

## Group 4

- 1) Time and work
- 2) Pipes and Cisterns

### I) Time and work

1) Main point  $\rightarrow$  (Invert)  $\begin{matrix} \swarrow & \searrow \\ N & \frac{1}{N} \end{matrix}$

ex: total work in 30 days, the one day  $\rightarrow \frac{1}{30}$  of work done

- 2) work  $\uparrow$ , time  $\downarrow$  days  $\downarrow$   
men  $\uparrow$ , work  $\uparrow$ , time  $\downarrow$ , days  $\downarrow$

1) A can work 5 times faster than B and takes 60 days less than B to complete work. In how many days does A and B individually can complete the work?

Soln: given It takes  $\rightarrow$  60 days less than B

$\begin{matrix} A \\ \downarrow \\ n-60 \end{matrix}$	$\begin{matrix} B \\ \downarrow \\ n \end{matrix}$	$\begin{matrix} A \\ \downarrow \\ n-60 \end{matrix}$
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Also  $A \text{ days} = 5 B \text{ days}$  A complete 5 times faster  $\rightarrow 5 \times \text{less time}$

$$n-60 = \frac{n}{5}$$

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$$5n - 300 = n$$

$$4n = 300$$

$$n = 75 \text{ days}$$

$\rightarrow$  B complete days

$$A \rightarrow n-60$$

$A = 15 \text{ days}$   $\rightarrow$  A complete days.

(5 times faster don't put (5n) then A is bigger time)

2) If 24 men can finish a work in 10 days, then find the no of days required to complete same work by 30 men?

Soln. Mistake to be prone  $\rightarrow$  24  $\rightarrow$  10  
30  $\rightarrow$  n

$$\rightarrow 24 \times n = 30 \times 10$$

$$n = \frac{300}{24}$$

$$n = 12.5 \text{ days}$$

wrong  $\times$  bcs if no of men increase days should reduce

So Perfect answer approach:- use 'Inversion'

24 men  $\rightarrow$  in 10 days  $\rightarrow$  work done in one day  $= \frac{1}{10}$

$$\therefore \begin{array}{ccc} 24 & \frac{1}{10} & \\ 30 & ? & \end{array} \Rightarrow 24 \times n = \frac{30}{10} \rightarrow n = \frac{3}{24}$$

$$n = \frac{1}{8}$$

This is one day work by 30 men

So 30 men finish working?

invert  $\rightarrow$  8 days //

3) A can do work in 5 days B can do same work in 6 days and C in 7 days. If they work together, in how many days will they take to complete work?

A 5 days  $\rightarrow$  one day  $\rightarrow \frac{1}{5}$

B 6  $\rightarrow \frac{1}{6}$

C 7  $\rightarrow \frac{1}{7}$

$$\text{all in one day} \rightarrow \frac{1}{5} + \frac{1}{6} + \frac{1}{7} \rightarrow \frac{14+7+6}{42} \rightarrow \frac{27}{42} \rightarrow \frac{9}{14}$$

A, B, C one day  $\rightarrow$

Invest  $\rightarrow \frac{14}{9}$  days for A, B, C to complete work.

4) P and Q can do work in 12 days. Q and R can do same work in 16 days and R and P can do it in 24 days. Find time in which P, Q, R can complete.

$$\begin{array}{lcl} P, Q & 12 \text{ days} & \rightarrow \frac{1}{12} \\ Q, R & 16 & \rightarrow \frac{1}{16} \\ R, P & 24 & \rightarrow \frac{1}{24} \end{array}$$

$$(P+Q) + (Q+R) + (R+P) = \frac{1}{12} + \frac{1}{16} + \frac{1}{24}$$

$$2(P+Q+R) = \frac{4+3+2}{48} \Rightarrow \frac{9}{48} \times \frac{3}{16}$$

$$P+Q+R = \frac{3}{32} \Rightarrow \text{in one day}$$

$$P, Q, R \text{ take to complete} \rightarrow \frac{32}{3} \text{ days} //$$

5) P can do a work in 30 days. Q is 25% more efficient than P in completing the same work. How many days will Q complete the work?

Soln . P in one day  $\rightarrow \frac{1}{30}$

Q is 25% more so 125% of P

$$Q \text{ in one day} \rightarrow \frac{125}{100} \times \frac{1}{30} = \frac{5}{24}$$

$$Q \text{ complete work in } 24 \text{ days} //$$

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 by 8 men and 8 boys?

Soln:-  $3m \rightarrow 2 \text{ days}$   $\uparrow \times 3$   
 $4b \rightarrow 6 \text{ day}$   $\downarrow \div 3$

$$\text{So } 3m = 4b$$

$$m = \frac{4}{3}b \rightarrow 1 \text{ man does work of } \frac{4}{3} \text{ boys.}$$

To find work by 8 men, 8 boy

$$8m + 8b$$

$$\rightarrow m = \frac{4}{3}b$$

$$32b + 8b \Rightarrow 40b \text{ work.}$$

Given  $\rightarrow 4b \text{ in } 6 \text{ days} \rightarrow \text{in } 1 \text{ day } \frac{4}{6}b \rightarrow \frac{2}{3}b$

$$40b \text{ in one day} = \frac{10}{6}$$

$$40b \text{ total work} = \frac{6}{10} \text{ days}$$

$$8 \text{ men, } 8 \text{ boys entire work} \rightarrow \frac{6}{10} \text{ days} \\ \rightarrow \frac{3}{5} \text{ days.}$$

7) Sita, Gita do work in 20, 20 days resp. Both begin together but after few days, Sita leaves, then Sita finish remain work in 10 days. After how many days did Sita leave?

