratio of days of 1

income

$$7:5 \rightarrow 7 \text{ days}$$

$$5:7 \rightarrow 5 \text{ days}$$

So Ramesh

~~$\frac{7}{12} \times 480 = 280$~~ 

$$\frac{7}{12} \times 480 = 280$$

Suresh

$$1180 - 280 = 900$$

→

2) Ramesh can do a ~~particular~~ work in 15 days. Vijay and Ramesh together do the same work in 10 days. They received ₹ 1155 for that work. What is share of Ramesh & Vijay

$$R = 15 \text{ days: } \frac{1}{15} \quad v = \frac{1}{v} \quad \text{Total: } \frac{1}{10}$$

$$\frac{1}{v} = \frac{1}{10} - \frac{1}{15}$$

$$\frac{1}{v} = \frac{1}{30}$$

$$v = 30 \text{ days}$$

$$\text{ratio day } 1:15:30$$

$$\text{ratio of inc } 30:15$$

Income

$$\text{Ratio of 1 day } \frac{1}{15} : \frac{1}{30}$$

$$R = \frac{2}{3} \times 1155 = 770$$

$$v = 1155 - 770 = 385$$

5.) Wages of 44 women for 56 days comes to RS 29,560.  
 How many men are needed for 17 days to  
 do 20. If daily wage of a man being 5 times  
 of a woman.

$$44w \text{ for } 56 = 29,560$$

$$44w \text{ for 1 day} = \frac{29,560}{56}$$

$$1w \text{ for 1 day} = \frac{29,560}{56 \times 44} = \text{RS. } 12$$

also men get 5 times  
 $12 \times 5 = 60$

~~$1m$~~  1 man 1 day = 60

$$1 \text{ man } 17 = 60 \times 47$$

$$16920 = 60M \times 47$$

$$M = 6$$

4.) P, Q and R take a job for ₹ 640. P and Q finish work together =  $\frac{2}{5}$ . Rest is done by R. What is the share of R?

P + Q + R = 1      he gets rest

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

$$\frac{3}{5} \times 640 = 384$$

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

- 6) P can do a job in 30 days, while Q does it in 45 days. They work together for 15 days and rest is done by P in 6 days. They get 15,000 for whole job. What will be P's share?

$$P \rightarrow 30 = \frac{1}{30} \quad Q = 45 = \frac{1}{45}$$

$$\frac{1}{30} + \frac{1}{45} = \frac{1}{18}$$

They did it for 15 days.

$$\frac{15}{18} = \frac{5}{6}$$

Work done by P =  $\frac{1}{6}$

$$\text{So Share} = \frac{1}{6} \times 15000 = 2500$$

- 7) A man and a boy received ₹ 1800 as wages for 3 days for job they did together. The man's efficiency in work was 5 times that of a boy. What is the daily wage of the boy?

$$M+B = 1800 \text{ for } 3 \text{ days}$$

$$1 \text{ day } M+B = 600$$

5:1 is ratio of work

$$\frac{1}{6} \times 600 = 100$$

8) Parthiv was appointed for 100 days job. The condition was that he will be paid ₹ 29 every working days. He will also be fined ₹ 5/- for every day he is absent. If total wages are ₹ 402/- for how many days he was absent?

100 - K - he was absent  
fine - 240

$$(100 - K) \times 29 - 240 = 402$$

$$K = 55$$

9) Total wages of 6 men, 4 women & 8 boys is ₹ 5.26. if the wages of 5 men is equal to that of 8 women and wages of 4 women is equal to that of 6 boys. Then find out the total wages of 6 men, 4 women, and 8 boys.

$$6M = 8W \quad 4W = 6B$$

$$\frac{M}{6} = \frac{W}{8} \quad B = \frac{4W}{6}$$

taking all in single var -

$$6M + 4W + 8B = 16$$

$$8W + 4W + \left(\frac{9W}{6}\right) = 26$$

$$W = ₹ 1.5$$

$$M = ₹ 2$$

$$B = ₹ 1$$

Then we need to find  
6M + 4W + 8B

$$16 + 8 + 8 = ₹ 22$$

(10) P,Q,R get Rs 10800 for doing a work in 18 days.  
 P and R get Rs 37.60 for doing the same work in  
 10 days while Q and R get Rs 102 for doing same  
 2 days - find the amount by.

$$P+Q+R = \frac{10800}{18} = 600 \text{ Rs - 1 day}$$

$$P+R = \frac{37.6}{10} = 3.76 \text{ - 1 day}$$

$$Q = \frac{10800 - 720}{720} = 304 \text{ - 1 day}$$

$$P+Q+R = 600$$

~~$$P+R = 304 = 600$$~~

$$P = 296$$

$$P+R = 37.6$$

$$R = 80$$

(11) The amount of money with which A's wage  
 can be paid for 18 days when A is working alone  
 is enough for paying B's wage for 12 days  
 when B is working alone. If A and B start  
 working together, then same amount would  
 be enough for wages of both for how many  
 days?

$$A = 1d = \frac{N}{18} \text{ days} \quad B = \frac{N}{12} \text{ days}$$

$$\frac{N}{18} + \frac{N}{12} = \frac{2N}{36} = \frac{5N}{36} \text{ days}$$

$$\frac{5N}{36} = ? \therefore ? = \frac{36}{5}$$

12.)

Johnny employs 8 workers to work for 6 hours per day. In total he pays them Rs 630 for a week. How much should Johnny pay 18 workers working 4 hrs per day for a week?

Convert it into accn,

$$6 \text{ hrs} \times 7 = 42 \text{ hrs} \quad \text{A hr/day} \rightarrow 7$$

$$8 \text{ workers} \times 630$$

$$4 \times 7 = 28$$

$$1 \text{ worker} = \frac{15}{8} \text{ hrs}$$

$$18 \text{ workers} = \frac{135}{8} \text{ hrs}$$

$$18 \text{ workers} = \frac{15}{8} \times 18 = \frac{135}{4} \text{ hrs}$$

~~Rs. 945~~

13.)

Ram & Shyam have given a task of painting a house for Rs 800. With help of Rita, they complete the job in just 3 days. Had Ram alone be doing the job he would need 6 days. If Shyam need 8, how much more Rita get?

$$R \rightarrow 6 \text{ d} \rightarrow 1/6 \quad S \rightarrow 8 \text{ d} \rightarrow 1/8 \quad R+S=1/3$$

$$\frac{1}{6} + \frac{1}{8} + \frac{1}{x} = \frac{1}{3}$$

$$\frac{1}{x} = \frac{1}{24}$$

$$\frac{1}{6} : \frac{1}{8} : \frac{1}{24}$$

$$4:3:1$$

$$R:S:T = \frac{1}{4+3+1} \times 800 = 100 \text{ Rs.}$$

## Simple Interest

Simple Interest

Principle  $\times$  Rate of Interest  $\times$  Time

$$I = \frac{P \cdot R \cdot T}{100}$$

$$\frac{P \cdot R \cdot T}{100}$$

for half year

for month

$$\frac{1}{2}T = \frac{P \left( \frac{R}{2} \right) \frac{1}{2}T}{100}$$

$$\frac{P \left( \frac{R}{n} \right) \frac{1}{n}T}{100}$$

for Quarter

$$\frac{P \left( \frac{1}{4} \right) \frac{1}{4}T}{100}$$

1. An amount of Rs 6500 at simple quarterly interest of 8% will yield how much in 2 and half years.

$$6500 \times 8 \times 2.5 \times 4$$

$$100 \times 4$$

$$S.I = 1300$$

$$A.m.t + S.I = 7800$$

2. An amount becomes 7 times in 15 years. In how many years will the same amount increase 8 times? The rate of interest remains same.

$$\text{Amt} = P + SI \quad A = 10P = SI + P$$

$$SI = CP$$

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

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

$$\frac{900}{A0} = T$$

$$12 - \frac{600}{T} = R = 40\% \quad T = 21.5 \text{ years}$$

3) A sum becomes Rs 3000 at rate of 12% per annum.  
The same sum becomes Rs 3300 at rate of  
15% per annum. Find sum & duration.

$$P \xrightarrow[12]{15} 3000 \quad \textcircled{1}$$

$$PT = 10,000$$

$$\text{Amt}_2 - \text{Amt}_1 = 300 \quad SI_1 = \frac{10,000 \times 12}{100} = 1200 \text{ Rs}$$

$$P + SI_2 - P + SI_1 = 300$$

$$\text{Amt}_1 = 3000 = P + 1200$$

$$SI_2 - SI_1 = 300$$

$$P = 1800 \text{ Rs}$$

$$\frac{P \times 15 \times T}{100} = \frac{P \times 12 \times T}{100} = 300 \quad T = \frac{10,000}{1800} = 10 \frac{1}{3}$$

$$\frac{50}{9} \text{ yrs}$$

4) A man got Rs. 130 less as simple interest when he invested Rs. 2000 for 4 years as compared to investing Rs. 2250 for same duration. What is rate of interest?

$$\begin{array}{ll} P = 2000 & P = 2250 \\ R? & ? - 4 \\ T = 4 & R \end{array}$$

$$A = P + SI$$

$$R = \frac{130}{2250 \times 4} = 0\%$$

$$SI_1 - SI_2 = 130$$

$$SI_1 - SI_2 = 130$$

$$\frac{2750 \times R \times 4}{100} - \frac{2000 \times R \times 4}{100} = 130$$

5)  $\frac{1}{5}$  part of an amount was given at 3% SI,  $\frac{1}{3}$  part was given at 5% SI,  $\frac{2}{5}$  parts at 9% SI and remaining part at 11% SI. The total received was 297. How much amount was given originally?

$$\begin{array}{lll} \frac{P}{5} & \frac{P}{3} & \frac{2P}{9} \\ 3\% & 5\% & 9\% \end{array}$$

$$\frac{P}{15} \rightarrow 11\%$$

$$SI = SI_1 + SI_2 + \dots + SI_n$$

$$297 = \frac{P/5 \times 1 \times 3}{100} + \frac{P/3 \times 1 \times 5}{100} + \frac{2P/3 \times 1 \times 9}{100} + \frac{P/15 \times 1 \times 11}{100}$$

$$RS = 480$$

6) Rs 20100 was divided in 2 parts, and then invested one part for 6.75% for 8 yrs. The same as other for 7% at 5 yrs. What is the value of smaller part?

$$\frac{x \times 6.75 \times 8}{100} = \frac{(20100 - x) \times 7 \times 5}{100}$$

$$10x = 20100 \times 7 - 7x$$

$$x = 6400$$

7) If SI on a certain sum for 15 months at 7(1/11)% per annum exceeds the SI on some sum for 8 months at 12(1/2)% per annum by Rs. 37.50

$$SI_1 - SI_2 = 37.50$$

~~$$\frac{P \times 7.5 \times 15}{100 \times 11} - \frac{P \times 12.5 \times 8}{100 \times 11} = 37.50$$~~

$$\frac{45P}{1200} - \frac{40P}{1200} = 13$$

$$P = 3120$$

8) If simple interest for 2 years for a sum is Rs 1500  
and CI for same sum has rate of  
inter.

$$SI = \frac{300 \times 300}{100} = 600$$

$$CI = \frac{300 \times 300}{100} = 645$$

will be the same for first

Pt 300

$$A.S = \frac{300 \times 1 \times r}{100} = R = 15\%$$

9) Aman invest Rs 8000 at some rate of interest  
Being simple interest the money double in 5 years  
Now use this and invest Rs 6250 for 3 yrs,  
at same rate of interest find -

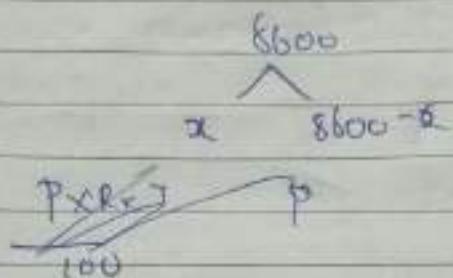
$$SI = 8000$$

$$\frac{8000 \times R \times 5}{100} = 6250$$

$$R = 20\%$$

$$\frac{6250 \times 20 \times 3}{100} = SI = 5750$$

10.) Aman got a salary of Rs 8600. The salary was invested by him in 2 parts. Find the difference between the two parts of his salary if 1st part is invested at 15% per annum S.I. which was same as the second part invested at 20% for 3 years.



$$\frac{M \times 15}{100} = \frac{(8600 - P) \times 20 \times 3}{100}$$

$$M = 4300 \text{ Rs.} \quad \text{--- (1)}$$

$$4300 \text{ Rs.} \quad \text{--- (2)}$$

11.) Ram gets Rs 2600 for 2000 Rs in S.I. at some S.I. had to be invested in other places where rate of S.I. is 5% more than current rate, how much ram would have got

$$2000 \text{ Rs.} \rightarrow 2600 = \cancel{P} \text{, } A = P + S \text{, }$$

$$S.I. = 2600 - 2000 = 600 \text{ Rs.} = \frac{P \times R \times T}{100}$$

$$\cancel{P}$$

$$R = 6\%$$

$$\text{Amt} = P + SI_2 = 2000 + \frac{2000 \times 9 \times 5}{100}$$

$$P = 2900$$

- Q.) Ramon paid Rs 11400 as interest after 3 years.  
He had borrowed some money at 6% for 2 yrs,  
9% for 3 years and 14% for next. How much did he  
borrow?

6% 9% 14%

2 yrs 3 yrs 4 yrs

$$SI = SI_1 + SI_2 + SI_3$$

$$11400 = \frac{P \times 2 \times 6}{100} + \frac{P \times 9 \times 3}{100} + \frac{P \times 14 \times 4}{100}$$

$$P = \frac{11400 \times 100}{91} = 12400$$

- Q.) Surash for 2 years invested Rs 500 in SBI  
He also invested Rs 300 in KBL for 4 yrs.  
He received 220/- as simple interest.  
What must have been the rate?

$$220 = \frac{500 \times 2 \times R}{100} + \frac{300 \times 4 \times R}{100}$$

$$R = 10\%$$

classmate  
Date \_\_\_\_\_  
Page \_\_\_\_\_

### Compound Interest

$$\text{Amount} = P + SI$$

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

2.) up

Adjustment factor

Simple

Diff b/w C.I & S.I for  
Diff b/w CI & S.I for  
Installments

Difference Compound I & SI for 2 yrs

$$\text{Diff} = P \left( \frac{R}{100} \right) = \frac{SI \times R}{200}$$

$$\text{Diff for 3 yrs} = P \left( \frac{R}{100} \right)^2 \left( \frac{R+3}{100} \right)$$

3.)

Population

$$\text{population in yrs} = P \left( 1 + \frac{R}{100} \right)^n$$

- 1.) what will be the interest earned on sum of 6400 kept for 6 months at 25% rate compounded annually

$$(M = P \left( 1 + \frac{R}{100} \right)^n) \quad r = \frac{R}{A} \quad T = A \cap = 4 \text{ yrs} \cdot 1 \cdot 1$$

6 months = 0.5

$$6400 \left( 1 + \frac{25}{100 \times 4} \right)^2 = 7252$$

2.) what compound interest will be Rs 5000 after  
in 3 years 6 months at 30%.

3 years and 6 months =  $3 \frac{1}{2}$

if its in mixed fraction

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

$\left[ 1 + \frac{\frac{9}{5}R}{100} \right]$   
for mixed fraction

$$5000 \left( 1 + \frac{30}{100} \right)^3 \left( 1 + \frac{\frac{9}{5} \cdot 30}{100} \right) = 13731.25$$

$$13731.25 - 5000 = 8731.25$$

3.) how much money invested at compound  
interest will yield Rs 6350.40 at end of  
3 yrs for first year it increases to 12% and  
for 3rd decreases to 8%.

$$P \left( 1 + \frac{R}{100} \right)^n = P \left( 1 + \frac{12}{100} \right) \left( 1 + \frac{12}{100} \right) \left( 1 + \frac{8}{100} \right)^1 = 6350.40$$

$$6350.40 = P \left( \frac{112}{100} \right) \left( \frac{112}{100} \right) \left( \frac{108}{100} \right)$$

$$Rs = 5000$$

4.) An amount becomes 4 times in 6 years  
 In how many years it will becomes by  
 times, the no. when remain same  
 $A \rightarrow 6 \text{ yrs} \rightarrow 4A \rightarrow 4 \text{ yrs} \rightarrow A(A) = 16 \rightarrow 16(n) = 4 \times$

$$3(6) = 18 \text{ yrs}$$

5.) Rs 400 in S.I. for a sum for 4 yrs at 10% rate  
 of interest per annum. for (?) for same  
 sum rate of interest for same time per -

$$400 = P \times 10 \times 4$$

$$P = 100 \text{ } \text{Rs}$$

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

$$1000 \left(1 + \frac{10}{100}\right)^9$$

$$\text{Rs} = 1464.0$$

$$A = P + CI$$

$$\text{Rs} = 1464.10 - 1000$$

$$\text{Rs} 464.10$$

6) In 5 years by CI, a sum becomes 7900.  
 But in 1 year it becomes 10007, what  
 is sum & rate of interest?

$$SI = ST - P = 18150.$$

$$P = 900 = ? \text{ for } 5 \text{ yrs}$$

$$SI = \frac{P \times R \times T}{100} = 100 \quad \text{①} \quad R = 100 / 9 \text{ %} = 11.11 \text{ %}$$

$$A = 900 = P \left( 1 + \frac{100}{11.11} \right) = Rs. 656.$$

See in this case we are taking it as  
 compound and 900 - 1000 as SI coz of  
 1 yr rule so we get answer

7) The population of a city is 50,000 at  
 present. If increases at the rate of 10% per  
 annum. what will be the population 3 yrs. from  
 now

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

$$50,000 \left[ 1 + \frac{10}{100} \right]^3 = 66550$$

8) The population of city is 50,000 at present. If it increases at rate of 10%. Then answer what was its population 1 yrs ago from present.

$$P = P \left( 1 + \frac{v}{100} \right)$$

for past:

$$\frac{P}{\left( 1 + \frac{v}{100} \right)^n}$$

$$\frac{50000}{\left( 1 + \frac{10}{100} \right)^1} = 34,151 \approx$$

9) What will be difference in population 3 yrs ago and 2 yrs ago of Devon village, whose current population is 100,000 & which is increasing at a rate of 25%.

$$P_3 < P_2$$

$$P_2 - P_3$$

$$P_3 = \frac{P}{\left( 1 + \frac{R}{100} \right)^n} = \frac{100000 \times 64}{125} = 0$$

$$P_2 = \frac{100000}{\left(1 + \frac{4}{100}\right)^2} = \frac{100000 \times 100}{25}$$

$P_2 - P_1$

$$\frac{100000 \times 64}{25} - \frac{100000 \times 64}{100} = 12800$$

- 10) The difference between Simple SI on a certain sum of money for 2yrs at 4 Percent per annum is Rs. 1. The sum of money

Diff = SI - CI for 2 yrs

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

$$1 = P \left( \frac{4}{100} \right)^2 = P = 625 \text{ Rs}$$

- 11) Sarang invested some money in HDFC at 3% rate of interest. What would be corresponding SI after 2yrs? Sarang got Rs 1.50 (7)

$$\text{Diff} = C.I. - S.I. = P \left( \frac{R}{100} \right)^2 - \frac{S.I. \times 2}{100}$$

$$101.50 - C.I. = \frac{S.I. \times 3}{200}$$

$$S.I. = \frac{Rs 1.50}{3}$$

Q. find the principal amount invested if  
difference between C.I and S.I for 3 years  
at r% of 15% is 320

$$\text{Diff} = C.I - S.I = P \left( \frac{R}{100} \right)^2 \left[ \frac{R+3}{100} \right]$$

$$320 = P \left( \frac{15}{100} \right)^2 \left( \frac{25+3}{100} \right)$$

$$P = 1575.35$$

## Profit & Loss

Selling Price Cost Price Profit

$$\text{Profit} \% = \frac{\text{Profit}}{\text{CP}} \times 100 \quad \text{Loss} \% = \frac{\text{Loss}}{\text{CP}} \times 100$$

Cost price of book = 500 we need to sell with 10% profit

$$\text{SP} = (100 + 10\%) \times \text{CP}$$

$$\text{SP} = 110\% \times \text{CP}$$

$$\text{SP} = \frac{500 \times 110}{100} = 550$$

$$\text{SP} = (100 - 10\%) \times \text{CP}$$

$$100 - 10\% \times \text{CP}$$

$$\text{SP} = \frac{500 \times 90}{100} = 450$$

- 1) Ajay incurred a loss of 20% by selling a vase for Rs. 2880. To get a profit of 20%, what was the CP?

$$2880 = (100 - 20)\% \times \text{CP}$$

$$2880 = 80\% \times \text{CP}$$

$$\frac{2880 \times 100}{80} = \text{CP}$$

$$2000 = (100 + 20)\% \times \text{CP}$$

$$\frac{2000 \times 100}{120} = \frac{1000}{60}$$

$$\text{Rs } 4320$$

2.) Ramababu sells paper planes at the rate of 20 planes for 1. If he gets profit of 20%, how many planes did he buy?

1 (100%) CP

$$1 = \frac{100}{100+20} \times CP = CP = \frac{100}{120} \quad \textcircled{1}$$

$$\frac{20}{?} = \frac{100}{120} = ? = 20 \times \frac{100}{120}$$

? = 24 planes

3.) Uma wants to gain 15% of profit on her sale of sugar. She buys 120 kg at Rs 24 per kg to mix with 180 kg of sugar bought at Rs. 28/kg. She sells at

$$SP = (100 + \text{Profit} + \%) \times CP$$

$$\frac{115}{100} \times CP$$

The bought to 2

$$120 \text{ kg} : 120 \times 24 = 2880 \text{ Rs}$$

$$180 \text{ kg} : 180 \times 28 = \underline{\underline{5040}}$$

7920 Rs

$$SP = \frac{115}{100} \times 7920 = 9108 \text{ Rs}$$

A) Truddi buys some oranges in a shop at 9/- each. She goes to another shop and buys same number of orange at 5/- per rupee. She then combines them in a basket and sells them at 4/- each. Will she get profit or loss and how much?

$$SP - CP = + - \text{ Profit}$$

$$SP - CP = - - \text{ Loss}$$

$$\frac{1}{9} - \frac{1}{5} = \frac{1}{45}$$

$$\frac{1}{5} - \frac{1}{9} = \frac{4}{45}$$

so she sold both

$$2 = \frac{1}{9} + \frac{1}{5} = \frac{9}{45} + \frac{9}{45} = \frac{18}{45} = \frac{2}{5}$$

$$SP = \frac{1}{5} - \frac{9}{45} = \frac{1}{9}$$

$$P\% = \frac{\frac{1}{9} - \frac{1}{5}}{\frac{1}{5}} \times 100 = \frac{4}{9} \times 100 = \frac{400}{9} = 44\frac{4}{9}\%$$

5) Ramesh gets a profit of 20% in one trade & suffers loss of 20% in the second, when he sells 2 cycles for 4000 each. What is his profit or loss?

