Basic Concepts

Friday, May 21, 2021 1:51 PM

⇒ Total amount of a complete job (or assigned job) = 1 always, unless specified.

⇒ If any person 'm' complete a job alone in t days

Alone time for 'm' = t.

⇒ 1 day's work by any person

$$= \left(\frac{1}{\text{Alone time}}\right)^{th} \times \text{part of total work}$$

$$\text{Alone time of } \frac{1}{\text{1 day's work}}$$

⇒ Important Formula's

1// (i) If A can do a piece of work in x days and B can do same work in y days, then both of them working together will do the same work in $\left(\frac{xy}{x+y}\right)$ days.

(ii) A, B, C while working alone can complete a work in x, y and z days respectively then they will together complete the work in

$$\frac{xyz}{xy + yz + zx} \text{ days.}$$

Ex: A can do a piece of work in 6 days and B can do in 9 days. How many days will both take together to complete the work?

$$\frac{xy}{x+y} = \frac{6 \times 9}{6+9} = \frac{54}{15} = 3.6 \text{ days.}$$

Here A = 6, B = 9

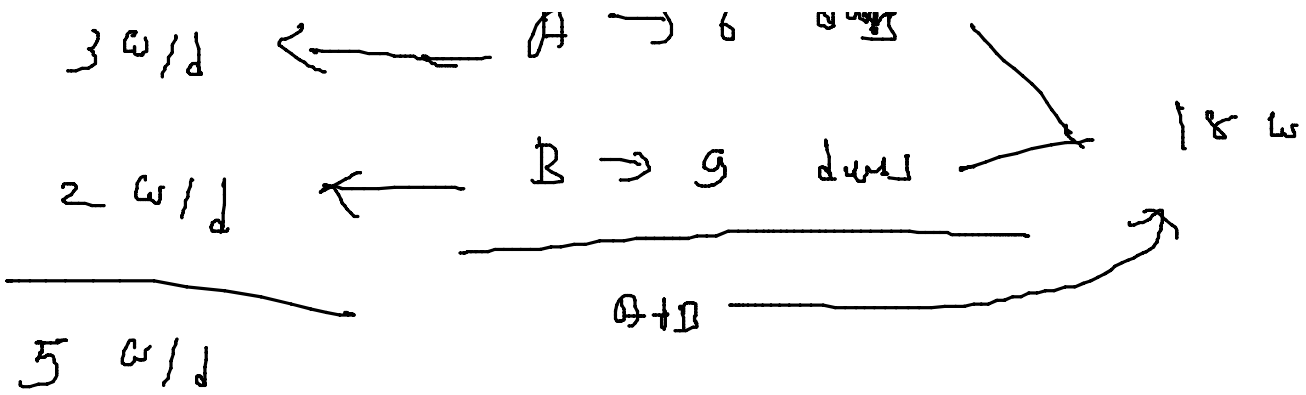
together

$$= \frac{1}{6} + \frac{1}{9} = \frac{3+2}{18} = \frac{5}{18}$$

together days $= \frac{18}{5}$ days $= 3.6$ days.

L.C.M method.

3 0 | 6 ⟵ A → 6 days



$$\text{together} = \frac{18}{5} = 3.6 \text{ days.}$$

Ex If man A complete a piece of work in 12 days & the same work is completed by B & C in 15 days & 20 days respectively. In how many days the work is completed if they work together?

→ Work/day of A, B & C $= \frac{1}{12} + \frac{1}{15} + \frac{1}{20}$

$$= \frac{5+4+3}{60} = \frac{12}{60} = \frac{1}{5}$$

Total days $= 5$ days //

⇒ L.C.M. method.

5 w/d —— A - 12 days

4 w/d —— B - 15 days

3 w/d —— C = 20 days

L.C.M

60 = Work

3 will ——— C = 20 days

12 will (A+B+C)

Total work done by (A+B+C) = 12 work

Total work is done by (A+B+C)

$= \frac{60}{12} = 5$ days.

