CHAPTER

10 TIME AND WORK

TIME AND WORK

In most of the problems on time and work, either of the following basic parameters are to be calculated :

TIME

- If A can do a piece of work in X days, then A's one day's work $= \frac{1}{X}$th part of whole work.
- If A's one day's work $= \frac{1}{X}$th part of whole work, then A can finish the work in X days.
- If A can do a piece of work in X days and B can do it in Y days then A and B working together will do the same work in $\frac{XY}{X+Y}$ days.
- If A, B and C can do a work in X, Y and Z days respectively then all of them working together can finish the work in $\frac{XYZ}{XY+YZ+XZ}$ days.

Example ***1 :*** **A can do a piece of work in 5 days, and B can do it in 6 days. How long will they take to finish the work if both work together ?**

Solution :

A's 1 day's work $= \frac{1}{5}$th part of whole work and

B's 1 day's work $= \frac{1}{6}$th part of whole work

$\therefore$ (A+B)'s one day's work $= \frac{1}{5}+\frac{1}{6}=\frac{11}{30}$th part of whole work.

So, both together will finish the work in $\frac{30}{11}$ days $= 2\frac{8}{11}$ days.

By Direct Formula :

A + B can do the work in $\frac{5\times 6}{5+6}$ days $= \frac{30}{11}=2\frac{8}{11}$ days.

Example ***2 :*** **Two men, Vikas and Vishal, working separately can mow a field in 8 and 12 hours respectively. If they work in stretches of one hour alternately, Vikas beginning at 8 a.m, when will the mowing be finished?**

Solution :

In the first hour, Vikas mows $\frac{1}{8}$ of the field.

In the second hour, Vishal mows $\frac{1}{12}$ of the field.

$\therefore$ In the first 2 hours, $\left(\frac{1}{8}+\frac{1}{12}=\frac{5}{24}\right)$ of the field is mown.

$\therefore$ In 8 hours, $\frac{5}{24}\times 4=\frac{5}{6}$ of the field is mown.

Now, $\left(1-\frac{5}{6}\right)=\frac{1}{6}$ of the field remains to be mown.

In the 9th hour, Vikas mows $\frac{1}{8}$ of the field.

Remaining work $= \frac{1}{6}-\frac{1}{8}=\frac{1}{24}$

$\therefore$ Vishal will finish the remaining work in $\left(\frac{1}{24}\div\frac{1}{12}\right)$

or $\frac{1}{2}$ of an hour.

$\therefore$ The total time required is $\left(8+1+\frac{1}{2}\right)$ or $9\frac{1}{2}$ hours.

Thus, the work will be finished at $8+9\frac{1}{2}=17\frac{1}{2}$ or 5.30 pm.

Example ***3 :*** **A can do a piece of work in 36 days, B in 54 days and C in 72 days. All the three began the work together on the Dec. 15, 2014, but A left 8 days and B left 12 days before the completion of the work. If C took the rest for a week then in how many days, the work was finished from the day it started ?**

Solution :

Let the total time taken be x days.

According to the given condition

$$\Rightarrow \quad \frac{x-8}{36}+\frac{x-12}{54}+\frac{x}{72}=1$$

$$\Rightarrow \quad \frac{6(x-8)+4(x-12)+3x}{216}=1$$

$$\Rightarrow \quad \frac{6x-48+4x-48+3x}{216}=1 \Rightarrow \frac{13x-96}{216}=1$$

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$\Rightarrow \quad 13x-96=216 \Rightarrow \quad 13x=216+96=312$

$\Rightarrow \quad x=\frac{312}{13}=24$

Since, C takes the rest for a week, so the number of days in which the work was finished from one day it started = 31 i.e. on 14.01.2015.

Example 4 : A and B can do a certain piece of work in 18 days, B and C can do it in 12 days and C and A can do it in 24 days. How long would each take separately to do it ?