If he has some profit & loss sell at some price he is gonna suffer loss

$$SP = \text{some } 4000/-$$

$$\text{So } \frac{(20)}{100} \text{ loss } \% = 1\%$$

- b.) Simran bought pet food worth Rs 56000. She then sold  $\frac{1}{3}$ -rd of it incurring loss of 10%. What profit she must earn on rest of supplies to nullify loss.

$$\begin{array}{ccc} 1 & 2 & 3 \\ -40 & 20 & 20 \end{array}$$

1st divide loss according to required loss  
to nullify loss

- 7.) A sold a car to B at a profit of 25%. B incurred a loss of 15% while selling the vehicle to C. A spent Rs. 50000 for that car. At what price did C buy it?

$$SP_A = (100+20)\% \cdot CP$$

$$SP_B = 85\% \cdot CP$$

$$\frac{120}{100} \times 50,000 = 62500$$

$$\frac{85}{100} \times 62500$$

$$Rs - 53,125$$

- 6.) A cheater manipulated his weighing machine so that it shows 1 kg for 970 grams. How much profit does he get?  
1kg  $\rightarrow$  970 grams Profit

$$\% \text{ pr} = \frac{30}{970} \times 100 = \frac{3}{97} \times 100 \approx 1\%$$

9) Rohit got Profit of 11% by selling his old car. However he realized that he sold this for ₹8100 his Profit would be 38.5%. At what price did he buy the car.

$$11.5\% \quad 38.5\%$$

$$\frac{1 - P}{P} = \frac{38.5\% - 11.5\%}{11.5\%} = \frac{27}{11.5}$$

$$27/11.5 = 100$$

$$\frac{27}{100} \times CP = 8100 \Rightarrow CP = 30,000$$

10) Chaman sells 40 fans at 15% profit. He wants a total of 20% profit on entire sale. Since he got 160 fans at a rate of ₹ 100 each, at what profit he must sell.

$$\text{Total Profit} = \text{Profit in } 40 \text{ fans} + \text{Profit in } 120 \text{ fans}$$

Profit in 40 fans:

$$\% P = \frac{P_v - P_c}{P_c} \times 100$$

$$15 = \frac{P_v - 100}{100} \times 100 \Rightarrow P_v = 115$$

Total profit

$$20 = \frac{P_v}{160} \times 100$$

$$P_{v \text{ total}} = 320$$

12a:

$$A.Y = \frac{P_r P_s}{100 \times A} \times 100$$

$$P_r P_s = 100 \times A$$

$$5200 = 100 + (100 \times A)$$

$$\frac{A - 2800}{100} = 23.33Y.$$

- 11) Suman buys 160 chocolates for Rs 480. She wants to earn 30% profit by selling them. But Rabeh visited her and she gave him 25% of those chocolates at cost price. But even after doing this she earned profit of 30%, as desired. For how much did she sell each chocolate?

$$(C.P. = 480 \text{ Rs}) - 160 = 480 \text{ Rs} = \frac{160}{160} = 3 \text{ Rs}$$

$$\frac{75 \times 160}{100} = 120 \text{ C}$$

$$30\% = \frac{P_r P_s \times 100}{480}$$

Total

$$S.P. = C.P. + P.v = 3 + 1.2$$

$$Rs = 4.2$$

$$P_r P_s = 144$$

There are only 120 chocolates.

$$120 \text{ C} \quad 144 \\ ? \quad ?$$

$$\frac{144}{120} = 1.2$$

12.) Barnesh sold a Statue for a Price 15% higher than original price of the statue. He brought it at 20% discount on original price with the profit of Rs 2025, find original price.

$$80\% \cdot P \rightarrow S = 115\% \cdot P$$

$$P = 115 - 80 = 35\%$$

$$2025 = 35\% \cdot 0.01 \cdot P$$

$$P = 4500 \text{ Rs}$$

13.) A Shapshaker earns a profit of 15% after selling a book at 20% discount on the printed price. The ratio of cost Price & Printed Price of book

$$SP = (100+15)\% \cdot CP$$

$$SP = (100-20)\% \cdot CP$$

$$SP = \frac{115 \times CP}{100} \rightarrow ①$$

$$SP = \frac{80\% \times CP}{100} \rightarrow ②$$

$$\frac{CP}{SP} = \frac{80}{115} = 16:23$$

14.) The ratio of cost price and selling price is 4:5. The Profit percent is

$$CP:SP = 4:5$$

$$Pr = SP - CP = 1 \\ \% \frac{1}{4} \times 100 = 25\%$$

15) If selling price of 40 articles is equal to cost price of 50 articles, then profit is?

S.P. = ?

$$CP \text{ for } 50 \text{ articles} = 100$$

$$CP \text{ for } 1 \text{ article} = 2$$

$$SP \text{ for } 40 \text{ articles} = 100 \times 40 / 50 = 80$$

$$\text{Profit \%} = SP - CP / CP \times 100 = 80 - 100 / 100 \times 100 = -20\%$$

$$SP = CP + \frac{P}{100} \times CP = 100 + 20 = 120$$

16) A fruit seller buys lemons at 2 for a rupee and sells them 5 for 3 rupees. What is gain percent?

2 lemons  $\rightarrow$  Rs. 1

$$2 \times 100 = 200 \text{ lemons}$$

$$CP \text{ for } 200 \text{ lemons} = 100$$

$$\begin{array}{rcl} 5 & & 3 \\ 200 & & ? \end{array}$$

$$P \% = \frac{200 - 100}{100} \times 100 = 100\%$$

$$100 - 100 = 20$$

$$\frac{20}{100} \times 100 = 20\% \text{ Profit}$$

## Discount

simply Paying less amount

Marked Price List price, original price = L.P.

M.P > L.P

10% offer on ₹30 book

$$100 - 10\% = 90 = \frac{90}{100} \times 30 = 27$$

Successive discounts

2 successive discounts = 10% & 5%.

1000Rs  $\xrightarrow{10\%}$  Price A  $\xrightarrow{5\%}$  Final Price

Important formulae

ADD - Multiply - Single Equivalent  
100 Successive discount

say the same scenario

$$10+5 - \frac{10 \times 5}{100} = 14.5\%$$

- 1.) During monsoon clearance sale, Amit buys a shirt at double discount 20% & 10%. what was the price he bought if M.P = ₹1000

$$100 - 20\% = 80 = \frac{80}{100} \times 1000 = 800 \text{ ₹}$$

$$80 - 10\% = 90 = \frac{90}{100} \times 800 = 720 \text{ ₹}$$

$$\frac{20}{100} \times 1000 = 200 \text{ ₹} \quad \text{Third time} \quad \frac{90}{100} \times 800 = 720 \text{ ₹}$$

2.) If successive discounts are 15% & 10%, then what single equivalent discount?

ADD - Multiply

$$15+10 = \frac{15 \times 10}{100} + 23.5\%$$

3.) If SD are 10%, 20%, 30%, then what is single equivalent discount?

$$10\%, 20\%, 30\%$$

$$28\%, 30\%$$

ADD - Multiply

$$10+20 = \frac{10 \times 20}{100}$$

ADD - Multiply

$$28+30 = \frac{28 \times 30}{100}$$

$$28\%$$

$$49.6\%$$

4.) 2 successive discounts with first being 20% were given on a table having marked price of Rs 6400. Finally it was sold for Rs 1608. How much was 2nd discount?

$$6400 = 100\% - 20\% = 80 = \frac{80}{100} \times 6400 = 5120$$

$$5120 = (100 - A)\% = \frac{100 - A}{100} \times 5120$$

$$1608 = \frac{100 - A}{100} \times 5120$$

$$A = 10\%$$

5) Sonali could not decide between 2% or 3% given on P.S 2000. What is the difference between 2 discount?

$$\frac{30 \times 2000}{100} = 600 \text{ F}$$

$$25\% - 25\% = \frac{25 \times 5}{100} = 12.5\%$$

$$22.75\%$$

$$\frac{28.75 \times 2000}{100} = 575 \text{ P.S.}$$

$$600 - 575 = 25 \text{ P.S.}$$

6) Which of the following gives maximum discount on P.S 6896

- 1.) 2 successive discounts of 5% and 5%
- 2.) 10%
- 3.) 8% and 2%

$$5\% + 5\% = \frac{5 \times 5}{100} = 9.75\% \quad \text{①}$$

$$10\% = \frac{10}{100} = 10\% \quad \text{longer}$$

$$8\% + 2\% = \frac{8+2}{100} = 10\% \quad \text{②}$$

7) Fay decides to sell her watch at 3% discount. But her brother buys it from him and he gives him his 8% discount. Due to this Fay gets Rs 10 less in profit - what was marked price?

$$3\% \text{ gave as loss so } 3\% = 10$$

$$\begin{array}{r} 3 \\ \times 100 = 45 \\ 100 \end{array}$$

$$\text{MP} = 1500$$

8) Ramesh was getting due offers on MP either two successive discount of 20% or 2 successive discount of 30% and 10%. In which we can save more

$$\begin{array}{ccc} \text{1st} & & \text{2nd} \\ 20\% - \frac{20 \times 100}{100} & & 30\% - \frac{30 \times 100}{100} \end{array}$$

$$36\%$$

$$37\%$$

diff 1

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

9.) There was 25% off on hand bags. Nisha bought a hand bag which also got 10% discount. She paid Rs 403. What was the price tag on handbag?

Ques get 2 successive discount

$$\frac{2500}{100} = 25\% \text{ off}$$

$$100 - 25\% = 75\% \text{ off} = 40\%$$

$$\frac{75\%}{100} = 75\% \text{ off} = 40\%$$

- (i) Chandrikaben raised the price of products by 40%. How much discount they give to sell product on no profit no loss basis.

$$\text{Let } P =$$

$$\text{Sp. Price} = 140\%$$

so for selling back for no profit value

$$\frac{100}{140} \times 100 = 71.43\%$$

- (ii) There is 10% discount on a dozen pair of trousers marked Rs 8000. How many pair of trousers with Rs 2400

$$10\% \text{ off on 12 pairs} = \frac{10}{100} \times 8000$$

$$\text{So discounted } 8000 - 800 = 7200$$

$$12 \text{ pairs} = 7200, 1 \text{ pair} = 600$$

$$4 \text{ pairs} = 2400$$

14.) Blackberry announced a discount of 25% on their trousers. Vivek went to shop. He wanted to save Rs 900 in discount. How many trousers should he buy to do so. If each costs Rs 370.

$$25 \times 370 = \frac{25 \times 370}{100} = 900$$

Froms, we

so he needs to buy 5 trousers.

15.) How much does the sales sales revenue of Uday increase, if Uday announces 25% discount on Sales and sales volume increase by 40%.

$$\text{Revenue} = 1000 \times 10 = 10000$$

Given 25% discount

$$\frac{25}{100} \times 10000 = 2500$$

$$10000 - 2500 = 7500$$

Increase in %. 40%.

$$40\% \cdot 10 = 9$$

So

14400

Total revenue

$$7500 + 14400 = 21900$$

Rs 50

$$\frac{50}{100} \times 10000 = 5000$$

14400 initial

14) If a book cost Rs. 900 with a profit of 10% and its sold find MP is

$$100 - 10\% = 88\% \text{ MP} = \frac{88}{100} \text{ MP}$$

$$10\% \text{ offage} = 90\% \quad 100 - 10\% = 90$$

$$\text{Cost Price} = 900 \quad \text{CP}$$

$$\text{List Price} = 1100 - 10\%$$

$$900 = \frac{88}{100} \text{ CP}$$

Selling  
Price

$$\text{MP} = 1125$$

15) Profit of Ray while selling a book to Simon is Rs. 65. Despite a discount of 15% on book Ray manages to get 10% profit. What must be list price of book?

$$100\% - 15\% = 75\% \quad \frac{75}{100} = 0.75$$

$$10\% = 63 \text{ CP}$$

$$\text{CP} = 630 \quad \text{MP} = 630 + 63 = 693 \quad \text{MP} = 0.75 \times 693 \quad \text{MP} = 520$$

New CP on book

$$693: \frac{75}{100}$$

$$M = 900$$

Speed  
Distance  
Time

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

Speed = Distance / Time  
Distance = Speed × Time  
Time = Distance / Speed

### Different Problem

Same distance

Some speed

Some Time

Average Speed =  $\frac{\text{Total Distance}}{\text{Total Time}}$

- 1) A boy increases his speed to 9/5 times of original speed. By this he reaches his school 30 minutes before usual time. How much time he usually take.

Here we have same D  
D = S × T

$$S_1 \times T_1 = S_2 \times T_2$$

$$8 \times T = \frac{9}{5} \times (T - 30)$$

$$5T = 9T - 270$$
$$T = 67.5 \text{ min}$$

2.) Parash sees a thief at a distance of 80m. Parash starts chasing thief who is running at speed of 5m/s. Parash runs at 7m/s. How much distance does he run.

only time is same as both start running. Parash needs to cover 80m so

$$\frac{T_B}{T_P} = \frac{D_1}{D_2}$$

$$\frac{30}{37} = \frac{D_1}{7}$$

$$\frac{80 + D}{7} - \frac{D}{37} = D = 200m$$

3.) P, Q, R are in cycle race of 4500 m. P cycles twice as fast as Q. Q cycles  $\frac{1}{3}$ rd as fast as R. Compute the winner in 15 minutes. Then where was R from finish line when P finished?

$$P = 2Q$$

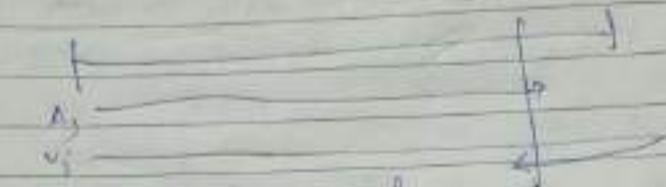
$$SP = 2SQ$$

$$Q = \frac{1}{2}P$$

$$P = 4500m$$

$$Q = 2250m$$

- 4.) Ajay and Vijay travel from A to B at 17 km/hr and 19 km/hr respectively. Ajay leaves B. Vijay reaches D first and returns immediately and meets Ajay. find total distance



only time is same

$$T_A = T_V$$

$$\frac{D_A}{S_A} = \frac{D_V}{S_V} = \frac{T_B - x}{17} = \frac{T_B + x}{19} \quad x = 4$$

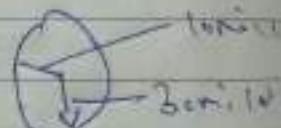
- 5.) Swander travels for 2 hr  
on horse to office by car, with avg speed of 50 km/hr he is late by 30 minutes  
But when he comes with a speed of 60 km/hr reaches 10 min ahead - How far is his office

1 method

$$T_1 - T_2 = 40$$

$$\frac{D_1}{S_1} = \frac{D_2}{S_2} = 40$$

$$D = 200 \text{ km}$$



Total 40

$$2.) \frac{D = 5x1}{50(x+30)} = \frac{6(x-1)}{60}$$

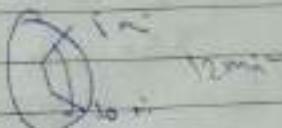
$$x = 7.2 \text{ hrs}$$

Time

$$D = 50 \left( \frac{7 + 30}{42} \right) \quad D = 200 \text{ km}$$

- 3.) Rohit drives from his home at a speed of 50 km/hr reaches his school 20 minutes late. Next day he increases his speed by 15 km/hr. but still comes late. How far is his school.

$$20 - 8 = 12 \text{ min}$$



$$T_1 - T_2 = 12 \text{ min}$$

$$\frac{D}{30} - \frac{D}{45} = \frac{12}{60}$$

$$D = 18 \text{ km}$$

- 4.) P-athish travels 96 kms at speed of 16 km/hr using a bike, 104 kms at 7 km/hr by car and another 103 kms at 7 km/hr in horse cart. There find the avg speed for entire distance travelled.

$$\text{Avg. T.D} = \frac{160}{77} \text{ hours} = 31.5 \text{ hrs}$$

$$\text{Total Time} = \frac{n}{s} = \frac{16 + 10 + 160}{7} = 15 \text{ hours}$$

$$\text{Avg. T.D} = \frac{316}{77} = 4 \text{ hrs}$$

- Q) Dabit covers one-fourth of total distance at 20 km/hr, one-fourth of total time and rest of his journey at 80 km/hr. find average speed

$$\frac{D}{A} = 20 \text{ km/hr}, \quad \frac{D - 10 \text{ km}}{A} = 80 \text{ km/hr}$$

$$T.T = T_1 + T_2$$

$$\frac{D_1}{20} + \frac{D_2}{80} = \frac{D}{A}$$

$$\frac{70}{160}$$

$$\text{Avg} = \frac{\frac{D}{70}}{\frac{160}{160}} = \frac{160}{70}$$

- Q) A walks from Jammu and Delhi and a  
same time B starts walking from Delhi  
to Jammu. After passing each other their  
journey in 36 hrs and 24 hours. Find  
ratio of speed of A to B



after reaching this.

$$SpA : SpB = \frac{S_1}{S_2} = \frac{\sqrt{288}}{\sqrt{36}}$$

$$\frac{SpA}{SpB} = \frac{\sqrt{288}}{\sqrt{36}} = \frac{17}{19}$$

- 10) A car travelling with  $\frac{5}{7}$  of its actual speed covers 47 km in the given time.  
Find actual speed of car.

$$\frac{Speed}{7} = \frac{5}{7}$$

Cross

1 hr for 5 km

$$60 \times 60 + 40 \times 60 \text{ m/s}$$

6041.666666666666 m/s

also convert km - m

$$47 \rightarrow 47000 \text{ m}$$

$$\frac{5}{7} = \frac{47000}{6041.666666666666}$$

$$S = 350 \text{ m/s}$$

$\frac{36}{7} \times 6041.666666666666 \rightarrow \text{m/s}$

$\frac{5}{7}$

divide

$$\frac{350 \times 18}{36} = 35 \text{ km/h}$$

## Percentage

Part of something, simply divide by  
 $\frac{1}{100} = \frac{1}{100}$

(common fractions)

$$\frac{1}{2} \text{ of } 100 = 50\% \quad \frac{1}{4} = 25\% \quad \frac{1}{8} = 12.5\% \quad \frac{1}{3} = 33\%$$

- finding %

10% of 260

$$\frac{10}{100} \times 260 = 26$$

in 10% placing decimal 1%.

26.

2.6 so on.

To find 30% of 260

$$\text{find } 40\% = \frac{40}{100} \times 260 = 104$$

$$1\% \text{ of } 260 = 2.6$$

$$104 - 2.6 = 101.4$$

63%

60% + 3%

$$10 \times 6 \\ 50 \dots$$

1) 56% of y is 16. find y

$$\frac{56}{100} \times y = 16$$

$$y = \frac{16 \times 100}{56} \quad y = \frac{320}{56}$$

2) what percent is 42 kg of 336 kg

$$\frac{42}{336} \times 100 = 12.5\%$$

3) if 15% of y is same as 21% of z, then  
12.5% of y is equal to what percent of -

$$15\% \text{ of } y = 21\% \text{ of } z$$

$$12.5\% \text{ of } y = ? \text{ of } z$$

$$15 \times ? = 21 \times 12.5$$

$$? = 17.5\%$$

4.) If Price of rice is 30% less than that of wheat  
then Price of wheat is how much percent  
more than rice

Just assume

$$Rs 100 = \text{wheat}$$

$$\text{rice} = 100 - (30\% \text{ of } 100) = 100 - 30 = 70$$

$$\% \text{ of wheat} = \frac{100 - 70}{70} \times 100 = 42.85\%, 100 - 70 = 30\% \uparrow$$

5)

The Price of apple is first increased by 10% and then decreased by 10%. What is change in Price of apple?

$$10\% \uparrow$$

$$\text{New} = 100 + 10 = 110$$

Then 10%

$$110 - 11 = 99$$

$$Y = \frac{1}{1+100} = 1\% \downarrow$$

$$\text{Change in Price} = 100 - 99 = 1 \text{ Rs}$$

6.)

If the Price of sugar is raised by 10%, then how much Prozent should a person reduce his consumption of sugar, so that expenditure remains same?

Let's assume Price and Quantity he looks at

$$1 \times 100 = 125 \times c$$

$$25\% \uparrow$$

$$100 + 25 = 125$$

$$( \therefore 0.8 \text{ kg} )$$

We should reduce by 0.7 kg  
Total reduction's.

$$\underline{0.7 \times 100 = 70\% \downarrow}$$

7.)

Y has to score 40% marks to pass. He gets 20 marks and fails by 40 marks. The max marks are

$$10\% \text{ of } M = \frac{10}{100} M = \frac{M}{10}$$

$$\text{Zonal mark} = \frac{10M}{100}$$

No. 13 marks

- b) A scores 10% and fails by 3 marks.  
 B scores 10% marks and gets 3 marks more than his marks. what are maximum marks

$$10\% \text{ of } M = \frac{10}{100} M = \frac{M}{10} + 3 \rightarrow \text{Fail}$$

$$10\% \text{ of } M = \frac{10}{100} M - 3 \rightarrow \text{Pass}$$

$$\frac{10M}{100} + 3 = \frac{10M}{100} - 3$$

$M = 200 \text{ marks}$

- c) In a class, 15% of total number failed in Science, 75% of total number of students failed in Math and 40% of total failed in both. How much percentage of student passed in both Maths & Science  
 Take care of double count

Q. 15  
Ans  
15%

$$15 + 75 - 10 = 30\%$$

$$\text{Pass} = 70\%$$

10) By 20% decrease in price Proph can buy 1kg more wine in Rs 1000. what was original price 1kg wine

$$\begin{aligned} \text{ExP} &= 0.8 \\ 100 &= 100 \\ A \times P &= (A+10) \times 0.8 \end{aligned}$$

$$A = \frac{8}{0.2}$$

20% of 1000

0.2P kg

P - 0.1P = 0.8P

$$P = 40 \text{ kg}$$

$$\begin{aligned} 100 &= 2.5 \text{ kg} \\ 40 & \end{aligned}$$

11) In an election which contested by 2 candidates one candidate got 40% of total vote and yet lost by 1000 votes. what is total number of votes

40% of total

$$\begin{array}{rcl} 40 & A & 60 A \\ \hline 100 & & 100 \end{array}$$

$$\begin{array}{rcl} 40 A & - 1000 & 60 A \\ \hline 100 & & 100 \end{array}$$

$$\begin{array}{rcl} A & 5000 \\ \hline & & \end{array}$$

P.) In a country 55% population is female.  
 80% of the male population is 115000.  
 How much of females are there if  
 total is 56%.

$$55\% \text{ of } 100 = 55 \text{ females}$$

45 males remain

$$80\% \text{ of } 45 = \frac{80}{100} \times 45 = 36 \text{ males}$$

$$f_1 + m_1 = T_1$$

$$\begin{aligned} T_1 &= 56 \\ \frac{56}{100} \times 100 &= 56 \\ 56 & \end{aligned}$$

$$f_1 + 36 = 56 \quad f_1 = 22$$

finding:

$$\frac{22}{56} \times 100 = 40\% \text{ females}$$

B.) If 20% of electricity bill is deducted, Rs 100 is still to be paid. How much was original bill?

$$80\% = 100$$

$$\frac{80}{100} \times B = 100$$

$$B = \frac{500}{4} = 125$$

(14) A's salary is 5% more than B's. How much percent is B's salary less than A's?

$$B = \text{Rs } 100$$

$$A - 5\% = 100 + 50 = 150$$

$$\begin{array}{r} \text{50} \\ \text{150} \\ \hline \text{diff} \\ = \frac{50 \times 100}{150} = \frac{100}{3} = 33\frac{1}{3}\% \end{array}$$

(15) Two numbers are less than a 3<sup>rd</sup> number by 30%. E.g. 37%. How much is 3<sup>rd</sup> number less than first?

$$\begin{array}{r} \text{3rd} \\ 3 \\ \hline = 100 \end{array}$$

$$\begin{array}{r} \text{1st} \\ 100 - 30\% = 70 \end{array}$$

$$\begin{array}{r} \text{2nd} \\ 100 - 37\% = 63 \end{array}$$

$$\begin{array}{r} \text{diff} \\ 70 \\ \hline 7 \\ \text{1st} \\ 70 \\ \hline 7 \end{array}$$

$$70 - 63 = 7$$

(16) 60% of inhabitants of a village having died of cholera. a Panis Sevin, during which 25% of remaining inhabitants left the village. The population was reduced to 40%. The number of inhabitants were

$$100 - 10\% = 90\% \text{ of } M = \frac{90M}{100}$$

Later 25% market

$$100\% - 15\% = 75\% \text{ of } \frac{90M}{100}$$

$$\frac{75}{100} \times \frac{90M}{100} = M = 6000$$

?

class

Q-2

Pipes &  
(systems)

Invert 1)

$$\frac{1}{M} + \frac{1}{N}$$

Pipe fills tank in 8 hours, then in  
1 hour,  $\frac{1}{8}$  amount is filled  
filling +, removing -

- 1) Two pipes M and N can fill a tank  
in 22 hours and 33 hours respectively.  
In how much time will tank be full if  
both pipes are opened simultaneously?

$$M = 22 \text{ hrs}^{-1} = \frac{1}{22} \quad N = 33 \text{ hrs}^{-1} = \frac{1}{33}$$

$$M+N = \frac{1}{22} + \frac{1}{33} = \frac{55}{22 \times 33} = \frac{5}{66}$$

simply invert again

$$\frac{66}{5} \text{ hours}$$

- 2.) P fills tank in 36 hrs, Q alone fills in 19 hrs  
R empties per 133 hours. If all pipes are opened  
together: how much time will be needed  
to fill tank.