$\Rightarrow$ Equation

$$= \frac{xyz}{xy+yz+zx}$$

$$= \frac{12 \times 15 \times 20}{(12\times15)+(15\times20)+(20\times12)} = 5 \text{ days}$$

2. Two person A and B working together, can complete a piece of work in x days. If A alone can complete the work in y days, then B working will complete the work in

$\left(\frac{xy}{y-x}\right)$ days.

Ex/ A and B together can do a piece of work in 5 days and A alone can do it in 8 days. B alone can do the same piece of work in

$$= \frac{1}{5} - \frac{1}{8} = \frac{8-5}{40} = \frac{3}{40} \quad \text{(40 days)} = 13\frac{1}{3} \text{ days.}$$

OR

8 d ← A & B ← 5 days

5 d ← A ← 8 days

} 40 work

3 d ← B

$$= \frac{40}{3} = 13\frac{1}{3} \text{ days.}$$

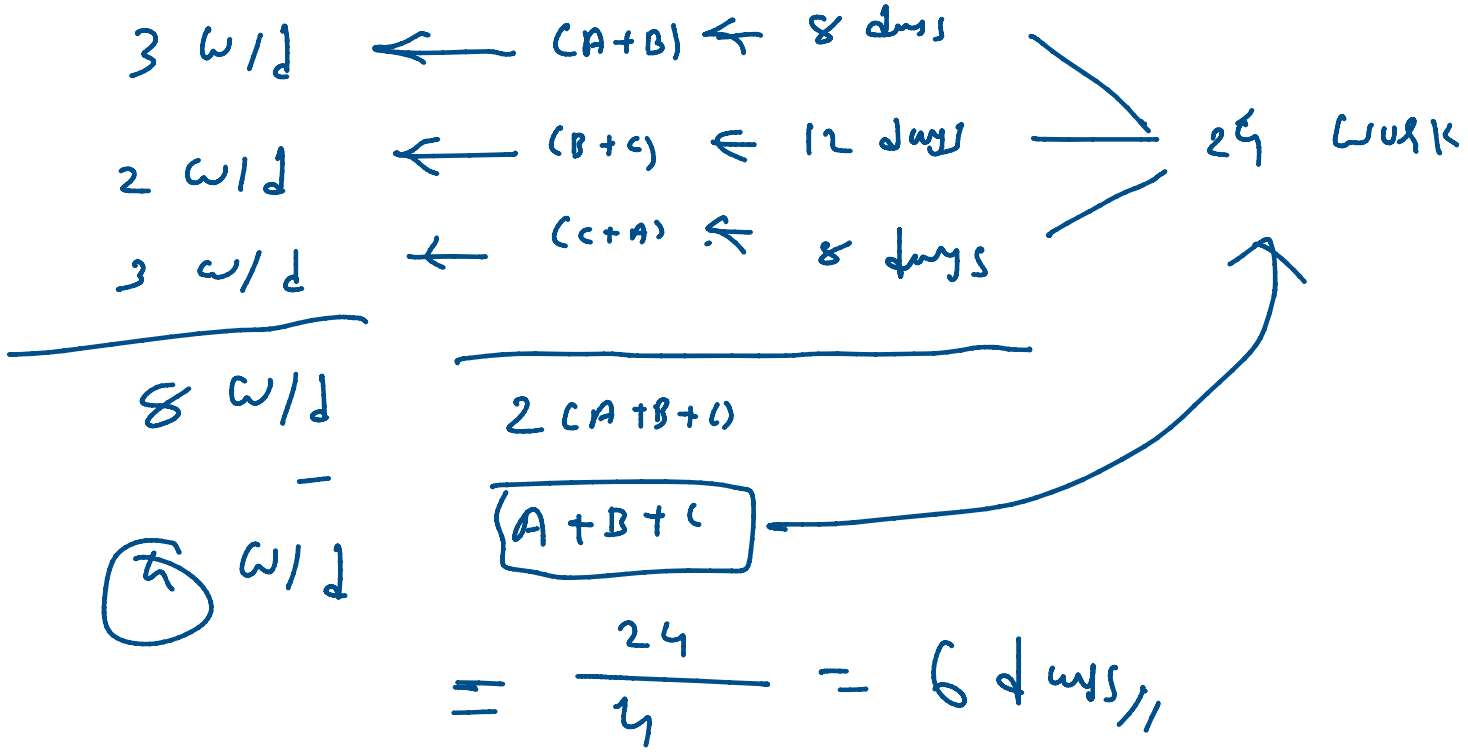
3// If A and B working together, can finish a piece of work in x days, B and C in y days, C and A in z days then