Solution :

(A + B)'s one days's work = 1/18,
(A + C)'s one days's work = 1/24,
(B + C)'s one days's work = 1/12,
Now add up all three equations :

$2\,(A+B+C)\text{'s one days's work} = \frac{1}{18}+\frac{1}{24}+\frac{1}{12}=\frac{13}{72}$

$(A+B+C)\text{'s one days's work} = \frac{13}{144}$

A's one days's work = (A + B + C)'s one days's work

$-\,(B+C)\text{'s one days's work} = \frac{13}{144}-\frac{1}{12}=\frac{1}{144}$

Since A completes $\frac{1}{144}$th part of the work in 1 day, he will complete the work in $\frac{144}{1}=144$ days

By similar logic, we can find that B needs $\frac{144}{7}$ days and C will require $\frac{144}{5}$ days to complete the work.

Remember

✧ If A and B together can do a piece of work in X days and A alone can do it in Y days, then B alone can do the work in $\frac{XY}{Y-X}$ days.

Example 5 : A and B together can do a piece of work in 6 days and A alone can do it in 9 days. In how many days can B alone do it?

Solution :

(A + B)'s 1 day's work = $\frac{1}{6}$th part of the whole work.

A's 1 day's work = $\frac{1}{9}$th part of the whole work.

$\therefore$ B's 1 day's work = $\frac{1}{6}-\frac{1}{9}=\frac{3-2}{18}$

$=\frac{1}{18}$th part of the whole work.

$\therefore$ B alone can do the work in 18 days.

By Direct Formula :

B alone can do the whole work in

$$\frac{6\times 9}{9-6}=\frac{54}{3}=18 \text{ days}$$

Remember

✧ A and B can do a work in 'X' and 'Y' days respectively. They started the work together but A left 'a' days before completion of the work. Then, time taken to finish the work is $\frac{Y(X+a)}{X+Y}$ days.

✧ If 'A' is 'a' times efficient than B and A can finish a work in X days, then working together, they can finish the work in $\frac{aX}{a+1}$ days.

✧ If A is 'a' times efficient than B and working together they finish a work in Z days, then time taken by A = $\frac{Z(a+1)}{a}$ days and time taken by B = Z(a + 1) days.

✧ If A working alone takes 'x' days more than A and B together, and B working along takes 'y' days more than A and B together then the number of days taken by A and B working together is given by $\left(\sqrt{xy}\right)$ days.

Example 6 : A and B can do alone a job in 6 day respectively and 12 days. They began the work together but 3 days before the completion of job, A leaves off. In how many days will the work be completed ?

Solution :

Let work will be completed in x days.
Then, work done by A in (x – 3) days + work done by B in x days = 1

i.e. $\frac{x-3}{6}+\frac{x}{12}=1$

$\Rightarrow \frac{3x-6}{12}=1 \Rightarrow x=6$ days

By Direct Formula:

$$\text{Required time}=\frac{12(6+3)}{12+6}=6 \text{ days}$$

Example 7 : A is half good a workman as B and together they finish a job in 14 days. In how many days working alone will B finish the job?

Solution :

Let B can do the work in x days
Then, A can do the work in 2x days

So, $\frac{1}{x}+\frac{1}{2x}=\frac{1}{14}$ (given)

$\Rightarrow x=\frac{3}{2}\times 14=21$ days

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By Direct Formula :

$$\text{Time taken by B} = 14\left(\frac{1}{2}+1\right) = 21 \text{ days}$$

Remember

✧ If n men or m women can do a piece of work in X days, then N men and M women together can finish the work in $\frac{nmX}{nM+mN}$ days.

Example ***8 :*** **10 men can finish a piece of work in 10 days, whereas it takes 12 women to finish it in 10 days. If 15 men and 6 women undertake to complete the work, how many days will they take to complete it ?**

Solution :

It is clear that 10 men = 12 women or 5 men = 6 women

$\Rightarrow$ 15 men + 6 women = (18 + 6) i.e. 24 women

Now 12 women can complete the work in 10 days

$\therefore$ 24 women will do it in 5 days.