A.) Two  
15 min  
off  
So

h

$$P \rightarrow 38 - 1/12 \text{ hr} \quad Q \rightarrow 18 - 1/12 \text{ hr} \quad R \rightarrow 12 - 1/12 \text{ hr}$$

$$PQR = \frac{1}{38} + \frac{1}{18} + \frac{1}{12} = \frac{1}{12} \quad \text{hrs}$$

- 3) A tap fills a tank in 24 hrs. Due to leak it takes 36 hours. If the tank is full, how much time will the leak take to empty it?

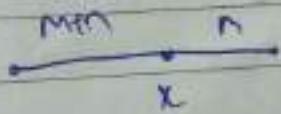
Tap - leak = Total work

$$\frac{1}{24} - \text{leak} = \frac{1}{36}$$

$$\text{leak in 1 hr} = \frac{3-2}{72} = \frac{1}{72}$$

Time to leak = 72 hrs

- A) Two pipes M and N can fill a tank in 22.5 and 15 min. If both pipes are opened simultaneously after how many times should N be closed so that tank is full in 18 minutes?



here everything is  $x$  is stopped first now

$$1/22.5$$

$$M = \frac{1}{22.5}$$

$$N = \frac{1-18}{22.5} = \frac{4.5}{22.5} = N$$

$$18M = \frac{18}{22.5}$$

$$N = \frac{1}{15} \times 22.5 = \frac{22.5}{15} = \frac{4.5}{3} = 1.5$$

$\therefore x = 3 \text{ times}$

5) Pipe A can fill a tank 5 times faster than pipe B and takes 37 minutes less than pipe B to fill the tank. If both the pipes are opened together, in how much time tank would be full?

$$A = 5B$$

$$5(T-37) = T$$

$$T_A = 8 \text{ min}$$

$$T_B = 5 \times 8 = 40 \text{ min}$$

Then when both are open

$$\frac{1}{8} + \frac{1}{40} = \frac{6}{40}$$

$$\frac{3}{10} \text{ - per minute}$$

$$\frac{20}{3} \text{ min suffices will be full}$$

6) A tank has 3 taps P, Q and R. Taps P and Q can fill tank in 1.5 and 2 hours respectively. Tap R can empty the tank completely in just half hour. Tap P is opened at 8 am, tap Q at 9 am. Tap R is opened at 10 am. At what time tank will be empty?

$$P = T, Q = T-1, R = T+2$$

$$P = \frac{1}{1.5} = \frac{2}{3} \text{ hrs}$$

$$Q = \frac{1}{2} \text{ hr}$$

$$R = \frac{1}{1.5} = 2 \text{ hrs}$$

see final work done here is 0

$$TP + TR - TR = 0$$

$$\left(\frac{2}{3}T\right) + \left(\frac{1}{2}(7.1)\pi - 2(7.1)\pi\right) = 0$$

$$T = 21/15 = 1.4$$

thus and min

1 hr 60m  
or 67

by 11pm min

min

- Ques 1) A cistern can be filled in 6 hours by taps P and Q. If tap R also joins then then cistern is filled in 5 hours. Tap P can fill cistern 2 at rate of tap Q. In what time Q and R fill the cistern

$$P \rightarrow 1/10 \quad Q \rightarrow 1/6 \quad R \rightarrow 1/5$$

$$\frac{1}{P} + \frac{1}{Q} = \frac{1}{6} \rightarrow 0 \quad \frac{1}{P} + \frac{1}{Q} + \frac{1}{R} \rightarrow 1/5$$

Q and R

$$\frac{1}{6} + \frac{1}{R} = \frac{1}{5} \Rightarrow \frac{1}{R} = \frac{1}{30} \quad \frac{1}{P} + \frac{1}{R} = \frac{1}{30}$$

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

P = 20

4)

$$\frac{1}{Q} + \frac{1}{R} = \frac{1}{6} \quad \frac{1}{Q} = \frac{1}{18} \quad \text{hours} = 4 \frac{1}{4} - \text{total}$$

6) A Cistern is filled by pipe A and pipe B together in 4 hours. Pipe A alone can fill cistern at rate of 100 litres per hour. Pipe B alone can fill the cistern in 4 hours. What is the capacity of cistern?

$$A \rightarrow \frac{1}{100}, B = \frac{1}{4}$$

$$\frac{1}{100} + \frac{1}{4} = \frac{1}{x}$$

$$\frac{1}{100} + \frac{1}{4} = \frac{1}{x} \text{ hrs of } x$$

The capacity will be

$$6 \times 100 = 600 \text{ litres}$$

7) Pipe R can empty a full tank in 30 hours. But 2 pipes P and Q can fill in 15 hours and 10 hours. Ram unknowingly opened all 3 taps. After 2 hours Mynam realized it and closed Pipe R. Due to the mistake how much more time it took to fill tank.

$$P \rightarrow \frac{1}{15}, Q \rightarrow \frac{1}{10}, R \rightarrow \frac{1}{30}$$

$$P+Q = \frac{1}{15} + \frac{1}{10} = \frac{5}{30} = \frac{1}{6} \text{ overall}$$

Thus

$$P+Q-R = \frac{1}{15} + \frac{1}{10} - \frac{1}{30} = \frac{1}{30}$$

be opened for 2 hrs

$$2 \times \frac{1}{30} = \frac{2}{30}$$

Total work done

$$1 - \frac{2}{30} = \frac{28}{30}$$

$$1 \text{ hr } \left( \begin{array}{c} 5/30 \\ ? \end{array} \right) - ? \frac{28}{30} = ? \frac{2}{5} = 4.4 \text{ hrs}$$

$$2+4.4 = 6.4 \text{ hrs}$$

$$6.4 \text{ hrs} \cdot 4 \text{ hrs} \times 60 = 24 \text{ min}$$

Time &  
work

simply again Invent

$$n \quad \frac{1}{n}$$

Total work = 30 amount of work in a day

Work / time

- 1) A can work 5 times faster than B and takes 6 days less than B to complete the work. In how many days does A & B individually (in complete work)

$$A = 5B$$

$$\frac{A}{n} : \frac{B}{n} = \frac{A}{B}$$

$$\frac{n}{B} = n - 60$$

$$An = 300$$

$$n = 75 - B$$

15 day - A

- 2) If 24 men can finish a work in 10 days then find the number of days required to complete some work by 30 men

24m :

30m :

A) A  
the  
do the  
work  
(complete

A

Total

A)  
P  
C  
P  
P

$$24m = \frac{1}{10} \text{ in one day}$$

$$30m = ?$$

$$? \times 24 = \frac{30}{10}$$

$$? = \frac{1}{8}$$

? - 8 days

$$\text{a day} = \frac{1}{30}$$

- 3) A can do a work in 3 days. B can do the same work in 6 days and C can do the same work in 7 days. If they work together, in how many days they complete work?

$$A = 1/3 \quad B = 1/6 \quad C = 1/7$$

Total work  $\rightarrow A + B + C$

$$\frac{1}{3} + \frac{1}{6} + \frac{1}{7} = \frac{9}{14} \text{ part of work}$$

$$\frac{14}{9} \text{ days}$$

- 4) P and Q can do work in 12 days. Q and R can do the same work in 16 days and P and R can do it in 24 days. Find the time in which P, Q and R

$$P, Q, R = 1/12 \quad Q, R = 1/16 \quad P, R = 1/24$$

$$P, Q, R = 1/11$$

$$P+Q+R+Q+R = \frac{1}{12} + \frac{1}{16} + \frac{1}{72}$$

$$2(P+Q+R) = \frac{9}{48} = \frac{3}{16}$$

$$\text{Total work: } \frac{31}{3}$$

- 5.) P can do a work in 30 days. Q is 25% more efficient computing same work. In how many days Q complete an-

$$\begin{array}{rcl} \text{100%} & 125\% \\ 100 & 125 \\ \frac{1}{30} & \frac{125}{100} \times \frac{1}{30} = \frac{1}{24} \end{array} - 24 \text{ days}$$

- 6.) If 3 men can do a work in 2 days and 4 boys can do the same work in 6 days, then in how many days will the same work be completed

Ans

$$\begin{array}{rcl} 3m & 2 \text{ days} \\ 4b & 6 \text{ days} \end{array}$$

$$3m = 3(4b)$$

$$m = 4b$$

N

$$8m + 8b$$

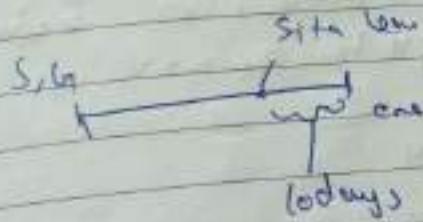
$$\bullet 8 \times 9 = 32$$

$$32b + 8b = 40b$$

$$1b \quad \frac{1}{16}$$
  
$$40b \quad ?$$

$$1 \text{ day} - \frac{1}{16} = \text{Total work: } \frac{1}{10} \text{ day}$$

7) Sita and Gita can do a work in 2 days and 25 days. Both begin but after few days Sita leaves. The Gita finishes remaining work in 10 days. After how many days Sita leaves?



$$S = \frac{1}{20}, G = \frac{1}{25} \quad \text{G in 10 days} = \frac{1}{25} \times 10 = \frac{2}{5}$$

$$G + S = \frac{3}{5} \quad \text{①}$$

Now they did

$$Sita = \frac{1}{20} + \frac{1}{25} = \frac{9}{100}$$

$$Sita = \frac{9}{100} \times 2 = \frac{9}{50}$$

$$\frac{9}{100} = \frac{3}{5} \quad \therefore x = 20 \text{ days}$$

8) When P alone does a work, he takes 25 days, more than the time taken by P & Q together. But Q alone takes 9 days, more than P and Q. In what time, P and Q together finish work.

$$P+Q = N$$

$$P = N - Q$$

$$Q = N - P$$

$N = \sqrt{P \times Q}$  : Extra

$$N = \sqrt{75 \times 9} : 5 \times 3 = 15$$

9.) A can complete a work in 12 days, and B can complete in 8 days. A works for 8 hours every day while B works for 10 hours every day. If A and B together start working 8 hours a day, in how many days will they complete the work?

$$A = 12d = 12 \times 8 = 96 \text{ hours}$$

$$B = 8d = 10 \times 8 = 80 \text{ hours}$$

(Counting hours)

$$A \rightarrow \frac{1}{96} \quad B \rightarrow \frac{1}{80}$$

↓

$$A+B = \frac{1}{96} + \frac{1}{80} = \frac{176}{96 \times 80} = \frac{96 \times 80}{176}$$

$$\frac{8}{8}$$

$$A+B = 60 \text{ hours}$$

Ray can build a house alone in 16 days  
but Suzy alone can build it in 12 days  
Ray and Suzy, on alternate days: If Ray  
works on first day, the house will be  
built in how many days?

$$R - 7 \text{ lets: } \frac{1}{16} \quad S - 7 \text{ lets: } \frac{1}{12}$$

Passes 1,

$$\frac{1}{16} + \frac{1}{12} = \frac{7}{48} \quad \text{here we are taking 6 days, instead of 7 so we should choose a multiple value with 48)} \\ \frac{7}{48} \times 6 = \frac{42}{48} = \frac{7}{8}$$

$\frac{7}{8}$  work is done

$$\frac{1}{8} = \frac{1}{8} \text{ remain}$$

$$S - \frac{1}{12} \quad \frac{1}{8} \text{ left}$$

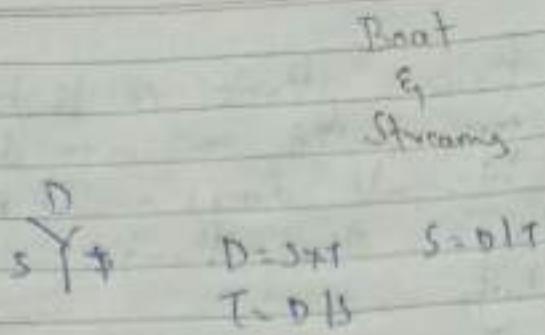
$$14 - S - \frac{7}{12} = \frac{1}{12} > \frac{1}{16}$$

$$\frac{1}{16} = 2 \times \frac{1}{12} \quad x = 3 \frac{1}{4}$$

$$3 \frac{1}{4}$$

$$\frac{1}{12}$$

$$\frac{1}{16} ?$$



we need to calculate speed of river + speed of boat

Speed

$\square \rightarrow$  upstream  $\rightarrow x+y$   $\square \rightarrow$  downstream  $\rightarrow x-y$

$\sim \sim \rightarrow$

- 1) what will be the boat speed in still water  
if speed of river, if the boat takes 12 h.  
to row 48 km upstream and comes to now  
the same in down stream

$$V_g = S - \frac{D}{T} = \frac{48}{12} = 4 \text{ Km/h.} \quad D_s = \frac{48}{8} = 6 \text{ Km/h.}$$

$$x-y=4 \quad \text{---} \quad x+y=6 \quad \text{---}$$

$$x-y+x+y=10$$

$x = 5 \text{ Km/h}$  boat

$y = 1 \text{ Km/h}$  river

2) If a man takes twice as long to swim up as to swim down the river. If the river has a speed of  $12 \text{ km/h}$  in still water. What is river's flow?

$$T_u = 2T_d$$

$$\frac{D}{x+y} = 2 \frac{D}{x-y}$$

$$3y = 2x$$

$$3y = 12$$

$$\frac{x-y}{2}$$

3) It takes  $9 \text{ hr}$  to row to a place and to come back. If the river is running at  $2.4 \text{ km/hr}$  and p has a speed of  $11 \text{ km/hr}$  in still water, what distance is row from p's starting point

$$T_u + T_d = 1$$

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

$$\frac{D}{x-y} + \frac{D}{x+y} = 1$$

$$\frac{14.4D + 9.6D}{9.6 \times 14.4} = 1$$

$$D = 5.76 \text{ Km}$$

4) An ocean current flows at a rate of 1.5 km/h. A 12 km car swim in still water at rate 4.5 km/hr. what is the average speed for entire distance travelled, if swimmer swims from India to Australia?

$$\text{Avg. Total T} = \frac{2D}{T+1.5}$$

$$x+y=6 \\ x-y=3$$

$$T+1.5 = \frac{D+1.5D}{6} = \frac{D}{2}$$

$$2D/D = 4 \text{ km/hr}$$

5) Ajay takes 4 hrs more while upstreaming the downstream. His speed in still water is 10 km/h. The speed of stream is 2 km/hr. what is the distance?

$$Tu = 10 + v$$

$$\frac{D}{x-y} - \frac{D}{x+y} = 4$$

$$x+y=12 \\ x-y=4$$

$$\frac{D}{8} = 4 + \frac{D}{12}$$

$$D = 9\sqrt{6} \text{ km}$$

7) Toy swims 26 km downstream in a time twice as  
long upstream what is his speed in still  
water is 5 km/h.

$$\frac{Dv}{S_o} = \frac{D_u}{S_o}$$

$$T=7$$

$$\frac{14}{x-y} = \frac{26}{x+y}$$

$$14y = 12x \quad \frac{x}{y} = \frac{10}{3} \quad y = 3$$

$$\frac{x}{3} - \frac{10}{3} = x = 10 \text{ km/h}$$

1) Ratio of Guddi's swimming speed in still water to speed of river is 7:1. She swims 42 km up the river in just 18 min. How much time will Guddi take to swim 18.9 km down the ri-

$$x:y = 7:1 \quad x = 7y$$

$$D = 42 \text{ km}$$

$$T = 18 \text{ min}$$

$$V_r = \frac{D}{T} = \frac{42}{18} = 0.3 \text{ km/h}$$

$$x-y = 0.3$$

$$Ty - y = 0.3 \quad y = 0.05 \text{ km/h}$$

$$x = Ty = 0.35 \text{ km/h}$$

Downstream

$$D = 18.4 \text{ km} \quad S = x+y$$

$$D/3140 = 0.05$$

$$0.40 \text{ km/h}$$

$$T_D = D/S = \frac{18.4}{0.4} = 46 \text{ min}$$

8)

Find the ratio of swimming speed of Ray  
in still water to speed of river if ratio of  
time taken to go 10km upstream to time taken  
to go 10km downstream is 5

$$\frac{T_u}{T_d} = \frac{11}{5} \quad \frac{D_{su}}{D_{so}} = \frac{11}{5}$$

$$\frac{10/x+y}{10/x-y} = \frac{11}{5} : \quad \frac{x+y}{x-y} = \frac{11}{5}$$

$$\frac{2}{y} = \frac{8}{3/1}$$

9.)

Ray swims for  $6\frac{1}{2}$  hours while going 24km  
downstream and 36 km upstream. But he takes  
6 hours to swim 36 km downstream and 16 km  
upstream. What is rate of river flow?

$$T_D + T_U = 6 \frac{1}{2} = 13 \text{ hr} \quad T_{D+U+C}$$

$$\frac{2A}{DS} + \frac{3U}{VS} = \frac{13}{2} \quad \frac{3U}{DS} + \frac{2A}{VS} = 6 - ①$$

$$\frac{4A}{DS} + \frac{7U}{VS} = 13 - ② \quad \frac{10U}{DS} + \frac{7U}{VS} = 18$$

$$\frac{10U}{DS} + \frac{7U}{VS} - \frac{11}{VS} - \frac{7U}{VS} = 18 - 13 \quad \frac{4A}{DS} + \frac{7U}{VS} = 13$$

$$DS = 12 \text{ km/hr}$$

$$A + \frac{7U}{VS} = 13$$

$$VS = ?$$

$$x+y=12$$

$$x-y=4$$

$$2x=20$$

$$x=10$$

$$y=2$$

Date \_\_\_\_\_  
Page \_\_\_\_\_

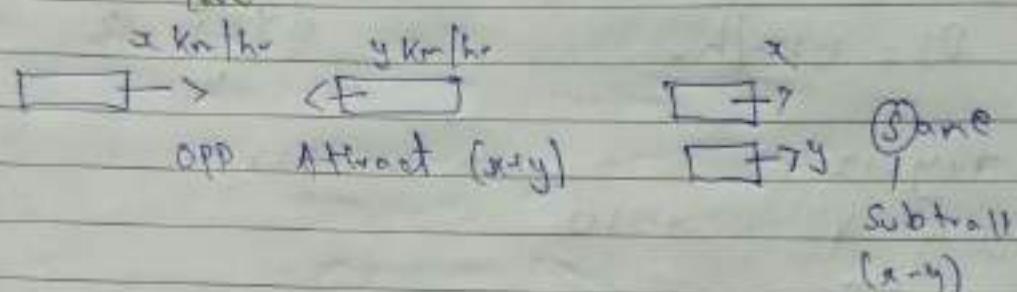
## Problems on Train

Important factors on train

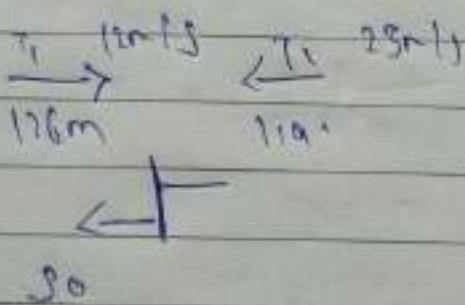
- 1) Length of Train
- 2) Length Pole, car, man = 0
- 3) Relative Speed  $\rightarrow \leftarrow$

Relative Speed

$\vec{v}_{rel}$  = speed of car in rotation to car



- 1.) Two trains with lengths 116m and 119m respectively are moving towards each other. Their speeds are 11m/s and 13m/s respectively. What will be the time needed by train 1 to cross each other.



Since train 2 is in opp we have to add

$$126 + 119$$

$$x+y = 11+13 = 43$$

$$\frac{245}{43} = 7 \text{ sec}$$

Distance

Length of train must be included in distance travelled

- Q) A train passes a stationary pole in 12 sec.  
The train also passes a 200 m long bridge in what is length of bridge the speed of train?

$$200 \text{ m} = l$$

$$\frac{D}{T} = \frac{l}{t} = \frac{1}{12} = \frac{200}{24}$$

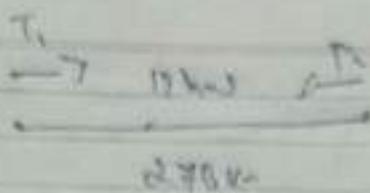
$$l = 80 \text{ m}$$

$$S = \frac{D}{T} = \frac{80}{8} = 10 \text{ m/s}$$

- Q) A train having length 150 m passes a platform of 550 m length. The time taken for it is 56 seconds. In how much time will the train take to pass the platform?

$$\frac{S-S}{T} = \frac{150+550}{56} = \frac{700}{56} \\ T = 31.25 \text{ seconds}$$

- Q) Stations M and N are 276 km apart. At exact same time, a train starts from M and other from N towards N and M respectively. They meet after 1 hr. The train travelling to N is slower by 14 km/hr in comparison to other train. What is speed of slower train?