A, B, C working together in

$$\frac{2xyz}{xy+yz+zx} \text{ days.}$$

Ex: A and B can complete a piece of work in 8 days; B & C can do in 12 days and C & A can do it in 8 days ....

→ L.C.M. method.



$$= \frac{24}{4} = 6 \text{ days}$$

Ex: A can complete a piece of work in 20 days

A & B can complete the same work in 25 days. If they start work together but after 5 days A left the work. In how many days the total work would be finished?

→ Work 1 day of A & B

$$= \frac{1}{20} + \frac{1}{25} = \frac{9}{100}$$

A and B's 5 day work $= \frac{5 \times 9}{100} = \frac{9}{20}$ //

Remaining work $= 1 - \frac{9}{20} = {}^{11}/_{20}$

→ since A left after 5 days hence

remaining work done by B $= {}^{11}/_{20}$ //

$$\frac{{}^{11}/_{20}}{{}^{1}/_{25}} = \frac{11}{20} \times \frac{25}{1} = 13\frac{3}{4} \text{ days} //$$

So, total days $= 13\frac{3}{4} + 5 = 18\frac{3}{4}$ days //

L.C.M.

5 w/d ← A – 20 days

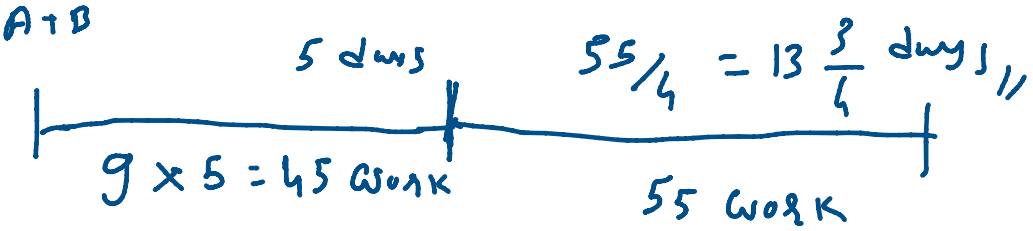
4 w/d ← B – 25 days

L.C.M. = 100 work

55

9 w/d

A+B



Total = $5 + 13\frac{3}{4} = 18\frac{3}{4}$ days

Ex: A and B can complete a piece of work in 24 days & 36 days respectively. They start the work but 3 days before completion of work, it left. In how many days will the total work be completed.

→ A's 1 day's work = $\frac{1}{24}$

B's 1 " " $= \frac{1}{36}$

$\therefore$ For last 3 days B's work $= \frac{3}{36} = \frac{1}{12}$

Remaining work $= 1 - \frac{1}{12} = \frac{11}{12}$

total days $= \frac{11/12}{\frac{1}{24} + \frac{1}{36}} = \frac{11/12}{5/72} = \frac{11}{12} \times \frac{72}{5}$