Soln:-  $\begin{array}{c} \text{S leaves} \\ \uparrow \\ \text{Sita} \quad \text{Gita} \quad \text{Finish} \end{array}$

$$\text{Sita} \rightarrow 20 \text{ days} \rightarrow \text{one day Sita} = \frac{1}{20} \text{ day}$$



Gita 25d  $\rightarrow$  one day G =  $\frac{1}{25}$  day

in work last 10 day gita does

$$\rightarrow 10 \times \frac{1}{25} \rightarrow \frac{2}{5} \text{ of work}$$

remaining work =  $\frac{3}{5}$  done at first

$$\rightarrow \left( \frac{2}{5} + \frac{3}{5} = \frac{5}{5} = 1 \right)$$

So first Sit, Gita work together

$$S+G = \frac{1}{20} + \frac{1}{25} \rightarrow \frac{4+3}{20 \times 25}$$

$$S+G = \frac{7}{100} \rightarrow 1 \text{ day}$$

Let the first day S+G work be n

$$\text{the work they complete} = \frac{3}{5}$$

$$\frac{7}{100} \times n = \frac{3}{5} \Rightarrow n = \frac{300}{7 \times 100}$$

$$n = \frac{20}{3} \text{ days}$$

So Sit leaves after  $\frac{20}{3}$  days

8) When P alone does a work, he takes 25 days more than the time taken by P and Q working together to complete the work. But Q alone takes 9 days more than the time taken by P and Q working together to complete work. In what time, P and Q together finish work?

Sols.

P+Q  
N

P  
N+25

Q  
N+9

but here 1 day work method would be hard

formula:  $N = \sqrt{\text{Extra P} \times \text{Extra Q}} = \sqrt{25 \times 9}$

$N = \sqrt{5 \times 3}$

$P+Q \Rightarrow \boxed{N=15} //$

$P \Rightarrow N+25 \Rightarrow 40 //$

$Q \Rightarrow N+9 \Rightarrow 24 //$

Q) 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 per day, in how many days will they complete work?

Soln:- Here we have time in 2 format days, hours per day  
To find:- days needed to A, B complete if 8 hours a day

A 12d 8 hr  $\rightarrow 12 \times 8 \rightarrow 96 \text{ hours} \rightarrow \frac{\text{one hour}}{\text{one day}} \rightarrow \frac{1}{96}$

B 8d 10 hr  $\rightarrow 8 \times 10 \rightarrow 80 \text{ hours} \rightarrow \frac{\text{one hour}}{\text{one day}} \rightarrow \frac{1}{80}$

$A+B = \frac{1}{96} + \frac{1}{80} \Rightarrow \frac{80+96}{96 \times 80} \Rightarrow \frac{176}{96 \times 80} \text{ (one hour)}$

how many hours to complete (A+B)  $\rightarrow \frac{96 \times 80}{176}$

if 8 hours per day how many days  $\rightarrow \frac{96 \times 80}{176}$

$= \frac{24 \quad 10}{96 \times 80} \Rightarrow \frac{240 \quad 60}{480} \Rightarrow \frac{60}{11}$

If A, B work 8 hr per day they complete in  $\frac{60}{11}$  days

10) Raj can build a house alone in 16 days but Suraj alone can build it in 12 days. Raj and Suraj work on alternate days. If Raj works on first day, the house will be built in how many days?

Soln → R → 16d →  $\frac{1}{16}$

S → 12d →  $\frac{1}{12}$

alternate days → R S R S

2<sup>nd</sup> day =  $\frac{1}{16}$  2<sup>nd</sup> day =  $\frac{1}{12}$

2 days =  $\frac{1}{16} + \frac{1}{12} \Rightarrow \frac{12+16}{12 \times 16} = \frac{28}{192} = \frac{7}{48}$

2 day =  $\frac{7}{48}$

Let's take 2 day × 6 times = 12 day

$\frac{7}{48} \times 6 = \frac{49}{48} \Rightarrow > 1$  (not possible)

Should be  $< 1$  (if work)

So 2 × 6 times = 12 days

$\frac{7}{48} \times 6 \Rightarrow \frac{7}{8}$  work

remaining work  $\frac{1}{8}$  work

So now R + S × 12 days +  $\frac{1}{8}$  work

R S R S ... R S ... → R<sup>th</sup> day work

R →  $\frac{1}{16} < \frac{1}{8}$  (very low) for one day

S →  $\frac{1}{12} > \frac{1}{8}$  (near)

sof

Last day work to be done by R →  $\frac{1}{16}$  a day

$\frac{1}{8}$  to be done → 13<sup>th</sup> day R do  $\frac{1}{16}$

remaining work  $\frac{1}{8} - \frac{1}{16} \Rightarrow \frac{1}{16}$

14th day S finish  $\Rightarrow$  S one day =  $\frac{1}{12}$

to be done  $\frac{1}{16} < \frac{1}{12}$

$$\begin{array}{ccc} \frac{1}{16} & \frac{1}{12} & \text{in } 1 \text{ day} \\ & \frac{1}{16} & \text{in } n \text{ days} \end{array}$$

$$\frac{n}{12} = \frac{1}{16} \Rightarrow n = \frac{12}{16} \Rightarrow \frac{3}{4} //$$

To finish all work

(R, S) ... 12 days + R (1 day) + S ( $\frac{3}{4}$  day)

total  $13\frac{3}{4}$  days to complete. //