St. 2  
St. 2 (km) (km)

$$D_1 + D_2 = 276$$

$$x + 111 \text{ (extra)} \times 276$$

$$2 \times 9.5 \text{ km/hr}$$

- 5.) Two trains P and Q move towards each other at same time. Their speeds are 100 km/hr. and 100 km/hr., when two trains meet one has covered 80 km more than other train. find the distance between P and Q.

$$T_1 = 120 \text{ km} \quad T_2 = 100 \text{ km}$$

$$T_1 = 240 \text{ km} \quad T_2 = 200 \text{ km}$$

$$DT_1 + DT_2 = P$$

$$240 + 200 = P$$

$$440 \text{ km}$$

- 6.) Two trains A and B leave Kolkata for Sikkim at 6:00 pm and 6:30 pm respectively and run at 90 km/hr and 110 km/hr. At what distance from Kolkata, when will the two trains



$$D = D$$

only distance is ...

$$90 \times T = 540$$

$$90 \times T = 120 \times (T - 0.5)$$

$$T = 2 \text{ hrs}$$

$$90 \times 2 = 180 \text{ km}$$

- 7) A train takes 2 boys who are running at the rate of 8 km/hr. and 16 km/hr. in same direction. The train completely passes them in 36 sec and 48 sec respectively. What is length of train?

$$D = D$$

$$S_7 = S_1$$

$$\frac{(S_2) \times 36}{60 \times 60} = S_1 + \frac{48}{60 \times 60} \quad S = 88 \text{ km/hr.}$$

Speed train

$$L:D = \frac{(88 - 16)}{60 \times 60} \cdot 48 = 0.8 \text{ km}$$

- 8) With stoppage, the speed of train is 36 km/hr. However without stoppage it is 48 km/hr. Find out how many minutes does train take

$$T = D/S = \frac{48 \text{ km}}{48 \text{ km/hr}} = T = \frac{1 \text{ hr}}{60 \text{ min}}$$

Without stoppage

1 hr for

$\frac{1}{60}$  hr  
60 - minutes

- 9) There are 2 trains P and Q moving in same direction. They are equal length and cross each other in 5 sec and 6 sec respectively. In how much time cross each other.

$$T \cdot \frac{D}{S} = 2 - \text{relative}$$

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

$$R_s = \frac{1}{T} \cdot \frac{1}{S}$$

$$\frac{D \cdot L}{T} = \frac{2V}{L/30} = 1 = 60 \text{ J/m}^2$$

## Problems on numbers

- 1) The sum of 2 numbers is 36 and product is 243.  
What will be numbers.

$$A+B = 36 \quad AB = 243$$

$$\frac{1}{A} + \frac{1}{B} = \frac{B+A}{AB} = \frac{36}{243} = \frac{4}{27}$$

- 2) In a Poultry farm having hens and pigs, Rohan can see 84 heads and 282 legs.  
How many are hens?

$$H+P = 84 \quad \text{--- (1)}$$

$$2H+4P = 282 \quad \text{--- (2)}$$

$$4H+4P = 282 - 4P = 336 - 282$$

$$4H = 54$$

- 3) Summation of 5 consecutive numbers is found out to be 335. If we add largest & smallest what will we get?

$$x, x+1, x+2, x+3, x+4 \quad x=63$$

$$5x + 10 = 335$$

$$x = 63$$

$$63 + 64 = 127$$

- 4.) While Ray was not paying attention in class, instead of multiplying  $m$  by  $3/4$ , he divided by  $3/4$ . The led to difference of 19 between the two answers. what is value of  $m$ ?

$$\frac{m \cdot \frac{3}{4}}{\frac{3}{4}} - m = 19$$

$$\frac{3m}{4} - m = 19$$

$$m = \frac{2m}{4}$$

The - change

- 5.) Parom has 2 urns. Both have come for some problem. If 20 pebbles from urn B are shifted to urn A then, the number of pebbles in each urn become interchanged. But if 10 pebbles from urn A are put into urn B, then number of pebbles in both twice the number now. How many pebbles A and B have atleast?

urn A      urn B

A              B

B-20

$$B-20 = A$$

$$B-A = 20 \quad \textcircled{1}$$

$2(A-10)$

B

$$2A - B = 16 \quad \textcircled{2}$$

$\downarrow + \downarrow$

$$A = 30$$

$\downarrow$

$$B = 70$$

$\downarrow$

enclosing the digits in units and tens place  
in brackets between 0 and N.N - 2.7. The  
digit in units place is 2 way the digit in  
hundred's place. The digit in 10's place is  
3 since the digit in hundreds place is 1.  
25% of original number

$$H \times 100 + T \times 10 + U$$

$$100 H + 30 T + 2 U = 137 H - ①$$

$$H \times 100 + 1 \times 7 + 10 \times 6$$

$$123 H$$

$$131 H - 123 H = 8$$

$$H = 3$$

$$U = 6$$

$$T = 9$$

$$621 H - 7 = 361$$

$$0. N = 361$$

$$75\% \text{ of } 361$$

$$277$$

In an area 2% families have 5 children each. But 8% have no children at all. Among the rest of families 18% have 4 children and 27% have only one child. How many families live in area, if 807 families have either 2 or 3 children each.

$$\begin{array}{r} 100 \\ 10 \\ 8 \\ ? \end{array} \quad \begin{array}{r} 49.5 \\ 207 \end{array}$$

$$21. + 8\% = 10\%$$

$$100 - 10\% = 90\%$$

$$18\% + 27\% = 45\% \text{ of } 90 (100 - 1) \quad ? = 600 \text{ families}$$

$$100 - 45\% = 55\% \text{ of } 90 (100 - 3)$$

$$\underline{55 \times 90 = 495 \text{ families}}$$

8.)  $\frac{3}{4}$  part of tank is full of water. 10 litres of water is taken out it becomes empty. The capacity of tank.

$$\frac{3}{4} \times ? = 10 \text{ litres}$$

9.) A group wanted to renovate their club. Each member contributed an equal amount to decide the number of members in the club. But government contributed same. If each member contributed the same amount as number of members and govt had given an amount twice the number of members then they would have 210 £ less. How many members are there?

I. Myself + m

II. Myself + m

$$2m^2 + m - (m^2 + m) = 210$$

$$m^2 + m = 210$$

$$m = 15$$

✓

m nur negativ

17) Two digit numbers  $n$  is formed by reversing the digits of  $p$ . Both are two digit. The sum of  $p$  is 59 what is  $n$ ?

$$\begin{array}{ccc} p & n & \\ \text{Ten} & \text{One} & \text{Ten} - 0 \\ \text{Two} & \text{Unit} & \\ 10\text{Ten} + \text{One} & 10\text{One} + \text{Ten} & \end{array}$$

$$(10\text{Ten} + \text{One}) = (10\text{One} + \text{Ten}) - 45$$

$$7 - \text{One} = 5 - 0$$

$$7 + \text{One} - 4 = 0 + 5$$

$$27 = 9 \quad 7 - \cancel{\text{One}} = 5$$

$$\text{One} = 7$$

$$\begin{array}{cc} A & B \\ \text{Ten} & \text{One} \end{array}$$

18) 280 oranges are divided among some boys and girls where total number is 50 so that each boy gets 5 oranges and each girl gets 7 oranges. The number of girls is

$$B + G = 50 \times 5$$

$$5B + 7G = 280$$

$$5B + 5G = 250$$

$$5B + 7G - 5B - 5G = 280 - 250$$

$$2G = 30$$

## AGES

1.) Ram is three times as old as Sam 5 years ago. If was 5 times as old as Sam 5 years in his present age.

Present

R = ?

S = ?

R

S

=

$$R - 5 = 3(S - 5)$$

R

$$R = 3S$$

$$3S - 5 = S - 10$$

$$S = 4$$

$$3S = 3(4) = 12 \quad \text{and} \quad R = 12$$

2.) 12 years ago, age of P was 3 times the age of Q. After 10 yrs, ratio of ages Q and P will be 2:3 what is Present age of P?

P<sub>12</sub>

Present

P + 10

P - 12

P

P + 10

Q - 12

Q

Q + 10

$$P - 12 = 3(Q - 12)$$

$$\frac{Q + 10}{P + 10} = \frac{2}{3}$$

$$P = 3Q - 24$$

$$\frac{Q + 10}{3Q - 24 + 10} = \frac{2}{3}$$

$$Q = 20 \text{ yrs}$$

$$P = 36 \text{ yrs}$$

Rohan is as much younger than Ajay as he is older than Meena. The sum of ages of Ajay and Meena is 102. How old is Rohan?

MCPA

Mean of Ajay = 102

$$\frac{\text{Mean of Ajay} - 102}{2} = \text{Age of Rohan}$$

Rohan's age is five times Ajay's and also eight ninth of Meena's age. The sum of the ages of all three is 132 yrs. How much younger is Ajay than

Ajay:  $A$   $R = 5A$  yrs  $R = \frac{8}{9} M$  mean

$$M = \frac{8}{9} R \quad R = \frac{90}{17}$$

$$A + 5A + \frac{90}{17} = 132$$

$$A = 7$$

$$R = 5A = 35$$

$$M = \frac{90}{17} = 90$$

$$90 - 7 = 83 \text{ years diff}$$

5) Ram & Shyam average is 15 years. The average age of both Shyam & Jitu is 18 yrs. what is the age of Jitu?

$$\frac{R+S}{2} = 15 \quad R+S = 30 \quad (1)$$

$$R+S+J = 53 \quad 30+J = 53$$

$$J = 19 \text{ years}$$

6) The average age of 10 students and their teacher is 13 years. The average age of rest 11 students is 15 years and the age of last three is 11 years. what is the teacher's age?

$$\text{avg} = \frac{S_{10} + T}{11} = 13$$

$$\text{avg. } S_{10} + T = 163 \text{ yr}$$

$$S_7 = \frac{S_7}{7} = 15 \quad 105 \text{ yr}$$

$$S_3 = 33 \text{ yr}$$

$$\frac{S_7 + S_3 + T}{11} = 13$$

$$105 + 33 = 138 \text{ yr}$$

$$T = 27 \text{ years}$$

11

The average age of a group of 9 friends is 36 years. The youngest friend amongst them is 6 years old. What was average age of the group at the time of birth?

$$\text{Avg} = 36 = \frac{\Sigma a}{n}$$

6 years on  
Age = 6

$$\Sigma a = 144 \text{ yrs}$$

$$144 - 6 = 138 \text{ (Sum)}$$

One guy was just born so now,

$$\text{Avg (now)} = \frac{\Sigma}{7} = \frac{138}{3} = 46 \text{ years}$$

- i) Average age of family of 4 members was 19 years, 1 year back. Birth of new child left average age of the family same even today. How old is child?

$$19 = \frac{\Sigma a}{4}$$

$$+ 1 \times 4 : 1$$

$$\Sigma a = 80 \text{ yrs}$$

$$\Sigma a = 76$$

$n$  - child age

$$\text{Avg} = \frac{\Sigma}{7} = \frac{99 + k}{5} = 19 \text{ (3 years)}$$

## Partnership

Ratio of investment × time = Ratio of Profit

Investment × Time : B Investment × B Time =  
A profits : B profits

3) If  
a profit  
is low

- 1.) P and Q jointly buy a hotel. P invests twice investment of Q. on running profit Rs 84000 what will be P's share in it?

$$P = 6Q$$

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

$$P \text{ share} = \frac{6}{7} \times 84000 = 72000 \text{ Rs}$$

$$Q \text{ share} = 84000 - 72000 = 12000 \text{ Rs}$$

- 2.) Rohit starts a travel agency by investing Rs 40,000. After 3 months Ray joins the agency. Ray invests Rs 50000. What will be the profit share of they earn Rs 167000 as profit in entire year.

4.)

$$40,000 \text{ for } 3 \text{ months} : 50000 \text{ for } 9 \text{ months} = P_R : P_Q$$

$$40000 : 50000$$

$$6 : 5$$

$$\text{Pay} = \frac{5}{11} \times 167000 \quad \text{Pay} = 85000\text{₹}$$

3) M invests Rs 4000 in starting business.  
After 3 months N comes along with Rs 2000.  
P comes with Rs 20,000. The business gives  
a profit of Rs 112000 at end of each year.  
If profits of M, N & P are in ratio 6:9:3  
how many months P was involved.

$$M \quad N \quad P \\ 4000 \times 12 \quad 8000 \times 4 \quad 2000 \times x = 6:9:3$$

$$48000 \quad 32000 \quad 20000x = 6k:9k:3$$

$$48000 = 6k \\ k = 8000 \quad 20000x = 5(8000) \\ x = 2 \text{ months}$$

4.) Ratio of profits of P, Q, R are 5:8:9  
respectively. What is their investment ratio  
if time period is 7:5:8 respectively

$$\begin{array}{ccc} P & Q & R \\ I \propto T = P & 5 & 8 & 9 \\ T = \frac{P}{7} & 2 & 5 & 8 \end{array}$$

$$\text{LCM} = 40$$

$$\begin{array}{ccc} P & Q & R \\ 5 & 8 & 9 \\ 8 \times 5 & 8 \times 5 & 9 \times 8 \\ 40 & 40 & 72 \end{array}$$

$$\begin{array}{c} 40 \times \frac{5}{1} \quad 40 \times \frac{5}{5} \quad 40 \times \frac{9}{8} \\ 100:64:90 \\ 100:64:40 \end{array}$$

5) Ajay & Vijay investment ratio is 5:2.  
 Ajay gets 3420/- as profit after donating 10% of total to orphanage. What is Vijay's share?

$$A : V = 5 : 2$$

$$A = \frac{5}{7} \times \text{Total Profit}$$

$$3420 = \frac{5}{7} \times 712 \quad 684 \text{ Rs}$$

$$V = \frac{2}{7} \times 684 \text{ Rs} \quad V = 136 \text{ Rs}$$

6) P, Q and R start a hotel. Q and R invest equally but P invest one-fifth of total investment amount. On getting a profit of 225000, how much would be difference between P and R.

$$P = \frac{1}{5} (225000) = 45000 \text{ Rs}$$

$$Q = R$$

$$225000 - 45000$$

$$\frac{180000}{2} = 90000$$

diff

$$90000 - 45000 = 45000 \text{ Rs}$$

P and Q start a cafe with a capital Rs 20000.  
 and Q 10,000 respectively. After a year out  
 of profit Rs 1000, P gets his share of  
 profit plus same money as his salary.  
 In total, if P gets Rs 7000, what is the salary  
 amount he received?

$$I \propto T = P$$

$$20000 : 10000 = P:Q = 2:1$$

$$P = \frac{1}{3} \times (5000 - 500) \text{ Rs}$$

$$7000 = 5000 + \text{Salary}$$

Salary = 2000/-

Rs 15000 were invested by Ram & Shyam  
 together to start a small business. They  
 got profit of Rs 2000 at the end of year.  
 Shyam took his profit share of Rs 600  
 How much did Ram receive?

$$R:12 \quad S:12 = 1400 : 600$$

$$R :: = 1400 : 600$$

$$R = \frac{14}{20} \times 700$$

$$R = 4900$$

Square of cube roots

$$34 \quad 34+8 \quad 34-5$$

$$34 \times 10 = 1360 + 3 = 1369$$

for ending 5

$$85 = 72 \sqrt{75} = 725$$

$$75 = 136 \cdot 125$$

Since square doesn't end in 5  
cancel 69      2 and 8 are ending

$$14 = 196$$

$$142 \sqrt{141}$$

$$196 + 14$$

$$210 > 201$$

So choose lesser

Cube root

$$\begin{array}{r} 250047 \\ - 25 \\ \hline 0047 \end{array}$$

now cancel down

$$250 - close to 280 + 6$$

$$63$$

1) Largest  
such  
no's  
having

2) What  
with

3) If  
+

1) Damesh arranged his 17429 chocolates such a way that there are as many as many chocolates in each row as did he place in all.

(i)

$$N \times N = 17429$$

$$N = \sqrt{17429}$$

$$N = 132$$

Total no.  
Sqr. = 132  
Ans.

2) What least number should be multiplied with 384 to make it perfect square?

$$384 = 2 \times 192$$

$$2 \times 2 \times 96$$

$$2 \times 2 \times 4 \times 24$$

$$2 \times 2 \times 4 \times 4 \times 6$$

$$2 \times 2 \times 4 \times 4 \times 3 \times 2$$

$$2^7 \times 3 \times 2$$

new numbers  
432

62

3) If square root of 5625 is 75, then  $\sqrt{0.5625}$  is

Since  $\sqrt{a} = \sqrt{\frac{a}{100}} \times \sqrt{100}$

$$75 + 7.5 + 0.75 = 83.25$$

4) what is the value of  $\sqrt{56}, \sqrt{56+\sqrt{56}}, \dots$

$56 \rightarrow 2 \times 7 \times$  calculate it by fact  
 $\Delta + A$  choose factor which  
 $7 \times 8$  diff 1  
 $7 \quad 8$  then since its addition  
 $\frac{8}{2}$  choose higher one

5) what will be value of  $\sqrt{\frac{9}{8}}$  if value of  $\sqrt{7} = 8.2405$

$$\sqrt{\frac{9}{8}} = \sqrt{\frac{9}{8} \times \frac{8}{8}} = \sqrt{\frac{72}{64}} = \frac{8.2405}{8} = 1.0301$$

6) Value of  $\sqrt[6]{0.004096}$

$$(0.004096)^{\frac{1}{6}} = (0.004096)^{\frac{1}{1/6}}$$

$$(0.16)^{\frac{1}{1/6}}$$

$$0.001 = 1.$$

0.16

7) find value of  $\frac{1}{\sqrt{5}-\sqrt{4}}$  if  $\sqrt{2} = 1.411$

rationalize

$$\frac{1}{\sqrt{5}-\sqrt{4}} \times \frac{\sqrt{5}+\sqrt{4}}{\sqrt{5}+\sqrt{4}}$$

$$\frac{\sqrt{12} - \sqrt{12}}{25 - 12}$$

$$\frac{5 + \sqrt{99}}{7}$$

$$\frac{5 + 3(\sqrt{11})}{7}$$

1.310

Q) Squares of difference between 2 numbers is 9 and sum of the squares is 225  
find their product.

$$(A-B)^2 = 9$$

$$A^2 + B^2 - 2AB = 9$$

$$225 - 2AB = 9$$

$$AB = 54$$

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

$$5400 = 2^3 \times 3^4 \times 5^2$$

$$200 \times 2^7$$

$$200 = 2^3 \times 2^4 \times 5^2$$

$$2^3 \times 5^2 \times 7^3$$

b) Value of  $\sqrt{0.000027 \times 0.001}$  is

$$0.0003 \times 0.1 = 0.0003$$

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

1.) which among the following number is greater?  $\sqrt{2}$ ,  $\sqrt{3}$ ,  $\sqrt{5}$ ,  $\sqrt{7}$

$$\sqrt{8}, \sqrt{7}, \sqrt{10}, \sqrt{5}$$

$\sqrt{8} > \sqrt{7} > \sqrt{10} > \sqrt{5}$

greatest is greatest

2.) what should come in place of question mark

$$? = \frac{90}{\sqrt{72}} = \sqrt{\frac{90}{72}} = \sqrt{\frac{5}{4}} = \frac{\sqrt{5}}{2}$$

$$? = \left( \frac{60}{72} \right)^{1/2} = \frac{60^{1/2} + 1/2}{72} = \frac{60^{1/2}}{72} = \frac{60}{72} = \frac{5}{6}$$

$$\left( \frac{A}{n} \right)^{1/2} = \left( \frac{1}{n} \right)^{1/2} \cdot \frac{3}{2} = \frac{90}{1}$$

$$? = 60$$

Average

$$\text{Avg} = \frac{\text{Sum}}{\text{Total values}}$$

$$\text{Sum} = \text{Total values} \times \text{Avg}$$

1.) Vijay  
2.) 65  
3.) 60

2.) what  
3.) 60

3.

1) Vijay expenditure for first 3 days is Rs 100,000/-  
 Q3 is what will be 4th expenditure as his 4 days average is 90.

$$\text{Avg: } \frac{310+?}{4} = 90 = \frac{310+?}{4} ? = 502$$

2) What will be average price of all goods bought  
 of Ajay Sir 30 expn for 30 each, 33 chocolates  
 for 10 each, 25 kgs for 40 each

$$T = 30 + 3 \times 30 = \text{avg good}$$

$$\frac{3(30) + 35(10) + 15(10)}{90} = \frac{500}{90} = 5.55$$

3) Out of 20 cycles sold by Ajay, average cost  
 of 11 cycles is Rs 18000. In total he earned  
 is 300000. What was average of 11?

$$\begin{aligned} S &= A \times N \\ 18000 \times 11 &= 198000 \\ 12 cycles &= 216000 \\ 20 cycles &= 300000 \\ 8 cycles &= 84000 \end{aligned}$$

$$\text{Avg: } \frac{S}{7} = \frac{84000}{8} = 10500$$

4) Without considering the salary of the boss  
 the average salary reduces by 1000. What  
 will be salary of boss if avg salary  
 of 11 employee is 10000

Aug.  $\frac{2}{7}$  S. Aug. 7

$$S = 18000 \times 12 \quad S = 216000$$
$$\text{Avg.} = 17000$$

$$S = 17000 \times 11 = 187000$$
$$216000 - 187000 = 29000 \text{ less Judge}$$

- 5) Average age of 5 people is 13 years. Another group has 8 people who have average of 15 years. When both groups are mixed what is average of all people?

$$A = \frac{S}{n} = \frac{\text{Total. Avg.}}{13} \quad S_{\text{Avg.}} = \frac{S_1 + S_2}{7} \quad \frac{S}{5} = \text{Avg.} = 210$$

$$\text{Avg.} = \frac{S_1 + S_2}{7} = \frac{S_1 + S_2}{8} = 640 \text{ year}$$

$$\text{Total. } 13 \text{ years} + 640 = 663 \text{ years}$$

- b) 5 boxes have total average weight. when one box which weighs 89 kg is replaced by another box, the average weight increases by 5 kg. how much the new box weigh

$$WWW \rightarrow \boxed{?} \rightarrow W'WS \rightarrow W'S > WWS$$

The new box should compensate  
all value

$$89 \text{ kg} \times 5 = 445 \text{ kg}$$

7.) How old will Raju be in ratio of his age and one of his two grandsons at any age and if both grandsons is 35, then

$$A_v = \frac{5}{7} = S_0 = \frac{S_2}{3} = 15 \text{ years} \quad R.C.R = 11:7 \quad 11K:7K$$

$$15K = 150 \text{ years} : K = \cancel{15 \text{ years}} : K = 110 \text{ years}$$

8.) Had Ajay Scored 18 runs more in his 5th inning, and 4 runs more in his 7th innings, his average would have been 6 runs. But it is 6 runs less how many inning did he play?

$$\frac{242 \text{ runs}}{64 \text{ runs}} - \frac{18 + 4 \text{ runs}}{66} = 22$$

$$N \times 2 = 2N - \text{Cov per inning}$$

$$2N = 22$$

$$N = 11 \text{ ; inning})$$

9.) In a group of people, the oldest and youngest have an age difference of 100 years. If these two are left out of counting, then average age of remaining 40 people is 28. If the average age of entire group being 30, how old is older?

$$40 + 100 = A_2$$

$$28 = \frac{S_{40}}{40} \quad \left\{ N = 40 \text{ ; } N = 0 \text{ year} \right.$$

$$100N = 100 \text{ old}$$

$$30 = \frac{S_{42}}{42} - S_{11} = 1260 \quad S_{40} = 1120$$

$$\frac{A_2}{N + 100 + N} = \frac{1260}{1120 + 100} = \frac{1260}{1120 + 100} = 30$$

- 10) A batsman played 11 innings and has a certain average. This average is raised by 2 runs when his 3innings of 31 runs, 33 runs, 34 runs are replaced by 3 other innings. Find 3 innings are

$$2 \times 11 = 22$$

$$\text{Avg} = \frac{10}{3}$$

$$3n = 32 + 33 + 31 + 22$$

$$\text{Avg} = \frac{40}{3}$$

$$3n = 125$$

chain rule

- 1.) 40 boys paint a house in 96 days by working 9 hours per day. How many hours per day all boys need to work so they can paint the house in 95 days

$$40 \text{ B} \times 96 \text{ D} \times 9 \text{ hours} \times 1 = 48 \text{ B} \times 45 \text{ D} \times ? \times 1$$

1) A batsman played n innings and has a certain average. This average increases by 2 runs when the 3rd inning of 37 runs was 33 runs. Find 3rd inning, n.

$$2 \times n = 22$$

$$3n = 32 + 33 + 3n + 21$$

$$3n = 121$$

$$\text{Avg. } \frac{W}{3}$$

$$\text{Avg. } \frac{W+1}{3}$$

Chains rule

1.) 40 boys paint a house in 96 days by working 9 hours per day. How many hours per day 48 boys need to work so they can paint the house in 63 days?

$$40B \times 96D \times 9\text{hours} \times 1 = 48B \times 45D \times ? \times 1$$



$$? \approx 8 \text{ hours}$$

$$N.D.T.W = M.D.T.W$$

Men-power = Time hours of work

- 2) 54 toy makers can prepare 36 toys in 1 hr.  
 Ajay wants 116 toys. How many toy makers  
 should he employ to get the job done in 1 day?

$$54 \times 1 \times 116 : ? \times 16 \times 36$$

$$? = 30.7 \text{ toy man}$$

- 3) 200 children in a school had enough chocolates for 10 days. But some children never come to school and chocolates lasted for 50 days. How many never come?

$$2000 + 40x1 = (2000 - m) \times 50x1 \quad (2000 - m)$$

$$2000 = 1500 - m$$

$$m = 500$$

some did. =

1500

- 4) A woman and 4 children start working together. How many days will they need to paint a house completely, if 3 women alone can paint the house in 8 days and 6 children too can do same in 12 days?

$$3W = 16 \text{ days}$$

$$6C = 12 \text{ days}$$

$$1W = 2C$$

$$4W + 9C = 6C$$

$$8C + 11C = 12 = 6C$$

$$12 \times ? + 1 = 6C + 18 + 1$$

$$? = 90$$

5) 17 Pumps of one type pump 3<sub>o</sub> litres of water when each is running for 16 hours per day. But a set of 16 pumps of other type pump 3<sub>o</sub> litres of water when each is running for 24 hours per day. How efficient are former type of pumps than latter type?

efficient

$$12 \times 18 \times 40 = 16 \times 24 \times 30$$

$$A = 168$$

$$12f \times 18 \times 40 = 16f \times 24 \times 30$$

$$\frac{f}{L} = \frac{4}{3} = F = \frac{4}{3} C$$

6) 75 girls complete one-third decoration of a building in 40 hours. Now they have only 50 hours to complete rest of decoration. How many more girls are necessary to complete?

$$MDTW_2 = MTPW_1$$

$$75 \times 40 \times \frac{2}{3} = (75 + x) \times 50 + \frac{1}{3}$$

$$(x = 40)$$

7) Fahad wants to build a tank in 20 days for which he hires 60 workers. After 10 days he sees that only 30% work has been done. To speed up the work and get tank built how many workers without

$$60 \times \frac{10}{10} = 60 \text{ hours}$$

$$\text{Min. } \frac{10}{3} \text{ hours}$$

$$140 - 60 = 80 \text{ hours}$$

$$30 \cdot \frac{30}{100}$$

$$70 \cdot \frac{7}{10}$$

A tank gives oxygen for 71 patients and can last for 54 hours. If patient reduce their oxygen consumption by 10% then 90%. Can these patients use this oxygen?

$$728 \times 54 = \frac{90 \times 90 \times P}{100} \text{ hr}$$

$$\text{1hr } 1\text{ patient}$$

$$\text{1hr } 72 \text{ p}$$

$$? = \pi \text{ hr}$$

$$728 \times 54$$

$$- 10\%$$

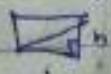
$$90 \times P = \frac{90P}{100}$$

Area & Perimeter.