By Direct Formula :

$$\text{Required time} = \frac{10\times12\times10}{10\times6+12\times15} = 5 \text{ days}$$

Example ***9 :*** **If 3 men or 4 women can reap a field in 43 days, how long will 7 men and 5 women take to reap it ?**

Solution :

3 men reap $\frac{1}{43}$ of the field in 1 day.

$\therefore$ 1 men reaps $\frac{1}{43\times3}$ of the field in 1 day.

4 women reap $\frac{1}{43}$ of the field in 1 day.

$\therefore$ 1 woman reaps $\frac{1}{43\times4}$ of the field in 1 day.

$\therefore$ 7 men and 5 women reap $\left(\frac{7}{43\times3}+\frac{5}{43\times4}\right) = \frac{1}{12}$ of the field in 1 day.

$\therefore$ 7 men and 5 women will reap the whole field in 12 days.

Alternate method

$$\text{Required number of days} = \frac{1}{\left[\frac{7}{43\times3}+\frac{5}{43\times4}\right]}$$

$$= \frac{43\times3\times4}{7\times4+5\times3} = 12 \text{ days.}$$

Example ***10 :*** **If 12 men and 16 boys can do a piece of work in 5 days and 13 men and 24 boys can do it in 4 days, how long will 7 men and 10 boys take to do it ?**

Solution :

12 men and 16 boys can do the work in 5 days .... (i)

13 men and 24 boys can do the work in 4 days .... (ii)

Now it is easy to see that if the no. of workers be multiplied by any number, the time must be divided by the same number (derived from : more worker less time).

Hence multiplying the no. of workers in (i) and (ii) by 5 and 4 respectively, we get 5 (12 men + 16 boys) can do the work in 5/5 = 1 day

4 (13 men + 24 boys) can do the work in $\frac{4}{4}$ = 1 day

or, $5(12m+16b) = 4(13m+24b)$

or, $60m+80b = 52m+96b$

or, $60m-52m = 96b-80b$

or, $8m = 16b$

$\therefore$ 1 men = 2 boys.

Thus, 12 men + 16 boys = 24 boys + 16 boys = 40 boys

and 7 men + 10 boys = 14 boys + 10 boys = 24 boys

The question now becomes :

"If 40 boys can do a piece of work in 6 days how long will 24 boys take to do it ?"

Using basic formula

we have,

$40\times5 = 24\times D_2$

or, $D_2 = \frac{40\times5}{24} = 8\frac{1}{3}$ days

Example ***11 :*** **Two men and 7 boys can do a piece of work in 14 days. 3 men and 8 boys can do it in 11 days. In how many days can 8 men and 6 boys do a work 3 times as big as the first?**

Solution :

2 men + 7 boys in 14 days $\Rightarrow$ 28 men + 98 boys in 1 day

3 men + 8 boys in 11 days $\Rightarrow$ 33 men + 88 boys in 1 day

$\therefore$ 28 men + 98 boys = 33 men + 88 boys

$\therefore$ 2 boys $\equiv$ 1 man

Now, 2 men + 7 boys = 11 boys; 8 men + 6 boys = 22 boys

More boys, fewer days; more work, more days

Boys	Days	Work
11	14	1
↓	↑	↑
22	x	3

$\therefore \frac{x}{14} = \frac{11}{22}\times\frac{3}{1}$ $\therefore$ Number of days = 21 days.