$= 13\frac{1}{5} = 16\frac{1}{5}$ days

$+3$

↳ L.C.M. Method

3 w/d — A - 24 days

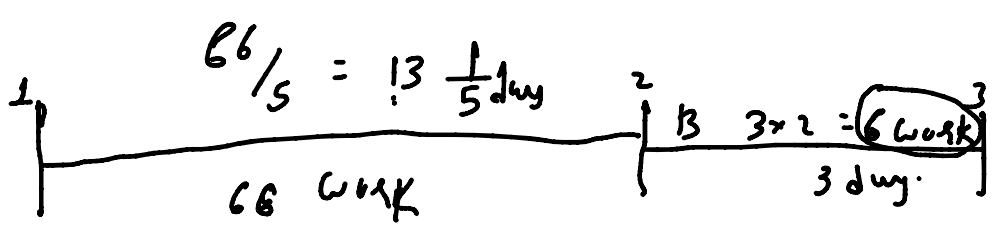
2 w/d B - 36 days

L.C.M. = 72

Total work

5 w/d A+B

1. $66/5 = 13\frac{1}{5}$ days $\therefore$ total days $= 13 + 3$



total days

$= 13\frac{1}{5} + 3$

$= 16\frac{1}{5}$ //

Ex: A can complete a piece of work in 9 days and B is 12 days. If they work for a day alternately, In how many days the work could be finished, if A begins the work?

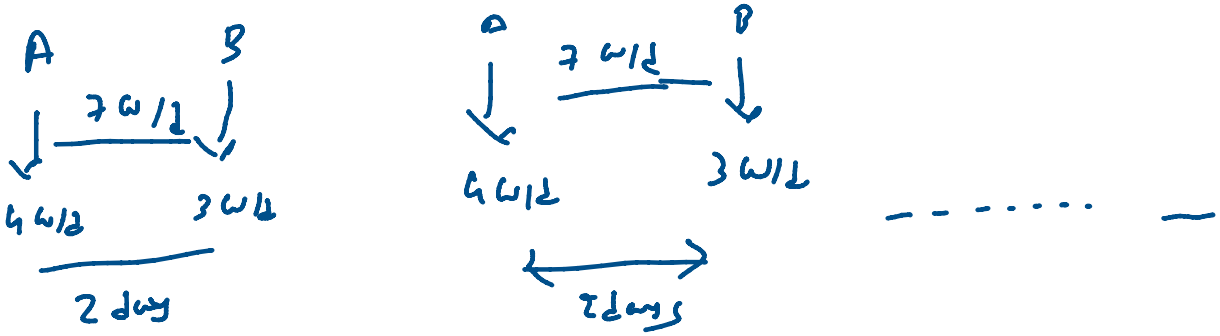
→

A - 9 days → 4 w/d

B - 12 days → 3 w/d

LCM = 36 work

7 w/d



$7\omega \rightarrow 2$ days

$5 \times 7\omega \rightarrow 5 \times 2$ days

$35\omega \rightarrow 10$ days //

Remaining work $= 36 - 35 = 1$ work

1 ω will be done by A

$1\omega \rightarrow \frac{1}{4}$ days //

total time $= \left(10 + \frac{1}{4}\right)$ days $= 10\frac{1}{4}$ days //

h// Work efficiency of any worker inversely proportional to time taken by him/her.

$$\text{work efficiency} \propto \frac{1}{\text{time}}$$

Ex: A is twice as good a workman as B

& together they finish a piece of work in 18 days. In how many days will A alone finish the work?

→ A : B = 2 : 1

1 → 18

2/3 → 18 × 3 = 54

Time taken by A & B = 18 days

Work done by A & B = 18 × 3 = 54 work

A will Alone do work = $\frac{54}{2}$ = 27 days //

Ex // If the ratio of work efficiency of A & B is 6 : 5 & that of B : C is 6 : 5. If A can complete the piece of work in 2 days, how many days the same work can be completed by B seperately?