Area - amount of space occupied by 2d figure.

Rectangle:  $l \times b = \text{Area}$ , Perimeter:  $2(l+b)$ , Largest Path:

$$d^2 = l^2 + b^2 \Rightarrow d = \sqrt{l^2 + b^2}$$



Square

$$\text{Area} = a^2$$

$$\text{Perimeter} = 4a$$

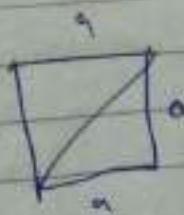
Area  $\propto$  side

per side

$$a^2 \quad 2a \quad 3a$$

$$Aa \quad Aa \quad aa$$

$$Aa \quad 8a \cdot 12a \quad \text{Perimeter}$$



$$\text{Area} = \frac{1}{2} d^2$$

$$\frac{10}{t_0} \frac{M \times 10^3}{t_0}$$

$$M = \frac{AIC}{3} = 140 \text{ m}^3$$

$$140 \text{ m}^3 = 140 \text{ m}^3$$

$$30\% \quad \frac{30}{100}$$

$$70\% \quad \frac{70}{100}$$

A tank has oxygen for 71 patients and can last for 59 hours. If 70 patients, reduce their oxygen consumption by 10%. Can use this oxygen in

$$71P \times 59 = \frac{90 \times 90 \times P}{100} \text{ h}$$

$$1 \text{ h} \quad 1 \text{ patient}$$

$$1 \text{ h} \quad 70 \text{ p}$$

$$? = 71 \text{ h}$$

$$72P \times 54$$

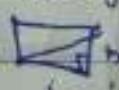
- 10%.

$$90 \times P = \frac{90P}{100}$$

Area & Perimeter

Area - amount of space occupied by 2d figure.

Rectangle:  $l \times b = \text{Area}$  Perimeter =  $2(l+b)$  Largest Path =  $d^2 = l^2 + b^2$ :  $d = \sqrt{l^2 + b^2}$



Square

$$\text{Area} = a^2$$

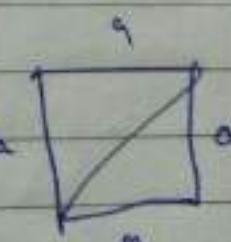
$$\text{Perimeter} = 4a$$

$$\text{Area} \propto \text{side}^2$$

$P \propto \text{side}$

$$\begin{array}{cccccc} a & 2a & 3a \\ d^2 & 4a^2 & 9a^2 \\ \text{Area} & 4a^2 & 9a^2 \end{array}$$

$$Aa = 8a \cdot 12a \quad \text{Perimeter}$$

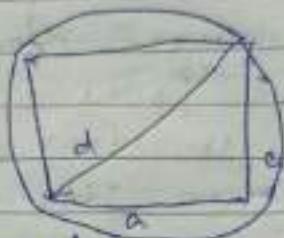


$$\text{Area} = \frac{1}{2} d^2$$

## Incircle & Circumcircle



$$a = \text{diameter} = \frac{a}{2}, A = \pi r^2, \pi \frac{a^2}{4}$$



diameter = diagonal

$$\sqrt{2}a, A = \pi r^2$$

$$r = \frac{\sqrt{2}a}{2} = \frac{a}{\sqrt{2}}, \pi a^2 / 2$$

## Circle & Semicircle

$$\text{Area} = \pi r^2, \text{Circumference} = 2\pi r$$



$$\text{length of arc} = 2\pi r \theta / 360$$

$$\text{Area of Sector} = \frac{1}{2} * \text{arc length} * r = \pi r^2 \theta / 360$$



$$\text{Area} = \frac{1}{2} \pi r^2$$

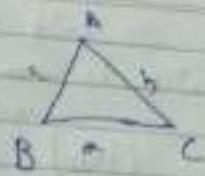
$$\text{Circumference} = 2\pi r$$

$$\text{Perimeter} = \pi r + 2r$$

Trigon

$$\text{Area} = \frac{1}{2} ab \sin C$$

$$\text{Area} = \frac{\sqrt{3}}{4} s^2 = (\sqrt{3}/4) * (\text{Side})^2$$



$$\text{Incircle radius } r = \frac{s}{2\sqrt{3}}$$



$$\text{Circumradius } R = \frac{s}{\sqrt{3}}$$

- i) The length of a rectangle is increased by 40% and breadth is decreased by 10% what will be change in area.

By what percent should the breadth be increased to maintain same Area if decrease in length is 40%.

$$l, b$$

$$\frac{l+0.4l}{100} \times \frac{b-0.1b}{100} = \frac{100}{100} \times \frac{60}{100} \times l \times b$$

$$\frac{64}{100} \text{ or } 64\% \text{ increase}$$

$$16\% \text{ of } A$$

ii) 60% of  $l \times b = lb$

$$\frac{60}{100} l \times b = lb$$

$$B = \frac{100}{60} m \quad 1.6 \text{ times of } A$$

$$1.6 = 80, \text{ Then } 1.6 = 60$$

$$60 \rightarrow 60 \downarrow$$

- iii) Ram was in a hurry to catch a bus so rather than walking from A to B and then from B to C along given rectangular path, he decided to take a short cut. This saved his distance which was

equal to half of the length of the garden.  
difference between longer & shorter side

$$(l+b) = \sqrt{l^2 - b^2} = \frac{1}{2}$$

$$\frac{l+b}{2} = \sqrt{l^2 - b^2}$$

$$Ab = 31$$

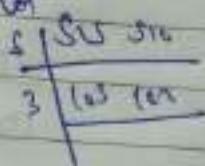
$$\frac{l}{b} = 4 : 3$$

- 3) How many minimum number of square tiles are needed to cover a rectangular floor of dimension 5.10 m and 3.10 m.

$$l = 5.10 \quad b = 3.10 \quad \text{Take grid}$$

$$s = 15$$

$$\frac{\text{Area of rectangle}}{\text{Area of sq}} = \frac{52.5 \times 5.10}{15^2}$$



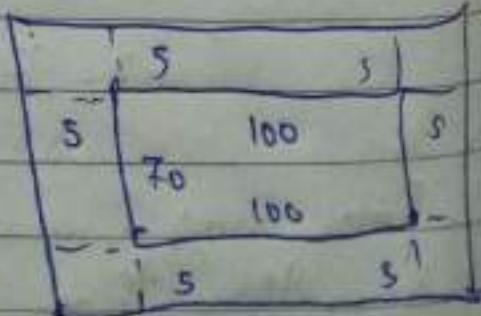
1140 tiles

- 4) The perimeter of a rectangular garden of length 100m is 390m. A flower bed 5 meters built around it. A gardener works for 2 days on this flower bed charges 8/- per square meter. His fixed charges per day is by 300/-, what will the total paid on completion or in

$$2(l+b) = 390$$

$$l+b = 170$$

$$b = 70$$



$$l_1 = 110 \text{ m} = 100 + 10$$

$$l_2 = 70 + 50 + 5 = 80$$

$$A_0 = l_1 = 100 \text{ m}^2$$

$$100 \times 5 = 1000$$

$$A_1 = 100 \times l_1 = 7000$$

$$A_0 = 100 + 10 = 110$$

$$(1000 + \text{Berk}) = 15000$$

Daily work

- 5) A rectangular garden 100m by 80m has 2 mutually perpendicular foot paths running through centre. one foot path runs across the length while the second one runs across the breadth. The width of both the path is 10m find the gravel cost at rs. 35 per sq.m.

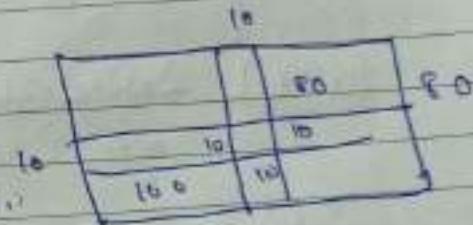
$$\textcircled{1} - 100 \times 80 = 800 \text{ m}^2$$

$$2 - 100 \times 10 = 1000 \text{ m}^2$$

we add extra twice removal

$$10 \times 10 = 100 \text{ m}^2$$

$$1700 \text{ m}^2 \times \text{Rs. } 35 \text{ per m}^2$$



- 6) find the area of shaded portion of given figure  $r = 7 \text{ cm}$

$$A_{\text{sq}} = 4r^2 = 16r^2$$

$$A_{\text{cir}} = \pi r^2 = \pi r^2$$

$$A_{\text{shaded}} = A_{\text{sq}} - A_{\text{cir}} = 16r^2 - 4\pi r^2$$

$$16 \times 7^2$$

$\approx$

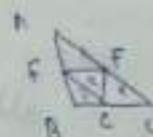


- f) An equilateral  $\Delta$  is drawn on diagonal of square of side  $a$ .  
 what is the relation between the areas of triangle and square.
- $\Delta_{\text{square}} = \frac{\sqrt{3}}{4} a^2$   $\Delta = \frac{\sqrt{3}}{4} (\sqrt{2}a)^2 = \frac{\sqrt{3}}{4} \cdot 2a^2 = \frac{\sqrt{3}}{2} a^2$
- 

- g) The sides of triangle are 3cm, 4cm, 5cm. find the area and perimeter of triangle formed by joining the mid points of 3 sides of original triangle.

$$k^2 = l^2 + b^2 = 3^2 + 4^2 = 25 \Rightarrow k = 5$$

Totally & trivially



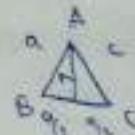
The length of EF will be  $\frac{EF}{2} = \frac{bc}{2} \sin A$

$$A = \frac{1}{2} \times b \times h = \frac{1}{2} \times 3 \times 4 = 6 \text{ cm}^2 \quad \Delta_{\text{ABC}}$$

$$EFA = \frac{6}{2} \text{ cm}^2 = \frac{3}{2} \text{ cm}^2$$

$$\frac{3}{2} + \frac{4}{2} + \frac{5}{2} \text{ (Perimeter)} = \frac{3+4+5}{2} \cdot \frac{12}{2} = 6 \text{ cm} \text{ - perimeter.}$$

- h) If the length of median of equilateral triangle is  $a$ , find its Area.

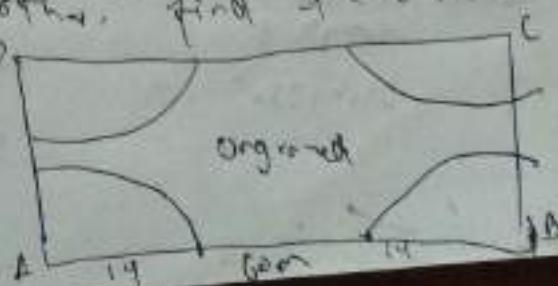


$$\Delta_{\text{ABD}} \rightarrow R + \angle A$$

$$a^2 = \left(\frac{a}{2}\right)^2 + m^2 \quad \Delta_{\text{ABC}} = \frac{\sqrt{3}}{4} a^2$$

$$m^2 = \frac{3}{4} a^2 \quad \frac{\sqrt{3} m^2}{3} = \frac{r^2}{\sqrt{3}}$$

- i) four houses are tied with the help of a long rope at the corners of a rectangular field  $ABCD$ . The houses can't reach other. find the area left unoccupied.



$$\text{Sector's Area} = \frac{\pi r^2 \theta}{360} = \frac{\pi 14^2 \times 90}{360} = 154 \text{ m}^2$$

$$S_1 + S_2 + S_3 + S_4 = \text{Area of } \triangle = 616 \text{ m}^2$$

$$\text{Total area} = 60 \times 43 = 2580 \text{ m}^2$$

$$2580 - 616 = 2084 \text{ m}^2$$

Volume &

Surfaces

make sure to go through  
all important formulae

Cube

Cuboid

No. of sides

12

12

No. of faces

6

6

No. of vertices

8

8

Diagonal

$\sqrt{3}a$

$\sqrt{a^2 + b^2 + h^2}$

$$\text{Sectors} : \frac{\pi r^2 \theta}{360} = \frac{22}{7} \times 14 \times 14 \times \frac{90}{360} = 154 \text{ m}^2$$

$$5 \times 15 + 2 \times 14 = 405 \text{ m}^2 = 616 \text{ m}^2$$

$$\text{Total area} - \text{boxes} = 2400 \text{ m}^2$$

$$2400 - 616 = 1784 \text{ m}^2$$

Volume &

Surfaces

make sure to go through  
all important formulae

	Cube	Cuboid
No. of sides	12	12
No. of faces	6	6
No. of vertices	8	8
Diagonal	$\sqrt{3}a$	$\sqrt{a^2+b^2+c^2}$
Volume	$a^3$	$l b h$
Surface Area	$6a^2$	$2(lb+lh+bh)$

like rectangle & square

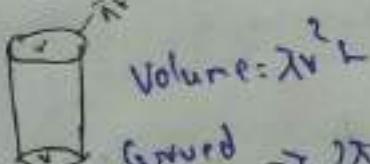
$$V = a^3 \quad V = l b h$$

$$\text{Side } a \quad 2a \quad 3a \quad V = 2a^3 = 8a^3$$

$$\text{Volume } a^3 \quad 8a^3 \quad 27a^3 \quad SA = 6(2a)$$

$$SA = 6(2a) \quad 6 \times 4a = 24a$$

Cylinder



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

$$\text{Curved Surface} \rightarrow 2\pi r h \quad \pi r^2 + 2\pi r h = \pi r^2$$

A.P.A.

$$\text{Total S.A.} \rightarrow \text{total surface area} \\ 2\pi r h + 2\pi r^2$$



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

$$(SA = \pi r l)$$

$$TS.A = \pi r l + \pi r^2$$

$$\text{Slant height} = l = \sqrt(r^2 + h^2)$$

*Swerk*  $L_1$  *Punkt*  $\vartheta_{\text{min}}$

$$v_{\text{bulk}} = A(3 - \frac{r}{R})^2$$

14

Volume 2153?

$$1.34 \times 10^{-5} = 9.56 \times 10^{-6}$$

$\lambda_{\text{VH}} = 3660 \text{ cm}^{-1}$ , Volumen desorbiert: 1300.

It's for fighters, however.

$$(\partial_m v) \partial_n v + v \partial_n v = -\partial_m u + \partial_m v - \partial_n u$$

(a)  $\pi^{\text{obs}} \approx 100$  fm $^{-1}$

- 1) May have 2 coms with him it can be either  
June or the end of August both the other bird  
in the island make of the first com

$$\begin{array}{cc} 1 & 2 \\ 2 & \times \\ \hline 1 & \end{array} \quad u = \frac{1}{3} x^{3/2} \quad u_1 u_2 = 2 \cdot 1$$

$$\frac{u_1}{u_2} = \frac{\frac{1}{3} x^{1/2}}{\frac{1}{3} x^{1/2}}$$

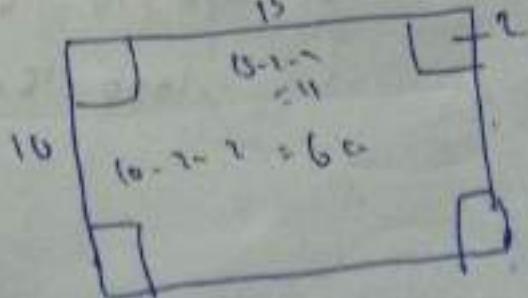
$$= x^{1/2}$$

- 2) 2 cylinders have their radii in the ratio 4:7. If  
their heights are in ratio of 21:8 then their volumes  
are in what ratio

$$\frac{v_1}{v_2} = \frac{\lambda(70)^{-1}}{\lambda(10)^{-1}} = \frac{v_1}{v_2} = 7$$

- 3) Ramesh, a fab. 't' (do), has an old shed with dimension 15 m x 10 m. Squared with a side 2 m are cut from each of four corners. The shed is then folded to form a planter with depth 1 m. what will be the volume of planter

$$v = k \epsilon b f^{-2}$$



- 4) A closed metal box has dimensions  $20\text{cm} \times 15\text{cm}$ .  
Thickness of the metal sheet is 1 cm. How much  
liquid can fit in box?

$$20 - 1 - 1 = 18\text{cm}$$

$$15 - 1 - 1 = 13\text{cm}$$

$$10 - 1 - 1 = 8\text{cm}$$

$$\text{V}_{\text{box}} = 18 \times 13 \times 8 = 1.872\text{L}$$



- 2) A solid wooden cube has a tank of water inside it. The tank has a base area of  $1\text{m}^2$  and a height of  $1\text{m}$ . How much water will be displaced by the cube?

- 5) Ram has a cubical dice with total length of its 40 cm diagonals as 16 cm. What is total length of edges? (there are 12 edges in a cube)

A - Space diagonal

$$A_n = 16\text{ cm}$$

$$a = 4\text{ cm}$$

$\sqrt{3}s = A$  - length of diagonal

$$s = \frac{A}{\sqrt{3}}$$



It's  
We  
()

- 6) A solid metallic box with dimensions  $16\text{cm}$  and  $12\text{cm}$  respectively weighs  $50\text{kg}$ . What will be the change in weight, if all the dimensions are halved?

$$1 \times b \times h = 50 \quad \frac{1}{2} \times \frac{b}{2} \times \frac{h}{2} = \frac{1}{8} (V) = \frac{1}{8} \times 50 = 6.25\text{kg}$$

- 7) From a cube of side  $10\text{cm}$ , a  $4\text{cm}$  hole of side  $4\text{cm}$  is hollowed from end to end. What is the volume of solid left?

$$V_1 = a^3 = 10^3 = 1000\text{cm}^3$$

$$V_2 = A \times l = 160\text{cm}^3$$

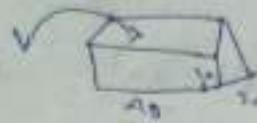
$$1000 - 160 = 840\text{cm}^3$$

-10.)

- i) A solid spherical ball can float in a plate of liquid water or water. If 40 such balls are immersed in a tank at a time, what will be the rise in level of water. Dimensions are given below.

$$1 \text{ ball} = 7 \text{ cm}^3$$

$$40 \text{ balls} = 280 \text{ cm}^3 = 280 \text{ ml}$$



$$280 \text{ ml} = 10 \times 7 \times h$$

$$h = \frac{280 \text{ ml}}{10 \times 7 \text{ cm}} = \frac{1}{2} \text{ cm} = 1 \frac{1}{2} \text{ cm} = 1.5 \text{ cm}$$

- ii) A well with inside diameter 10 m is dug 15 m deep. The soil taken out is spread all around it to form an embankment of width 3 m. What is the height of embankment?

$$\pi r^2 h = \pi \times 5 \times 5 \times 15 \text{ m}^3$$



$$C_1 = \pi \times 5 \times 2 \times 15$$

$$C_2 = \pi \times 8 \times 2 \times 15$$

$$C_2 - C_1 = \pi (8A - 5A) = \pi \times 3 \times 15$$

$$\frac{\pi \times 5 \times 3 \times 15}{3} \text{ m} = L = 81 \frac{1}{3} \text{ m}$$

- iii) Tribals wish to setup a tent for rainy tent. The base area of the tent would be 616 sq.m and height is 10 m. The width of canvas available in market is 11.5 m. How much length of canvas is needed.



$$\text{Since } \pi r^2 = 616 = \frac{22}{7} \pi r^2 \Rightarrow r = 14 \text{ m}$$

base radius  $R = 14 + 14 = 28 \text{ m}$

$$\text{Circumference} = \frac{2\pi R}{4} = 10\pi \sqrt{2} = 56\pi$$

$$\text{Length} = \frac{\pi r^2}{11\sqrt{2}} = 56\pi$$

- Q) Three solid iron balls are melted to form a single solid iron ball. The radii of three balls are 6 cm, 8 cm, 10 cm. What will be radius of new ball formed?

$$\frac{4}{3}\pi r^3$$

$$\frac{4}{3}\pi(6^3 + 8^3 + 10^3) = \frac{1}{3}20^3$$

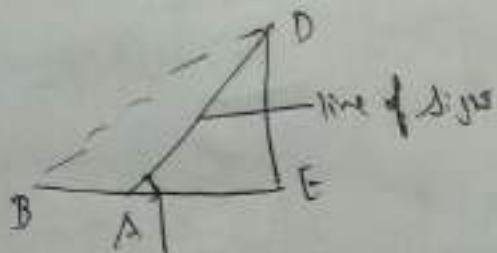
$$R = 10 \text{ cm}$$

$$\begin{matrix} 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{matrix}$$

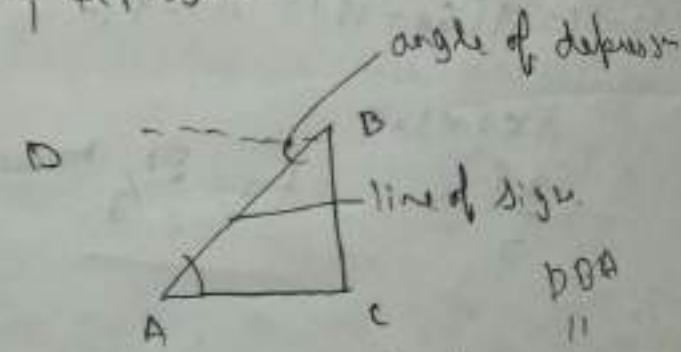
$$V_1 = V_2$$

Height

Angle of elevation - angle of depression



angle of elevation  
as we move towards  
B it decreases



angle of depression

$DBA \parallel BAC$

So both are equal

$$\text{Surface area} = \pi r^2 = \pi (5)^2 = 25\pi$$

$$V = \frac{4}{3}\pi r^3 = \frac{4}{3}\pi (5)^3 = \frac{500\pi}{3}$$

$$\text{Length} = \frac{\lambda \cdot V}{\pi r^2} = \frac{56 \cdot \frac{500\pi}{3}}{\pi (5)^2} = 160 \text{ cm}$$

- (b) Three solid iron balls are melted to form a single solid iron ball. The radii of the balls are 6cm, 8cm, 10cm. What will be radius of new ball formed.

$$\frac{4}{3}\pi r^3$$

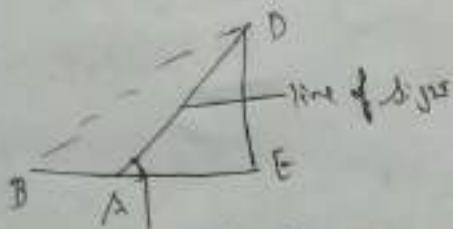
$$\frac{4}{3}\pi(6^3 + 8^3 + 10^3) = \frac{1}{3}20^3$$

$$\frac{4}{3}\pi R^3 = \frac{4}{3}\pi r^3$$

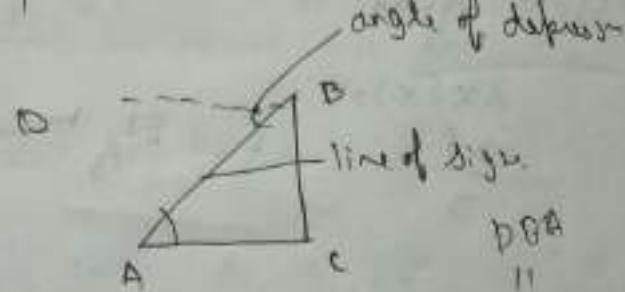
$R = 10 \text{ cm}$

Weight

Angle of elevation - & Depression



angle of elevation  
as we move towards  
it drawn



angle of depression

$DBA \parallel BAC$

So both are equal

Tree, building, Town  
always perpendicular to



Shadow cast - angle given  
units given



Bank of river - parallel

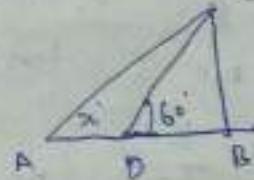
horizontal  
bank parallel river

	0°	30°	45°	60°	90°
sin	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1
cos	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0
tan	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	∞

$$\sqrt{3} \sin 60^\circ = \text{height} \quad 1/\cos 60^\circ = \text{sec } 60^\circ = \text{hypotenuse}$$

- 1) The angle of elevation of the top of tree from certain point on ground. If observer moves 30 m towards the tree, the angle of elevation becomes 60 degrees. what is height of tree

$$\tan 60^\circ = \frac{h}{DB} = \sqrt{3}$$



$$DB = \frac{h}{\sqrt{3}} \quad \text{--- (1)}$$

$$\Delta CAB \quad \tan 45^\circ = \frac{h}{30+DB}$$

$$\frac{1-h}{30+DB} = \frac{h}{30 \sqrt{3}}$$

$$\begin{aligned} h &= 30 \cdot \frac{\sqrt{3}}{\sqrt{3}-1} \\ &\approx 30 \sqrt{3} \end{aligned}$$

$$\frac{30\sqrt{3}}{\sqrt{3}-1} + \frac{\sqrt{3}+1}{\sqrt{3}-1} =$$

$$\frac{30\sqrt{3}(\sqrt{3}+1)}{2} \approx 95 \text{ m}$$

2) The top's angle of elevation is  $30^\circ$  from a point on ground  $300\text{ m}$  away from tree. What is the true height of the angle of elevation from  $60^\circ$  from same point. How much did triangle

$$\tan \theta = \frac{P}{B}$$

In  $\triangle PAB$



$\tan 30^\circ$

$$\tan 30^\circ = \frac{PA}{AB}$$

$$\tan 30^\circ = \frac{h}{300}$$

$$\tan 30^\circ = 0.577$$

$$\frac{1}{\sqrt{3}} = \frac{h}{300} \quad h = \frac{300}{\sqrt{3}} \text{ m}$$

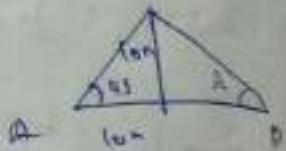
$$h = \frac{300}{\sqrt{3}} = 100\sqrt{3}$$

$$100\sqrt{3} \text{ m}$$

3) There is a town at  $10\text{m}$  between two parallel roads. The angles of depression from top of the tower are  $30^\circ$  and  $45^\circ$ . How far are the roads

$$\tan \theta = \frac{P}{B}$$

In  $\triangle ACD$



In  $\triangle ABC$

$$\tan 30^\circ = \frac{10}{DB} = \frac{1}{\sqrt{3}}$$

$$\tan 45^\circ = \frac{10}{AB} = 1$$

$$DB = 10\sqrt{3}$$

$$AD = 10\text{m}$$

$$AB = AD + DB = 10 + 10\sqrt{3} \quad AB = 27.3\text{m}$$

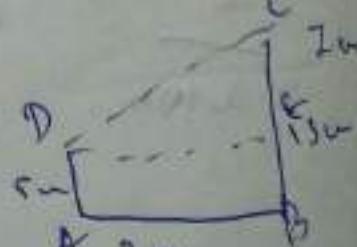
4) Damesh & Suresh's mud forts have height  $8\text{m}$  &  $15\text{m}$ . They are  $20\text{ m}$  apart. How far are the fort tops from each other?

$$AD = 8\text{m} \quad (B = 9)^\circ$$

$$CE = 15 - 8 = 7\text{m}$$

$$\triangle CDE = h^2 + r^2$$

$$h = 25\text{m} \quad r = 13\text{m}$$



5) Laddi was standing on ground near a wall. She can look up away from the wall and able to see the top of the wall from the road in such away that top of the tree, which is between her and the wall, was exactly in line of sight with top of the wall. The tree height is 10m and it is 20m away from Laddi. (wall is 10m high)

$\Delta OAB$

$$\tan \theta = \frac{OB}{AB} = \frac{10}{20} = \frac{1}{2}$$



$\Delta ACB$

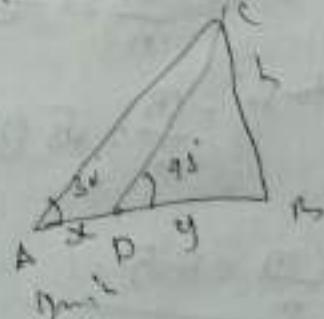
$$\tan \theta = \frac{CB}{AB} = \frac{1}{2}$$

$$\frac{CB}{1000} = \frac{1}{2} \Rightarrow CB = 500m$$

- 6) A light house is build to give directions to sailing ship. It observes that a ship is sailing towards it in straight line at uniform speed. It also notices the angle of depression to change from  $30^\circ$  to  $45^\circ$  in 13 minutes. How soon will the ship reach light house.

$$\text{In } \triangle OAB: \tan 45^\circ = \frac{h}{y} = 1 \Rightarrow h = y$$

$$\text{In } \triangle CAP: \tan 30^\circ = \frac{h}{AD+DB} = \frac{h}{2y} = \frac{1}{\sqrt{3}}$$



$$h = h(\sqrt{3}-1) = 715m$$

$$h(\sqrt{3}-1) = \frac{15}{h} \times h = \frac{15}{\sqrt{3}-1} \text{ min} \quad 20.92 \text{ min}$$

7) Ram stands on the top of a building and observes a car going away from the building when the car is 60 m from the building, angle of depression is 45 degree. After 55 sec, it is 70 degree what is speed of car

$$\text{In } \triangle ABC: \tan 45^\circ = \frac{h}{60} = 1$$

$$h = 60 \text{ m}$$

$$\Delta CAD: \tan 30^\circ = \frac{60}{AD}, \frac{60}{AD+60} = \frac{1}{\sqrt{3}}$$

$$60\sqrt{3} = AD + h$$

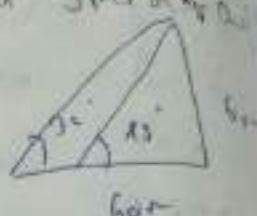
$$AD = 60(\sqrt{3} - 1)$$

$$AD = 24.2 \text{ m}$$

$$60\sqrt{3} = AD + h$$

$$S = \frac{D}{T} = \frac{43.8}{55 \text{ sec}}$$

$$8.7 \text{ m/s} \times \frac{9}{5} \text{ Km/h} = 31.32 \text{ Km/h}$$



8) Angles of elevation of pole are  $60^\circ$  and  $45^\circ$  from points at distances  $m$  and  $n$  on ground respectively. Here  $m$ , when measured from base of the pole is less than  $n$ , what is height of the pole

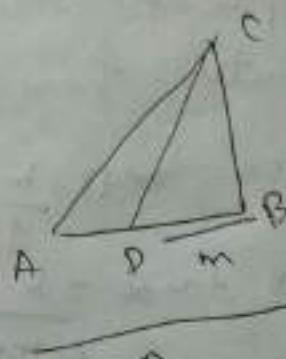
$$\Delta CAB: \tan 45^\circ = \frac{CB}{n} = 1 \quad \text{①}$$

$$\Delta CBD: \tan 60^\circ = \frac{CB}{m} = \sqrt{3} \quad \text{②}$$

Let

$$\frac{CB}{n} = \frac{CB}{m} = k$$

$$CB = \sqrt{mn}\sqrt{3}$$



## Logarithms

Exponent form:  $a^m = x$

Log form:  $\log_a(x) = m$

$\overbrace{\text{exp}}^{\text{log}}$

base doesn't change

$y = \log_3 x$       ) swapped  
 $x = 3^y$

Exp to log convert:

$$10^3 = 1000 \Rightarrow \log_{10}(1000) = 3$$

$$2^3 = 8 \Rightarrow \log_2(8) = 3$$

$$3^{-2} = 1/9 \Rightarrow \log_3(1/9) = -2$$

$$\log_1 x = 0$$

$$\log_a(a) = 1$$

Product rule:  $\log_a(xy) = \log_a(x) + \log_a(y) \neq \log(x+y)$

Quotient rule:  $\log_a(x/y) = \log_a(x) - \log_a(y)$

Log power:  $\log_a(x^y) = y \cdot \log_a(x)$

Power isotope:  $\log_a(b^x) = (1/b) \log_a(b)$

Switch base:  $\log_a(x) = 1/\log_x(a)$

Change base:  $= \log_a(x) \cdot \log_c(x) / \log_c(a) =$   
 $\log(x) / \log(c)$

find the value of

$$\text{i.) } \log_3(81)$$

$$\log_3(81) = 2 \times \log_3(9)$$

$$2 = \frac{\log_3(81)}{\log_3(9)}$$

$$\text{ii.) } \log_{81} 3$$

$$81 = 3^4$$

$$\log_{81} 3 = \frac{1}{4} \times \log_3(3)$$

find the value of

$$\log_{\sqrt{7}}(1/243)$$

$$\frac{1}{243} = \frac{1}{7^3} = 7^{-3}$$

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

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

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

$$-3 \times \frac{1}{2} + 1 = -6$$

$$\frac{1}{4} \sqrt{1}$$

$$\frac{1}{4}$$

$$\log_{0.0001}(1000)$$

$$1000 = 10^3$$

$$0.0001 = \frac{1}{10^4}$$

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

$$\text{v.) } \log_2\left(\frac{5n+256}{3n}\right)$$

$$\text{vi.) } \log_2(0.0625)^{-1/4}$$

$$-0.0625 = \frac{1}{2^4}$$

$$\log_2\left(\frac{1}{2^4}\right) = \log_2(2^{-4})$$

$$\log_2\left(\frac{2^4 \times 2^4}{2^4}\right)$$

$$\log_2 2^2$$

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

$$\frac{12}{2}$$

$$-4 \times \log_2 2 = -4 \times 1$$

$$-4$$

2) find the value of  $y$ , if  $\log_y(25) = 2$

$$y^2 = 25 \quad \frac{1}{y^2} = \frac{25}{9} \quad y = \frac{3}{5}$$

3) If  $\log_9 u = 36$  and  $\log_3 v = 6$ , what is relation between  $u$  and  $v$ .

$$\begin{aligned} 9^{36} &= u & 3^6 &= v \\ u &= 3^{72} & v &= 3^6 \\ (3^6)^n &\leftarrow n & u &= v \end{aligned}$$

when no base given take it as 10

4) find  $\frac{\log 10000}{\log 100}$

$$\frac{\log_{10}(10)^4}{\log_{10}(10)} = \frac{4 \times \log_{10}(10)}{2 \times \log_{10}(10)} = \frac{4}{2} = 2$$

5)  $\log_2 (2^1 \cdot 2^2 \cdot 2^3 \dots 2^n)$   
 $\log_2 (2^{1+2+\dots+n})$   
 $\frac{n(n+1)}{2}$

$$\log_2(n^4) = 4S \times \log_2(1) \quad \frac{a(10)}{c}$$

AS

6)  $\log_2 \log_2 \log_3 \log_5 (10) = ?$   $\log_5(n)$   
 $\log_5(s)$

$$\log_2 \log_2 \log_3(3)$$

$$\log_2 \log_2(6) = 0 \quad \log_2(0) = \infty \quad 3$$

7) find the value of  $\log(15/16) - \log(27/16)$  by log law  
by product

$$\log\left(\frac{15}{16} \times \frac{27}{27} \times \frac{16}{16}\right)$$

$$\log 1 = 0$$

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

(8) If  $\log$

$\log_{10}$

$\log_{10}(100)$

$\log_{10}(10)$

8)  $\log_{10} 2 = p$ ;  $\log_{10} 7 = q$ . find the value of  $\log_{10} 14$   
use change of base

$$\log_5(14) = \log_5 2 + \log_5 7$$

$$\log_5 2 + \log_5 7 = 2 \log_5 2 + \log_5 7$$

$$\log_a(x) = \log_c(x) / \log_c(a)$$

and product law

change of base -  $\frac{2 \log 2}{\log_{10} 5} + \frac{\log_{10} 7}{\log_{10} 5} = \frac{2p}{\log_{10}(10/5)} + \frac{q}{\log_{10}(10/7)}$

$$\frac{2p}{\log_{10} 10 - \log_{10} 5} + \frac{q}{\log_{10} 10 - \log_{10} 7} = \frac{2p}{1-p} + \frac{q}{1-q} = \frac{2p+q}{1-p+q}$$

9)  $\log(x^2 - 6x + 10) = 0$  find the value of  $x$

$$\log^{(x^2 - 6x + 10)} = 0 = \log^1$$

$$x^2 - 6x + 10 = 1$$

$$x^2 - 6x + 9 = 0$$

$$x = 3$$

(10) If  $\log_{10} (10s) = p$ , find  $(\log_{100} 10^s)(\log_{10} 10^s)$   
 $(\log_{100} (10s))$ .

$$\log_{100} (10s) = \frac{\log_{10} 10s}{\log_{10} 100}$$

$$\frac{\log_{10}(x) + \log_{10}(s)}{\log_{10} 100}$$

$$\frac{\log_{10} 10}{\log_{10} 100} \times \frac{\log_{10} 10}{\log_{10} 10} \times \dots \times \frac{\log_{10} 10s}{\log_{10} 10s}$$

$$\frac{\log_{10} 10s}{\log_{10} 100} = \frac{\log_{10} (10s)}{\log_{10} 100} = \log_{10}^{(10s)}$$

$$\frac{1}{2} + \log_{10} 10s = \frac{1}{2} + p = p/2$$

(11)  $\log 11 = a$ . find  $\log (11/10)$ .

$$\log \frac{1}{10} = \log(1/10)^{-1}$$

$$1/a = a^{-1}$$

$$-1 \times \log 10$$

$$-(\log(1/10))$$

$$-[ \log_{10} 11 \times \log_{10} 10 ]$$

$$-[ax] = -ax + 1 = \log \frac{1}{10}$$

12) If  $\log 2 = 0.3010$ , find the value of  $\log_{10} 2^{10}$

$$\log_{10} 2^{10} = \log(2)^{10}$$

$$10 \log 2$$

$$10 \times (0.3010)$$

$$3.010$$

characteristic

mantissa -

characteristic  
we can calculate

mantissa  
needs log book  
Always five

NOTE: (No. of digits in integral Part - 1)

No. of zeroes immediately after decimal point

applying those rule

before decimal

$$\log 7.23 = 71 = 1 - 1 = 0$$

$$\log 0.0723 < 1 =$$

$$\log 71.32712 \quad 2n = 1$$

$$[f+1] = a$$

b) if  $\log a = 0.3010$ , find the value of  $\log_{10} a^{\frac{1}{10}}$

$$\log_{10} a^{\frac{1}{10}} = \log(2)^{\frac{1}{10}}$$

$$10 \log 2$$

$$10 + (-3.010)$$

$$3.010$$

//

Characteristic

Mantissa

Characteristic

we consider

NOTE: (No. of digits in integral part - 1)

Mantissa  
needs log table  
Always true

NOTE: (No. of zeroes immediately after decimal point)

applying those rule

before decimal

$$\log 7.23 = \gamma_1 = 1 - 1 = 0$$

$$\log 0.0723 \leftarrow 1 \rightarrow$$

$$\log 71.37712 \leftarrow 1 = 1$$

$$-[1] = -1$$

Immediate zero

(3) find the number of digits in  $4^{10} \times 6^{10}$

$$\log [4^{10} \times 6^{10}] = \log [(2^2)^{10} \times (2 \times 3)^{10}] \text{ No. of digits in result}$$

$$[\log [2^{10} \times 2^{10} \times 3^{10}]] = \log [2^{30} \times 3^{10}] \text{ Characteristic}$$

product rule

$$30 \log 2 + 10 \log 3$$

$$13.801 + 1$$

$$30(0.3010) + 10(0.4771)$$

$$14.2$$

$$9.0309 \times 4.771 = 13.801$$

### Arithmetic Progression

$$a_1, a_2, a_3, \dots, a_n \quad a_1 - a_2 = a_2 - a_3 = \dots$$

common difference =  $d$

$$a_1, a_1+d, a_1+2d, a_1+3d$$

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

$$(n-1)d = a_n - a$$

$$n = \frac{\text{last term} - \text{first term}}{d} + 1$$

$$n = \left( \frac{a_n - a}{d} + 1 \right)$$

$$1, 3, 5, 7, \dots, 15$$

$$n = \left( \frac{15-1}{2} + 1 \right) = 8$$

$$8^{\text{th}} \text{ term} = 15$$

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

$$1 + 14 \times 2 = 1 + 14 = 15$$

$$a_1, a_1+d, a_1+2d, \dots, a_1+(n-1)d$$

$$(a_1 + a_2 + \dots + a_n) + \{d + 2d + \dots + (n-1)d\}$$

$$\frac{n(a_1 + (n-1)d)}{2}$$

$$\frac{n(n+1)}{2} d$$

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

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

$$S_n = \frac{n}{2} (\text{first term} + \text{last term})$$

Arithmetic mean

$$3) \text{ ABC} \quad D = \frac{a+e}{2}$$

$$a, a, \dots, a_n = \frac{(a_1+a_2+\dots+a_n)}{n}$$

Introducing Arithmetic mean

$$a, m_1, m_2, \dots, m_n, b$$

$$d = \frac{b-a}{n-1}, \text{ first mean}$$

$$m_1 = a + \frac{b-a}{n-1}$$

$$m_n = a + d$$

Add / subtract a particular number of terms of

$$\text{an AP } 1, 3, 5, 7, \dots, 35 \text{ FA } -\text{AP}$$

$+2 +2 +2 +2$

though u add it results in AP

multiply / Divide all terms by constant

$$\begin{array}{r} 1357 \\ \times 2 \\ \hline \end{array}$$

$$\begin{array}{r} 2, 6, 10, 14 \\ \hline \end{array} \quad - \text{ They are an AP}$$

Add two AP series - Resulting is also an AP

$$2, 4, 6, 8$$

$$3, 6, 9, 12$$

$$\begin{array}{r} 5, 10, 15 \\ \hline \end{array} \quad - \text{ An AP}$$

7) If 3<sup>rd</sup> and 7<sup>th</sup> terms of an AP are 18 and 29  
find its first term.

$$a+6d = 18$$

$$a+6d = 29$$

$$\underline{d=10}$$

$$d=25$$

$$a+2(25)=18 \quad a=18$$

2) 5<sup>th</sup> term of an AP is 7 while its 7<sup>th</sup> term is 17.  
which of the following is its n<sup>th</sup> term?

- i)  $8n-30$  ii)  $\frac{1}{2}(10n-36)$  iii)  $n-23$

$$8n-30 = 8(8)-30=10+2$$

$$\text{ii) } \frac{1}{2}(10n-36) = \frac{1}{2}(10 \times 3 - 36) = 7, \frac{1}{2}(10 \times 2 - 36) = 17$$

Satisfies

3) The ratio of 2<sup>nd</sup> to 7<sup>th</sup> term of an AP is 1:5  
4<sup>th</sup> term is 9. find 15<sup>th</sup> term. find an  
of this A.P with 15 terms

$$\frac{a+d}{a+6d} = \frac{1}{5}$$

$$5a+5d = a+6d$$

$$2a=3d \quad \frac{a}{d} = \frac{3}{2} \quad a=3x \\ d=2x$$

$$1^{\text{st}} : a+3d = 9$$

$$3x+3dx = 9$$

$$ax = 9, x = 1 \quad a_1 = 3 + 2d = 14$$

$$a = 3x = 3 \quad d = 2$$

$$a_{15} = a + 14d = 3 + 14 \cdot 2 = 31$$

$$A.M = \frac{3+31}{2} = 17$$

$$a_m = 17$$

b) 6<sup>th</sup> term of  
of first  
term and

- 4.) find the values of 10<sup>th</sup> term of the AP if  
6 times its 6<sup>th</sup> term is equal to 5 times its  
10<sup>th</sup> term.

$$6(a+5d) = 10(a+9d)$$

$$6a+30d = 10a+90d$$

$$4a = -60d \quad a = -15d$$

$$a_{10} = (a+9d) = -15d+13d = 0$$

- 5.) If  $T_p = a$ ,  $T_q = b$ ,  $T_r = c$  - what is the value  
of  $a(q-r) + b(r-p) + c(p-q)$ ?

$$T_p = x + (p-1)d = a \quad T_q = x + (q-1)d = b \quad T_r = x + (r-1)d = c$$

1st multiple term

$$[x + (p-1)d](q-r) + [x + (q-1)d](r-p) + [x + (r-1)d](p-q)$$

$$\stackrel{=}0$$

6) 15<sup>th</sup> term of an AP is -16 and sum of first 4 terms is 21. Find the first term and common difference.

$$\left. \begin{array}{l} a_{15} = a_1 + 14d = -16 \quad \text{--- (1)} \\ S_4 = \left[ \frac{a_1 + a_4}{2} \right] \times 4 \\ 36 = \left[ \frac{a_1 + a_1 + 3d}{2} \right] \times 4 \\ 36 = 2a_1 + 3d \quad \text{--- (2)} \end{array} \right\} \text{on solving (1) and (2)} \\ \begin{aligned} 2a_1 + 3d &= 36 \\ a_1 + 14d &= -16 \\ d &= -2 \\ a_1 + 11(-2) &= -16 \\ a_1 &= 22 \end{aligned}$$

7) What is the greatest possible sum of AP 25 21 19 ...?