→ A : B = 6 : 5 × 6 = 36 : 30

B : C = 6 : 5 × 5 = 30 : 25

(B) : C = (6) : 5 × 5 = 30 : 25

(A) : B : C = 36 : 30 : 25

time taken by A = 2 days

Work done by A = 36 × 2 = 72 work,

time taken by B = $\frac{72}{30}$ = $2\frac{2}{5}$ days //

5// Man - work - hours - Formula :

1. More man can do more work
2. More work means more times required to do work
3. More man can do same work in less time
4. If M_1 can do W_1 work in D_1 days working H_1 hrs/day for Rs. R_1 and M_2 man can do W_2 work in D_2 days working H_2 hrs/day for Rs. R_2 then

$$\frac{M_1 D_1 H_1}{\quad} = \frac{M_2 D_2 H_2}{\quad}$$

M : no. of persons

D : no. of days

$$\frac{M_1 D_1 H_1}{W_1 R_1} = \frac{M_2 D_2 H_2}{W_2 R_2}$$

D = no. of pw

H = no. of hours

W = work

R = Rate (in rs)

Ex: If 10 men complete half work in 12 days when they work 8 hours per day. In how many days 18 men complete the full work when they work 6 hours/day?

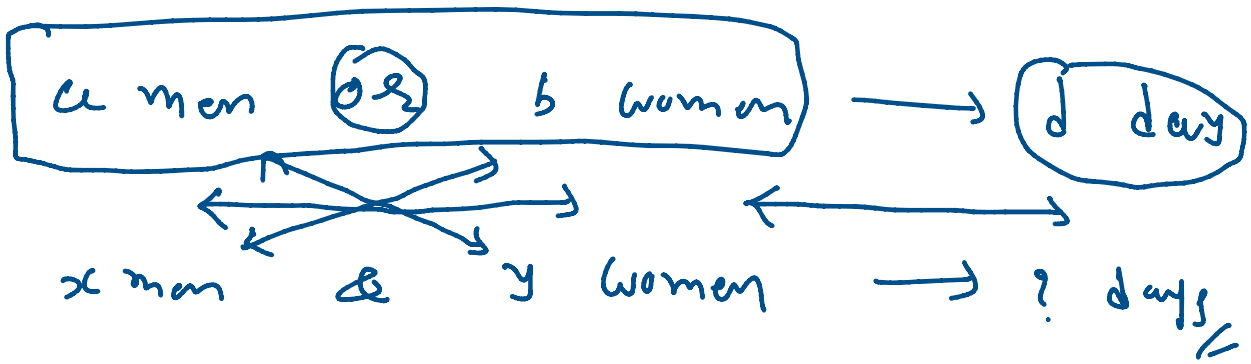
→ $$\frac{M_1 D_1 H_1}{W_1} = \frac{M_2 D_2 H_2}{W_2}$$

$$\frac{10 \times 12 \times 8}{1/2} = \frac{18 \times D_2 \times 6}{1}$$

$$D_2 = \frac{10 \times 12 \times 8 \times 2}{18 \times 6} = \frac{160}{9} = 17\frac{7}{9} \text{ days}$$

6/(ii) If a men or b women can do a piece of

work in d days then x men and y women together finish the whole work



$$D = \frac{a \times b \times d}{xb + ay}$$

6.(ii) If a men or b women or c children can do a piece of work in d days then x men, y women and z children together finish the whole work

$$D = \frac{a \times b \times c \times d}{xbc + yac + zab}$$

Ex: 3 men or 4 women can do a piece of work in 12 days then 1

in 43 days. In how many days 7 men & 5 women can do the same work?

→ 3m or 4w = 43 days

7m + 5w = (1)

From the formula

$$m_1 D_1 = m_2 D_2$$

$$3m \times 43 = (7m + 5w) \times D_2$$

$$129\,m = \left(7m + \frac{5 \times 3}{4} m\right) \times D_2$$

$$129\,y = \frac{43y}{4} \times D_2$$

$D_2 \Rightarrow 12$ days //

$$D = \frac{a \times b \times d}{2b + 5a} = \frac{3 \times 4 \times 43}{24 + 15} = 12 \text{ days //}$$

Ex: 1 man (or) 2 boys (or) 3 girls can do a piece of work in 8 days. In how many days one man, one boy and one girl can do the same work?