Highest possible sum = 1 So only first

$$S_n = \left( \frac{n+1}{2} \right) a n$$

$$2 \frac{3+1}{2} \times n = 1$$

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

$$25 + (n-1)(-2) = 1$$

$$n = 13$$

$$S_n = \left( \frac{25+1}{2} \right) \times 13 = \frac{149}{2}$$

8.)  $143 + 145 + 147 + \dots + 603$

$$143 + 145 + 147 + 149 + 151 + \dots + 603$$

There are 2 series

so take  $\frac{1}{2}$ , and add it

$$143 = a \quad a_1 s = a \quad 702 = 143$$

$a, q, a_1, a_2, \dots$  now they are  $\omega$ s

$a, a_1, a_2, \dots$  3 terms

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

$$\frac{30}{2} (8 + (19)s) = 2195$$

9.) If first term of an AP is 3. The sum of first 5 terms is equal to  $\frac{1}{4}$ A of the sum of next five terms. What is the 25<sup>th</sup> term?

$$S_5 = \frac{1}{A} (S_{10} - S_5)$$

$$4S_5 = S_{10} - S_5$$

$$5S_5 = S_{10} - ①$$

$$5 \left[ \frac{5}{2} (2+3+(5-1)d) \right]$$

$$2d = -18$$

$$d = -9$$

$$a_{25} = a + (24) \times (-9)$$

$$-219$$

10) Sum of three numbers in an AP is 18,  
sum of their squares is 134. What  
is the common diff. for convenience

$$a+d + a+2d = 18$$

$$3a + 3d = 18$$

$$a+d = 6$$

$$(a-d)^2 + a^2 + (a+d)^2 = 134$$

$$2d^2 = 50$$

$$d = \pm 5$$

$$a=6$$

$$\begin{array}{r} 11 \\ 6 \\ \hline 16 \end{array}$$

11) what is the sum of numbers in 4<sup>th</sup>  
row of following series

$$i) n+1 \quad ii) (n+1)-1 \quad iii) n^2 + (n+1)^2$$

$$n+1 = 9$$

$$\begin{array}{r} 1 \quad 1 \\ 9 \quad 2 \quad 3 \quad 4 \\ 33 \quad 56 \quad 82 \end{array}$$

$$n+1 = 9 \quad \text{so } n = 8$$

$$2n+1 = 16-1 = 15 \neq 9$$

$$n^2 + (n+1)^2 = 9+4$$

$$8+9$$

Geometric  
Progression

$a_1, a_2, a_3, \dots, a_n$  - we need common ratio  $r$ ,

Same

$$a, ar, ar^2, \dots, ar^{n-1}$$

$$a_n = ar^{n-1}$$

2, 4, 8, 16, 32, ...  
qth term

$$a_n = ar^{n-1}$$

$$\frac{a_2}{a_1} = \frac{ar}{a} = r$$

$$a_2 = 2 \times r$$

$$\frac{4}{2} = 2 = r$$

$$2(2)^n = 512$$

$$S_n = a + ar + ar^2 + \dots + ar^{n-1} \quad \text{--- (1)}$$

$$\sqrt{S} = \sqrt{a + ar + ar^2 + \dots + ar^{n-1}} \quad \text{--- (2) & v}$$

$$\rightarrow S = a + ar^n$$

$$S_n = \frac{a(1-r^n)}{1-r} ; r < 1$$

$$S_n = \frac{a(r^n - 1)}{r-1} ; r > 1$$

$$S_n = \frac{a(1-r^n)}{1-r} \Rightarrow S_n = \frac{[a(1 - (ar^{n-1})^+ r)]}{1-r}$$

$$S_n = \frac{[first\ term - (last\ term + a)]}{2}$$

for  $n^2$

$$S_n = \frac{a(n^2 - 1)}{n-1} \rightarrow S_n = \frac{[(a^{n+1})^2 - a^2]}{n-1} \quad \text{if } n \neq 0$$

$$S_n = \frac{[(last\ term^{n+1}) - first^{n+1}]}{n-1}$$

Geometric Mean

$$a, b, c \rightarrow \frac{b}{a} = \frac{c}{b} = b^2 = abc \Rightarrow b = \sqrt{abc}$$

odd number of terms in GP: middle term

$$\text{Even numbers: } (a_1 a_2 \dots a_m)^{1/m} = \sqrt[m]{a_1 \cdot a_2 \dots a_m}$$

Inserting terms

$$a, m_1, m_2, \dots, m_n, b$$

$$r = \left(\frac{b}{a}\right)^{1/(n+1)} \quad m_1 = ar \quad m_2 = ar^2 \quad \dots$$

Multiply or Divide each term of GP by same number  
 $\rightarrow$  resultant GP

$$2, 4, 8, 16$$

$$\times 3 \times 3$$

$$\frac{b_1}{2}, \frac{b_2}{2}, \dots, \frac{b_n}{2}$$

Raise each term by same power

$$2^2, 4^2, 8^2, 16^2$$

$$\frac{4}{a}, \frac{16}{a}, \frac{64}{a}, \dots$$

Multiplying 2 GP values

1)  $a = 2$

$2, 4, 8, \dots$

$3, 9, 27, \dots$

$\frac{3, 9, 27, \dots}{6, 18, 54}$

log of each term

GP : given AP

$2, 4, 8, \dots$

$\log 2, \log 4, \log 8, \dots$

$\log 2 = x$

$x, 2x, 3x, \dots$

AP

- 1) find the 7<sup>th</sup> term of series:  $\frac{3}{8}, \frac{3}{4}, \frac{3}{2}, 3, \dots$ . what is sum of the GP series of 7 terms

$$V = \frac{3}{2} \times \frac{1}{2} \Rightarrow$$

$$a_7 = \frac{3}{8} (2)^{7-1} = \frac{24}{2}$$

- 2.) If 3<sup>rd</sup>, 5<sup>th</sup>, 7<sup>th</sup> term of a GP are p, q and r respectively, then which one is true

a.)  $3q = (pr)^{1/3}$  b.)  $q^2 = pr$  c.)  $p+q+r=1$  d.)  $p+q+r=0$

$$\frac{q}{r^3}, \frac{q}{p^2}, \frac{q}{p}, a, ar, ar^2, ar^3$$

for our convinience

$$p = q/r$$

$$q = ar^n$$

$$r = ar^n$$

$$1.) q = p^x$$

$$a^n = \frac{a}{p} \times p^n$$

$$a^n = p^n$$

- 3) Geometric mean of two numbers is 16 and their AM is 20. find 2 numbers.

$$AM = \frac{ab}{2} = 20 \quad AM = ab = 40 \quad \text{---(1)}$$

$$GM = \sqrt{ab} = 16 \quad ab = 256$$

$$\frac{256}{b} + b = 40$$

$$b^2 - 40b + 256 = 0$$

$$\begin{cases} a = 32 \\ b = 8 \end{cases}$$

- 4.) Third term of a GP is 17. what is the product of first five terms of this GP

- a.)  $(H)^5$  b.)  $aa^5$  c.)  $17^5$

$$\frac{a}{r}, \frac{a}{r^2}, a, ar, ar^2$$

$$\therefore a^5 = 17$$

5) Three consecutive terms of G.P have their sum as 39 and product as 729. Find value of smallest.

$$\begin{aligned}
 & x+y+z = 39 \quad \text{---(1)} \\
 & xyz = 729 \\
 & y = \sqrt[3]{xyz} \\
 & y^3 = 729 \quad y = 9 \\
 & x+y+z = 39 \\
 & xz = \frac{729}{y} = 81 \\
 & x + \frac{81}{x} = 39 \quad x^2 - 39x + 81 = 0 \\
 & x+y=39 \quad x=9, z=9 \\
 & \text{Q. } 9, 9, 9 \\
 & 27, 9, 9
 \end{aligned}$$

6) find the sum of  $1+103+1005+10007+\dots$  up to  $n$  terms.

$$(10+1)+(100+3)+(1000+5)+\dots n \text{ terms}$$

$$(10+100+1000+\dots n) + (1+3+5+\dots n \text{ terms})$$

$$(10+10^2+10^3+\dots 10^{n-1}) + (1+3+5+\dots n \text{ terms})$$

$$\frac{10 \times (10^{n-1} \times 10 - 1)}{10 - 1} + n = \frac{10(10^n - 1)}{9} + n$$

Sum of odd terms

3) Find the sum of the series:  $3+33+333+3333+\dots$

$$\frac{3}{9} (9+99+999+\dots)$$

$$\frac{1}{3} [(10+100+1000+\dots) + (-1-1-\dots)]$$

$$\frac{1}{3} [(10+10^2+10^3+\dots+(n+10^{n+1})) - n]$$

$$\frac{1}{3} \left[ \left[ \frac{(10^{n+1}-10)}{9} - n \right] \right]$$

$$\frac{1}{27} \left[ \cancel{10(10^n-1)} - \cancel{9n} \right]$$

4) Find the sum of  $\left( 4 \frac{2}{3} + \frac{3}{3 \times 2} + \frac{4}{3 \times 2 \times 3} + \dots \text{terms} \right)$

$$i) \frac{3}{4} - \frac{3+3n}{4(3^n)} \quad ii) \frac{3}{4} \left[ 3 - \frac{(3+n)}{3^n} \right] \quad iii) \text{none of them}$$

$$N=2, \quad 1 + \frac{2}{3} = \frac{5}{3} \quad \begin{matrix} \text{Taking only first term} \\ \text{and substituting} \end{matrix}$$

$$ii) \frac{3}{4} \left[ 3 - \frac{(3+1)}{3} \right] = \frac{5}{3} = \frac{5}{3}$$

1) find the sum of the series  $3+33+333+3333+\dots$

$$3(1+10+100+\dots)$$

$$\frac{3}{9}(9+99+999+\dots)$$

$$\frac{1}{9}[(10+100+1000+\dots)+(1-1-1\dots)]$$

$$\frac{1}{9}[(10+10^2+10^3+\dots+(10+10^{n-1}))]-n]$$

$$\frac{1}{9}\left[\left(\frac{(10^n+10)-10}{9}-n\right)\right]$$

$$\frac{1}{27}\left[\cancel{\frac{10(10^n-1)}{9}}-9n\right]$$

2) find the sum of  $\left[ 1 + \frac{2}{3} + \frac{3}{3+3} + \frac{4}{3+3+3} + \dots \text{ (n terms)} \right]$

$$\text{i.) } \frac{3}{4} - \frac{3+3n}{4(3^n)} \quad \text{ii.) } \frac{3}{4} \left[ 3 - \frac{(3+n)}{3^n} \right] \quad \text{iii.) same of them}$$

$$\text{N=2, } \frac{1+2}{3} = \frac{5}{3} \quad \begin{array}{l} \text{Taking only first term} \\ \text{and substituting,} \end{array}$$

$$\text{ii.) } \frac{3}{4} \left[ 3 - \frac{(3+1)}{3} \right] = \frac{5}{3} = \frac{9}{3}$$

7) find the sum of an infinite G.P where  
first term is 15 and second term is 5

$$15, 5, \dots \infty$$

$$S_{\infty} = \frac{a}{1-r}$$

$$r = \frac{5}{15} = \frac{1}{3}$$

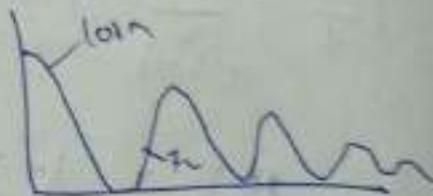
$$S_{\infty} = \frac{24}{1-\frac{1}{3}} = \frac{125}{3}$$

10) A ball falls from a height of 100 meter.  
it reaches 2/3 times its height every time  
it touches . if it continues to fall and  
re-bounce , what is the total distance covered

$$T_A = 100 + 72 = 180 \text{ m}$$

$$T_B = 72 + 48 = 120 \text{ m}$$

$$T_P = 48 + 32 = 80 \text{ m}$$



$$\frac{2}{3} \times 72 = 48$$

$$\frac{120}{180} = \frac{80}{120} = \frac{2}{3}$$

$$100, 100, \dots \infty$$

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

$$S_{\infty} = \frac{100}{1 - \frac{2}{3}} = 100 \times 3 = 300 \text{ m}$$

$$100 + \frac{2}{3}(100)$$

$$100 \text{ m}$$

$$\frac{100}{1 - \frac{2}{3}} = 300 \text{ m}$$

Algebra

$$\text{f}(x) = (5x^3 + 2x^2 - 17x + 12) \div (x+4)$$

$$x+4=0 \quad x=-4$$

$$5x^3 + 2x^2 - 17x + 12 \quad \text{remainder } R \\ x+4=0 \quad x=-4 \quad \text{Quotient} = 0 \quad x = -6/6$$

absolutely, completely, exactly divided means  $R=0$

$$Q1.) 4x^3 + 13x^2 - 5x + 1 \div x+4 \quad \text{find remainder}$$

$$x+4=0 \quad x=-4$$

$$4(-4)^3 + 13(-4)^2 - 5(-4) + 1$$

$$161=R$$

$$Q2.) 5x^3 - 3x^2 + cx + 2 \div x+3 \quad \text{find the value of } c \text{ if}\\ \text{the remainder is } 5$$

$$x=-3$$

$$5(-3)^3 - 3(-3)^2 + c(-3) + 2 = 5$$

$$-165 = 3c$$

$$c = -55$$

$$Q3.) (x^{529} - 1) \div (x-1) \quad \text{find remainder}$$

$$x=1$$

$$1-1=0$$

$$Q4.) (3x^3 + bx^2 + 9x) \div (x-9) \quad \text{leaves out remainder } 11x. \\ \text{find the value of } b \text{ in expression}$$

$$12x + 24 + 9x = 11x$$

$$4a = -10$$

$$a = -6$$

$$5) \quad \begin{array}{r} 1001 \\ + 52 \\ \hline 1453 \end{array}$$

find value

$$1453 \times 1$$

$$6) \quad \begin{array}{r} 5^2 - 5^3 \\ 25 - 125 \\ \hline -100 \end{array}$$

$$5^2 = 25$$

$$5^3 = 125$$

7.) Express

Take

$$\frac{26}{3}$$

8.)

5)  $x^{100} + 5x^a + a$  is completely divisible by (x+1).  
Find value of 'a'.

$$1 + 5(-1) + a = 0$$

$$a = 6$$

6) If  $5^x - 5^{-x} = 500$ . Find value of x

$$5^{2x} (5^x - 5^{-x}) = 500$$

$$5^{2x} = \frac{500}{4} \cdot 4 \quad x = 4 \Rightarrow 5^8$$

$$2x = 3$$

$$x = 4$$

See Assume a value that

Denominator is not 2000

7) Express the following in rational  $\frac{2(x+3)}{3(x-2)} - \frac{2(x+1)}{3(x-3)}$

Take x=0

$$\frac{2(0)}{3(-2)} - \frac{2(1)}{3(-3)} = \frac{-1+7}{9} = \frac{6}{9}$$

assume same x=0 in all those option  
option d

$$\frac{2(-7)}{3(-3)(-2)} = \frac{-14}{18} \checkmark$$

8)  $\frac{a+1}{a-1} + \frac{a-1}{a+1}$  is some  $\rightarrow$

a=1, a=1

$$\frac{1}{-1} + \frac{-1}{1} = -2 \text{ i.e. } \frac{2(0)}{-1} = -2 \checkmark$$

7) find the value of  $\frac{3x^3+8y}{x-4}$  and its reciprocal if  $x=1$

$$xy = 1, x = 1$$

$$\frac{3+0}{1-4} \times \frac{1-0}{3+0} = -\frac{1}{2}$$

8) if  $x+5y+3=0$ ; find the value of  $x^3+5y^3+7xy+2$

assuming  $y=0$

$$x = -3$$

$$x^3 + 27$$

$$(-3)^3 + 27 = 0$$

9) If  $a+b+c = 25$  and  $a^3+b^3+c^3 = 215$ . find  $4a^2b + ((a+b)$

$$a+b+c = 25$$

$$a^3+b^3+c^3 = 215$$

$$a+b = 15$$

$$c = 0$$

$$a^3+b^3 = 215$$

$$4a^2b$$

$$(a+b)^3 = a^3 + b^3 + 3ab = 625$$

$$225 + 3ab = 625$$

$$3ab = 400$$

$$4a^2b = (100)^2 = 160000$$

$$p.) \quad x = (a+2)(a); \quad y = (2a - 2)(a) \quad \text{div } \frac{(x-y)(y+2)}{a-2}$$

$$x = \frac{a+2}{a}, \quad y = \frac{2a-2}{a}$$

$$a = 11; \quad y = 9; \quad x = 12$$

$$\frac{(x-y)(y+2)}{x-2} = \frac{[12-9][9+2]}{12-2} = \frac{9}{10}$$

$$13.) \quad x+1/x = a \rightarrow x^2 + 1/x^2 = a$$

$$\left(x + \frac{1}{x}\right)^2 - 2 = a \rightarrow x^2 + \frac{1}{x^2} + 2 - 2 = a \rightarrow x^2 + \frac{1}{x^2} = a - 2$$

$$x^2 + \frac{1}{x^2} = a - 2 = \frac{a^2 - 4}{a}$$

$$14.) \quad x^2 + 1/x^2 = a \rightarrow x+1/x$$

$$\left(\frac{x+1}{x}\right)^2 = \frac{a^2 + 1}{a^2} \rightarrow \frac{x+1}{x} = \sqrt{a^2 + 1}$$

$$\frac{x+1}{x} = \sqrt{a^2 + 1}; \quad \frac{x+1}{x} = \sqrt{67+1} = \frac{8}{2}$$

$$\text{for } x+1/x = a \rightarrow x+1/x = \sqrt{a^2 + 1}$$

$$15.) \quad x+1/x, \text{ if } x+1/x = \sqrt{6}$$

$$x+1/x = \sqrt{6} \Rightarrow x^2 + 1/x^2 = 6 - 2 \cdot 1 = 4 \left(\frac{x+1}{x}\right)^2 - 16 \Rightarrow x^2 + 1/x^2 = 16 - 14$$

$$\left(\frac{x+1}{x}\right)^2 = 14.6 \quad x^2 + 1/x^2 = \frac{104}{2}$$

$$14) \quad H(x)|_x=4 \quad \text{find } \sqrt{x} + 1 |_{\sqrt{x}}$$

$$\sqrt{x}=a, \quad x=a^2$$

$$H(x)|_x=3 \quad \text{find } \sqrt{x} + 1 |_{\sqrt{x}}$$

$$\frac{a^2+1}{a^2} = 4 \quad ; \quad a+\frac{1}{a} = ?$$

$$\sqrt{x}=a, \quad x=a^2$$

$$\left(a+\frac{1}{a}\right)^2 = 4+2$$

$$a^2+\frac{1}{a^2}=13, \quad a+\frac{1}{a}=?$$

$$a+\frac{1}{a}=\sqrt{13}-3$$

$$\left(a+\frac{1}{a}\right)^2 = a^2+\frac{1}{a^2} =$$

$$\sqrt{x}(\frac{1}{\sqrt{x}}=3)$$

$$23+2=25$$

$$a+\frac{1}{a}=5 \quad -0$$

$$\left(a+\frac{1}{a}\right)^2 = 25+2 = 27 \quad a+\frac{1}{a}=\sqrt{27}$$

$$15) \quad H(x-1)|_x=5 \quad \text{find } x^{11}|_x \quad \text{if } x^3|_x=3; \quad \text{Find } x^{10}$$

$$\left(\frac{x-1}{x}\right)^2 = 25 = x^2 + \frac{1}{x^2} + 2$$

$$x^2 + \frac{1}{x^2} = 23$$

$$\begin{cases} \frac{x-1}{x}=3 \rightarrow x+\frac{1}{x}=9 & \text{if } \\ \left(\frac{x-1}{x}\right)^2 = x^2 + \frac{1}{x^2} + 2 \\ 121-2 = x^2 + \frac{1}{x^2} \end{cases}$$

(+) (-)  
true no

$$16.) \quad x+\frac{1}{x}, \quad x^2 + \frac{1}{x^2}$$

$$\left(x+\frac{1}{x}\right)^3 = a^3 = x^3 + \frac{1}{x^3} + 3x\frac{1}{x} \left(x+\frac{1}{x}\right)$$

$$x^3 + \frac{1}{x^3} + 3\left(x+\frac{1}{x}\right)$$

$$\left[ \frac{x+1}{x^3} = 0 \Rightarrow 1 \right] \rightarrow \left( \frac{x+1}{x} \right)^3 - 3\left( \frac{x+1}{x} \right)$$

if  $x+1=3\sqrt{2}$  find  $x+1/x^2$

$$(3\sqrt{2})^3 - 3(3\sqrt{2})$$

Ans

Find the diff. & change the sign

a) if  $x = 5 + 2\sqrt{6}$  find  $x$

$$x = 5 + 2\sqrt{6} ; \frac{1}{x} = \frac{1}{5 + 2\sqrt{6}}$$

$$\frac{1}{5+2\sqrt{6}} > \frac{5-2\sqrt{6}}{5-2\sqrt{6}} = \frac{5-2\sqrt{6}}{1} \quad x = 5 + 2\sqrt{6} \quad \frac{1}{x} = 5-2\sqrt{6}$$

only if diff. = 1

b) if  $x^{1/3} = 4 + \sqrt{15}$  find  $1/x^{1/3}$

$$y = 4 + \sqrt{15} ; \frac{1}{y} \quad x^{1/3} - 4 - \sqrt{15} = \frac{1}{2}$$

$$\frac{1}{y} = 4 - \sqrt{15}$$

c.) if  $x = 5 + 2\sqrt{6}$ , find  $x+1/x$

$$\frac{1}{x} = 5 - 2\sqrt{6}$$

$$x+1/x = \frac{10}{2}$$

b) if  $x = 5+2\sqrt{6}$  find  $|x|$

$$\frac{1}{x} = \frac{1}{5+2\sqrt{6}}$$

$$x^{-\frac{1}{2}} = \sqrt{6} \quad ; \text{(smallest term)}$$

Q.) if  $x = 13+3\sqrt{2}$  find  $|x|$

$$\frac{1}{x} = \frac{1}{13+3\sqrt{2}} \times \frac{13-3\sqrt{2}}{13-3\sqrt{2}}$$

$$\frac{13-3\sqrt{2}}{131} - \frac{1}{x} = \frac{13-3\sqrt{2}}{13^2 - (3\sqrt{2})^2}$$

b.) if  $x^{**} = 12+3\sqrt{7}$  find  $|x|^{**}$

$$144-63+1$$

$$\frac{1}{x} = \frac{12-3\sqrt{7}}{144-63} = \frac{12-3\sqrt{7}}{81}$$

## Statistics

frequency - how many times event occurred

class interval - clubbing date

mid point -  $\frac{U.L + L.U}{2}$  upper limit - lower limit

range = U.L - L.U

Mean =  $\bar{x} = \text{average of all observations}$   

$$\frac{\text{Sum of all observations}}{\text{Total No. of observations}}$$

$$\frac{\sum f_i x_i}{\sum f_i}$$

Q) Marks obtained by 40 students of class XI  
 are given find mean marks  
 (class mark)  $\frac{(U.L + L.U)}{2}$  fix it

Assumed Mean

find mean, assume value to be mean

Subtract Mean value from all

$$d_i = x_i - \bar{x} \quad \bar{x} = a + \frac{\sum f_i d_i}{\sum f_i}$$

55	10	$10 - 55 = -45$	2200	
80	30	$30 - 80 = -50$	1600	$50 f (-220)$
105	50	$50 - 105 = -55$	0	
95	70	$70 - 95 = -25$	1400	
45	45	$45 - 45 = 0$	1000	$-900$

Mean value gets

affected by addition, subtraction, division

v) The mean of 11 terms is 25. what is new?

If 5 is subtracted  $25 - 5 = 20$

5 is added  $25 + 5 = 30$

5 is multiplied  $25 \times 5 = 125$

5 is divided  $25 / 5 = 5$

Variance

how data points differ from mean  
always true, 6

$$\sigma^2 = \frac{\sum |x - \bar{x}|^2}{n} \quad \begin{matrix} x - \text{Data} \\ \bar{x} - \text{mean} \end{matrix}$$

e.g.) 2, 5, 8, 9

$$\bar{x} = \frac{2+5+8+9}{4} = 6$$

$x - \bar{x}$	$(x - \bar{x})^2$
2 - 6	16
-1	1
+2	4
+3	9
	$\overline{30}$

$$\frac{30}{4} = 7.5$$

Standard deviation

$\sigma$  always positive

Square root of variance

Co-eff. coeff. of variance =  $\frac{SD}{Mean} \times 100$

$$\frac{5}{5} \times 100$$

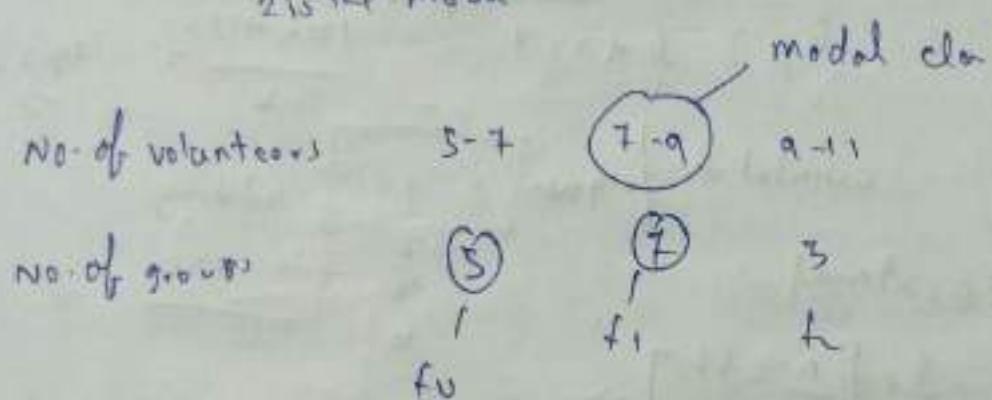
Answer is 100.

Mode -

Data that is repeated maximum number of times

No. of goals	0	1	2	3
match	1	1	3	1

2 is the mode



$$\text{range} = 7 - 19 = 12$$

Mode :  $L + \left( \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h$

Median

Middle most value (ascending order)

Value of  $\frac{n+1}{2}$  term

It gives the position of Med.

for even

Average of observations at  $\frac{n}{2}$  &  $\frac{n+1}{2}$  posn.

153, 160, 143, 159, 150, 147

153, 147, 159, 150, 153, 147

find mean

$$\frac{6}{2} = 3 \quad \frac{6+1}{2} = 4 \quad - \quad \frac{147 + 150}{2} = 148.5 \text{ m.t.}$$

cumulative frequency = 1 adding

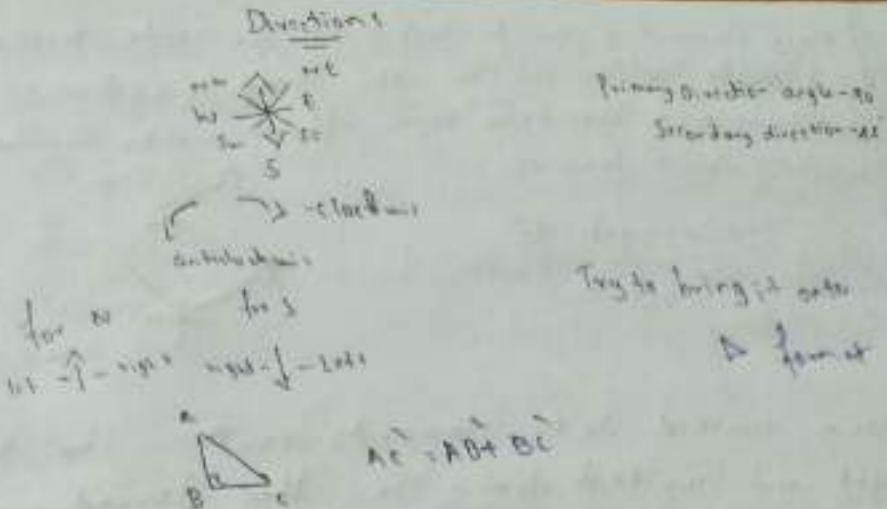
2  
3  
6

If class interval

$$l + \left[ \frac{\frac{n}{2} - CF}{f} \right] \times h$$

R/P b/w Mean, mode & median

$$\text{Mode} = 3^* \text{ Median} - 2^* \text{ Mean}$$



at 12 noon - northward

Morning - shadow to west Evening - shadow to east

N -

Sunrise - shadow left

Sunset - shadow right

S-facing  
Sunrise shadow right

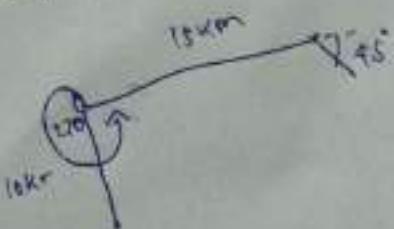
- 1) Joe is facing toward South and is anticlockwise.  
He turns again 180° in anti clockwise direction now  
He turns 270° clockwise. Which direction this?

South west



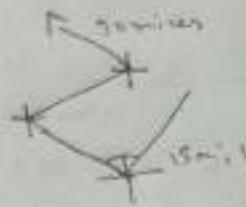
- 2) Morris is facing North and walks 10 km S. He turns 270° anti clockwise and walks 15 km S. Now again turns 180° clockwise and walks for 25 km S. Which direction is he facing now?

South East

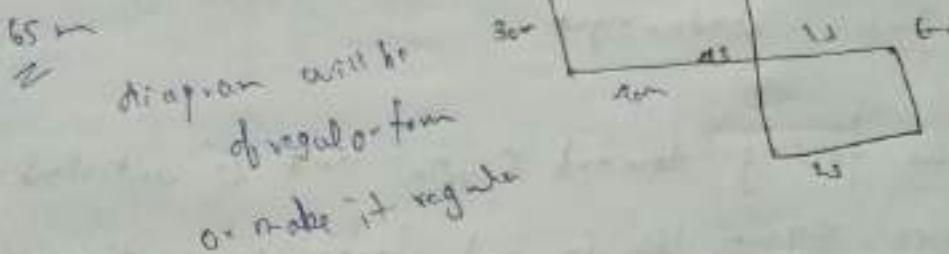


- 3) Mary is walking towards South west for 10 miles, turns right and walks another 10 miles. She turns 90 clockwise and walks 10 miles. Now she again turns left and walks 3 miles what direction is she from?

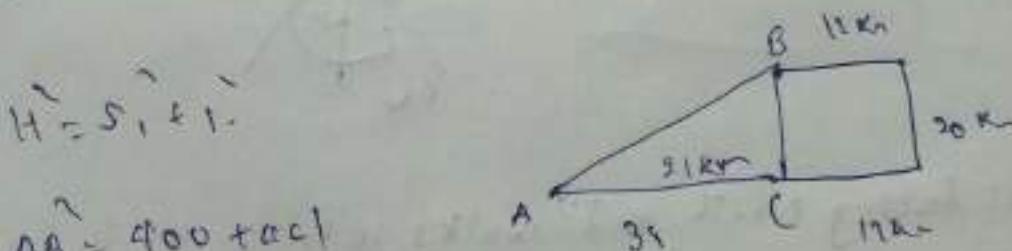
turns right -  $90^\circ$   
North west



- 4) Maria walked 30m towards north. She turned right and walked 40m. She then turned right and walked 15m. She turned left and walked 25m. Finally she turned left and walked 10m. How far is she from starting position?



- 5) A boy walks 12 km towards east. He turns  $90^\circ$  clockwise and walks 20 km. Then turned right and walked for 3 km. How far is he from starting?



$$AB = 29$$

$\angle$

- 7) A car travels 25 km's towards south from garage. It turns left and travels 10 km's, then turns right and travels 15 km - how far is it from garage.

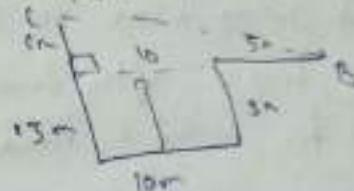
$$\begin{aligned} AC &= \sqrt{AB^2 + BC^2} \\ AB &= 50 \text{ km} \end{aligned}$$



- 7) Martin walked 13 m towards south from his garage, turned left and walked 9 metres. He took turn and walked 5 metres and then he turned right and walked 8 metres. How far is he from garage?

$$BC = \sqrt{AC^2 + AB^2}$$

$$BC = 17$$



- 8) One morning after sunrise, Joe was standing facing a pole. The shadow of pole fell exactly to his right. To which direction was he facing?

It was to his right

South



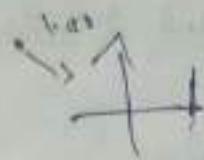
- 9) James and Henry were standing facing each other at 8 am. Shadow of Henry fell to his right. To which direction James was facing?

J - facing North



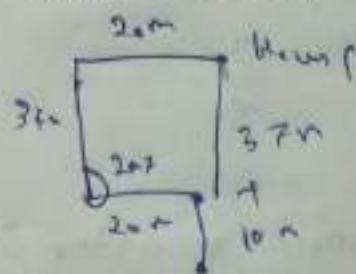
- (i) Prince was standing facing the pole at 11 a.m.  
 shadow of pole fell towards his right. To  
 which direction was Prince facing?

North



- (ii) Ted drives a car 10 miles towards North from his office. He turns  $270^\circ$  clockwise and drives for 2 miles. Now, he turns  $270^\circ$  anti-clockwise and drives a car for 3 miles. Finally he reaches his house after driving for 2 miles to the right. How far is Ted's house and in which direction?

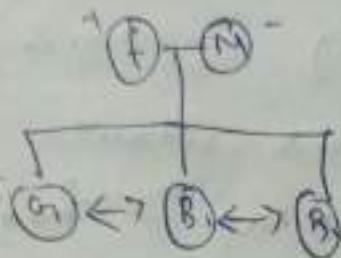
At North direction



Blood relation

Tricks

- 1) Draw diagram
- 2) mark the daughter onto new line
- 3) use symbols + male, female, etc siblings
- 4) no gen. diff. 5) no gender assumption



father of father or mother - grandfather  
 Mother of father

Numerical  
analogies

We have consider base factors or in other words we  
can consider base numbers as a their divisor to  
divide  $x$ . - is secondary given number in square  
using  $2x$ .

Formulas may be of type,

$$x \cdot x^2 \quad x \cdot (x+1)^{y+1}$$

$$x^2 \cdot x^3 \quad x^2 \cdot (x^2 - 1)$$

$$x \cdot (x^2 + 1) \quad x \cdot (x-1)^{y+1}$$

$$x \cdot \frac{x^2}{2}$$

make sure you find product square or cube  
or some relation

for finding which,  
number is similar

a) add sum of all digits and count the digits

$$363 = 3+6+3 = 12 \quad 1+2=3$$

b) Product of digits

$$102 = 1 \times 0 \times 2 = 1 \times 2 = 2$$

c)

~~13 4 246 351~~

260

d.) Sum will be equal to one mark

$$538 = 5+8-3=10 =$$

e.) ~~4719~~  
 $4719 = 52 \div 8$

finding from set

(6, 13, 22)

Simplest 27, 29

(9, 15, 21)

$\sqrt{13}$  - second

(21, 51, 15)

$3^2 + 1^2$

(6, 3, 2)

2<sup>nd</sup> number - 1

(12, 13, 11)

1<sup>st</sup> no. + 9

(19, 13, 9)

7, 5, 3

(236, 69, 11)

Squares

(12, 6, 1)

all are even

(246, 757, 368)

Sum of digits

(63, 29, 51)

~~square~~

Joker case

$\boxed{369}$

3 digits.

1

1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169, 196, 225, 256, 289, 324, 361, 400, 441, 484, 529, 576, 625, 676, 729, 784, 841, 900, 961, 1024, 1089, 1156, 1225, 1296, 1369, 1444, 1521, 1600, 1681, 1764, 1849, 1936, 2025, 2116, 2209, 2304, 2401, 2500, 2609, 2704, 2809, 2904, 3001, 3100, 3209, 3304, 3401, 3500, 3609, 3704, 3801, 3900, 4009, 4104, 4201, 4300, 4409, 4504, 4601, 4700, 4809, 4904, 5001, 5100, 5209, 5304, 5401, 5500, 5609, 5704, 5801, 5900, 6009, 6104, 6201, 6300, 6409, 6504, 6601, 6700, 6809, 6904, 7001, 7100, 7209, 7304, 7401, 7500, 7609, 7704, 7801, 7900, 8009, 8104, 8201, 8300, 8409, 8504, 8601, 8700, 8809, 8904, 9001, 9100, 9209, 9304, 9401, 9500, 9609, 9704, 9801, 9900, 10000, 10109, 10204, 10301, 10400, 10509, 10604, 10701, 10800, 10909, 11004, 11101, 11200, 11309, 11404, 11501, 11600, 11709, 11804, 11901, 12000, 12109, 12204, 12301, 12400, 12509, 12604, 12701, 12800, 12909, 13004, 13101, 13200, 13309, 13404, 13501, 13600, 13709, 13804, 13901, 14000, 14109, 14204, 14301, 14400, 14509, 14604, 14701, 14800, 14909, 15004, 15101, 15200, 15309, 15404, 15501, 15600, 15709, 15804, 15901, 16000, 16109, 16204, 16301, 16400, 16509, 16604, 16701, 16800, 16909, 17004, 17101, 17200, 17309, 17404, 17501, 17600, 17709, 17804, 17901, 18000, 18109, 18204, 18301, 18400, 18509, 18604, 18701, 18800, 18909, 19004, 19101, 19200, 19309, 19404, 19501, 19600, 19709, 19804, 19901, 20000, 20109, 20204, 20301, 20400, 20509, 20604, 20701, 20800, 20909, 21004, 21101, 21200, 21309, 21404, 21501, 21600, 21709, 21804, 21901, 22000, 22109, 22204, 22301, 22400, 22509, 22604, 22701, 22800, 22909, 23004, 23101, 23200, 23309, 23404, 23501, 23600, 23709, 23804, 23901, 24000, 24109, 24204, 24301, 24400, 24509, 24604, 24701, 24800, 24909, 25004, 25101, 25200, 25309, 25404, 25501, 25600, 25709, 25804, 25901, 26000, 26109, 26204, 26301, 26400, 26509, 26604, 26701, 26800, 26909, 27004, 27101, 27200, 27309, 27404, 27501, 27600, 27709, 27804, 27901, 28000, 28109, 28204, 28301, 28400, 28509, 28604, 28701, 28800, 28909, 29004, 29101, 29200, 29309, 29404, 29501, 29600, 29709, 29804, 29901, 30000, 30109, 30204, 30301, 30400, 30509, 30604, 30701, 30800, 30909, 31004, 31101, 31200, 31309, 31404, 31501, 31600, 31709, 31804, 31901, 32000, 32109, 32204, 32301, 32400, 32509, 32604, 32701, 32800, 32909, 33004, 33101, 33200, 33309, 33404, 33501, 33600, 33709, 33804, 33901, 34000, 34109, 34204, 34301, 34400, 34509, 34604, 34701, 34800, 34909, 35004, 35101, 35200, 35309, 35404, 35501, 35600, 35709, 35804, 35901, 36000, 36109, 36204, 36301, 36400, 36509, 36604, 36701, 36800, 36909, 37004, 37101, 37200, 37309, 37404, 37501, 37600, 37709, 37804, 37901, 38000, 38109, 38204, 38301, 38400, 38509, 38604, 38701, 38800, 38909, 39004, 39101, 39200, 39309, 39404, 39501, 39600, 39709, 39804, 39901, 40000, 40109, 40204, 40301, 40400, 40509, 40604, 40701, 40800, 40909, 41004, 41101, 41200, 41309, 41404, 41501, 41600, 41709, 41804, 41901, 42000, 42109, 42204, 42301, 42400, 42509, 42604, 42701, 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137501, 137600, 137709, 137804, 137901, 138000, 138109, 138204, 138301, 138400, 138509, 138604, 138701, 138800, 138909, 139004, 139101, 139200, 139309

## Classification

Take care of 1st and last numbers

$\sqrt{369}$  - division 4 especially when in 3 digits

Check for odd digits

number repeat

first and last number same

odd

prime numbers

Last digit more than first

repeating

even multiple

ratio a:b

$2 \times 1$  ↑  
~~2~~ 0

Take these multiple

soon

Try to find relation

after cont

first number on second number  $\times 2 + 3 + 1$   
= number

find any relation wif

Def +  
make sure you go clockwise

## Seating Arrangements

- 1) directions  $\uparrow$
  - 2) clockwise  $\swarrow$  - anti-clockwise
  - 3) facing inside or outside
  - 4)  $\left.\begin{array}{l} \uparrow \\ \downarrow \end{array}\right\}$  right  $\rightarrow$  left
- 
- 1.) Count number of people
  - 2.) Draw framework
  - 3.) Center G. Merge framework

Clarke

24 hrs

The minute  
hand rotates

To find minute degree of a hand  
subtract from  $360^\circ$

These are horizonte spaces

Total degree

$360^\circ$

In 1 hr

minute hand -  $360^\circ$

hour hand -  $30^\circ$

Second hand -  $60 \text{ min spaces} = 360^\circ \div 6^\circ$

So 1 minute =  $6^\circ$

Ans =  $30^\circ$

In 1 minute hour hand over

$$\frac{30}{60} = \frac{0.5}{2}$$

Every 1 hr

hour hand is slow by  $0.5^\circ$  minutes

for  $90^\circ$  we need 15 minutes Stacey

In 24 hrs we will have

22 times  $90^\circ$  degree in 12 hrs

49 in 24 hrs

every coincidence

over 1 hr.

but for 12 hrs its 11 times

1 hr -  $180^\circ$  deg

In 12 hrs - 11 times

In 24 hrs = 22 times

every day at will be in straight line

22  $\times$  44 min

$0^\circ$  as well as  $180^\circ$



Gaining

8  
losing

To

17:00 CT was 10 minutes fast by 1m. after Dn.  
12:59 was fast by 5m.

12:00 CT

1:05 CT

15 minutes past 7:15

20 minutes to 8 : 7:40

Quadrant past : 7:15 Pm

Quadrant to 6 : 5:45 Pm

In analog mistaken clock, the time  
may or may not be correct.

Clocks show correct time 2 times

a day.

Non Verbal

Analogies

Find patterns and rules  
check for similar elements

Eg

changes

Find group of elements and find it's

Pattern

key trick

deletion -

rotation

interchange of figure

Movement & rearrangement

addition & deletion

Identical figures

Statement

Eg

Conclusion

Just use the logic of the statement no  
general knowledge

advice or Result always true

Conclusion : infer u

Don't presume

For Probable go for either

Statement of Argument

Strong Argument

Weak Argument

Security of nation -

Over exaggeration, Assumption

Development of a  
Country

Words like Each, Nothing  
Every, All, only, none

Universal Truth

Comparison

Instructions from

Ambiguous

Supreme Authority  
fact based or  
experience

half explained argument

Educational  
development

Even advice & Suggestion  
few we a bit of

common sense.

In terms of advantage & disadvantage  
either both can be strong

(Cause &  
Effect)

and assume

So or Therefore

Combine L.R. with So

Statements

&

Assumption

Just assume the given statement without proof use common sense and logic to check whether true or false

Implicit - True

Explicit - False

every, each, none, all, only etc.

It's false

Assumptions about past or future are always explicit

If assumption goes against all explicit

If statement is specific or generalized  
and answer will vary it is explicit

### Coding-decoding

Subtract from 97 to get reverse order.

Types of problem

Letters

Numbers

Symbols

Group

Miscellaneous

ascending

descending

order

grouped

vowel position

M O U S E

(P N) - F O

Statement

knowable Course of Action

what should it know when able;

Statement is always true

Practical - logically implemented

Solution should not give birth

to new problem

Never choose outcome that you  
cannot predict

basically in 2 types Series

Frequently

Numerical

Letters

Alphanumeric

Types In List.

Most

Missing

odd man

Types

either Square, Cube, Multiple

or

addition, subtraction,  $\times$ ,  $\div$ , prime  
number, fibonaci etc

$\frac{x^2 + y^2}{2}$ , average, odd number

middle number, prime numbers total

addition so or

check for set near Square

} Fibonacci Series

1 1 2 3 5

- - - -

Check

especially

for alpha numeric

check for positioning of @ the number  
especially in reverse order.

We can break down

469@ 18 / 25

68(9)

Triangular method

1, 11, 34, 75, 139, ? 231

10 23 41 64 or

13 18 23 21

5 5

Syllogism

Finding which of those statement matches

Can be solved using venn diagram

Income - Expenditure methods

66/93

Triangular method  
1, 11, 34, 75, 139, ? 231  
80 23 91 64 or  
13 18 23 11  
5 5

### Syllogism

Finding which of those statement matches  
can be solved using Venn diagram.

Income - Expenditure method

Normal - Income Expenditure

Possibility - Venn

In conclusion if we  
want to can be , being possibility of  
being closed - possibility

All Cats

In more cases

every sentence has 2 closed  
Some bottles are glasses

Some C

4 important words

All	100	50
No/None	100	100
Some	50	50
Some... Not	50	100

Jacques & expert

Some bottles are glasses

50                    50

100                    50

All the glasses are colors

The

50                    100

at least one

✓ No glasses are colors

should have

50                    06

100

✓ Some colors are bottles

do for second

ord N

values are very same

A=B

2A=2C

B=C

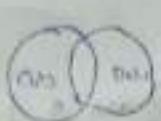
Venn Diagram

All Cats are dogs



Cats are dogs.

Some Cats are dogs



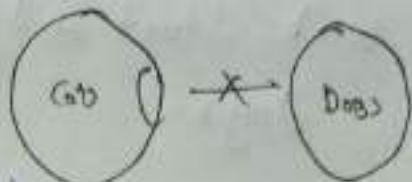
It can't be

true in both  
conditions

No Cats are dogs



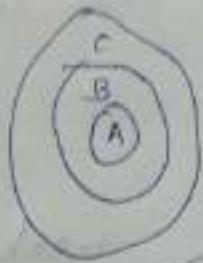
Some Cats are not dogs



Intuition of Venn diagram

We have to mark it as both conditions  
are going to condition is true. Consider its possibilities

All B are C



All A are B

Conclus. -

Two possibilities done in

✓ All B can be a

✓ Some not being B is also a possibility. If condition is possible?

X Some C can be all condition if it is

Y Some A can be C if it is

# Calendar

2 types of year

Normal - 365 days

Leap - 366 days

$$\frac{365}{7} = 52 \text{ weeks} + 1 \text{ day} \leftarrow (\text{odd day})$$

Week Starts and ends in  
day b/w

wednesday - Tuesday

for a normal year

If starts and ends in same day

leap year

weeks odd day

366 days 52 2

for leap year

Wed... Tue ... Wed ... Tue ...

for dividing  
leap year comes  
Divide by 4 for non century years

1756 - ✓

1852 ✓

Divide by 100 for century years

1900 - ✓

1700 - X

leap year doesn't come often  
4 years

$$\frac{1896}{100} - \frac{1900}{100} - \frac{1904}{100} \checkmark$$

how many leap years in 100 years

	leap years	Normal
100 years	25	75
200	50	150
300	75	225
400	97	303

odd days

$$10 \text{ day} \rightarrow 1 \text{ week} + 3 \text{ odd days} \quad 7 \overline{) 10} \\ + \\ \underline{3}$$

$$\text{for Jan} \rightarrow 31 - 7 \text{ weeks} + 3 \text{ day} \quad 7 \overline{) 31} \\ \text{remainders or odd days can only} \quad \underline{21} \\ \text{be } 0, 1, 2, 3, 4, 5, 6 \quad \underline{3}$$

odd factors

$$5 - 100 \text{ yrs}$$

$$3 - 200 \text{ yrs}$$

$$1 - 30 \text{ yrs}$$

$$6 - 90 \text{ yrs}$$

$$1001 - \frac{1001}{3} = 333 \quad \underline{3} \quad 1$$

way of finding such factors will

cancel

2F

3F

521

1A

7F

1F

2F

5F