Example ***12 :*** **Kaberi takes twice as much time as Kanti and thrice as much as Kalpana to finish a piace of work. They together finish the work in one day. Find the time taken by each of them to finish the work.**

Solution :

Here, the alone time of kaberi is related to the alone times of other two persons, so assume the alone time of kaberi = x,

Then, alone time of Kanti = $\frac{x}{2}$ and of Kalpana = $\frac{x}{3}$

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Kaberi's 1 day work + Kanti's 1 day work + Kalpana's 1 day work = combined 1 days work

$$\Rightarrow \frac{1}{x} + \frac{1}{x/2} + \frac{1}{x/3} = \frac{1}{1} \Rightarrow x = 6$$

$\therefore$ Alone time for Kaberi = 6 days, for Kanti = 6/2 = 3 days, Kalpana = 6/3 = 2 days,

Example ***13 :*** **1 man or 2 women or 3 boys can do a work in 44 days. Then in how many days will 1 man, 1 woman and 1 boy do the work?**

Solution :

Number of required days

$$= \frac{1}{\frac{1}{44\times1} + \frac{1}{44\times2} + \frac{1}{44\times3}} = \frac{44\times1\times2\times3}{6+3+2} = 24 \text{ days}$$

Remember

- ✧ If 'M_1' persons can do 'W_1' works in 'D_1' days and 'M_2' persons can do 'W_2' works in 'D_2' days then
  $M_1D_1W_2 = M_2D_2W_1$
  If T_1 and T_2 are the working hours for the two groups then
  $M_1D_1W_2T_1 = M_2D_2W_1T_2$
  Similarly,
  $M_1D_1W_2T_1E_1 = M_2D_2W_1T_2E_2$, where E_1 and E_2 are the efficiencies of the two groups.
- ✧ If the number of men to do a job is changed in the ratio a : b, then the time required to do the work will be in the ratio b : a, assuming the amount of work done by each of them in the given time is the same, or they are identical.
- ✧ A is K times as good a worker as B and takes X days less than B to finish the work. Then the amount of time required by A and B working together is $\frac{K\times X}{K^2-1}$ days.
- ✧ If A is n times as efficient than B, i.e. A has n times as much capacity to do work as B, A will take $\frac{1}{n}$ of the time taken by B to do the same amount of work.

Example ***14 :*** **5 men prepare 10 toys in 6 days working 6 hrs a day. Then in how many days can 12 men prepare 16 toys working 8 hrs a day?**

Solution :

This example has an extra variable 'time' (hrs a day), so the 'basic-formula' can't work in this case. An extended formula is being given:

$M_1\ D_1\ T_1\ W_2 = M_2\ D_2\ T_2\ W_1$

Here, $5\times6\times6\times16 = 12\times D_2\times8\times10$

$$\therefore D_2 = \frac{5\times6\times6\times16}{12\times8\times10} = 3 \text{ days}$$

Example ***15 :*** **A and B can do a work in 45 days and 40 days respectively. They began the work together, but A left after some time and B finished the remaining work in 23 days. After how many days did A leave?**

Solution :

B finished the remaining work in 23 days.

$\therefore$ Work done by B in 23 days = $\frac{23}{40}$ work

$\therefore$ A + B do together $1 - \frac{23}{40} = \frac{17}{40}$ work

Now, A + B do 1 work in $\frac{40\times45}{40+45} = \frac{40\times45}{85}$ days

$\therefore$ A + B do $\frac{17}{40}$ work in $\frac{40\times45}{85}\times\frac{17}{40} = 9$ days.

Alternate method :

If we ignore the intermediate steps, we can write a direct formula as : $\frac{40\times45}{40+45}\left(\frac{40-23}{40}\right) = 9$ days.

Example ***16 :*** **A certain number of men can do a work in 60 days. If there were 8 men more it could be finished in 10 days less. How many men are there?**

Solution :

Let there be x men originally.

(x + 8) men can finish the work in (60 – 10) = 50 days.

Now, 8 men can do in 50 days what x men do in 10 days, then by basic formula we have

$$\therefore x = \frac{8\times50}{10} = 40 \text{ men.}$$

Alternate method :

We have :

x men do the work in 60 days and (x + 8) men do the work in (60 – 10) = 50 days.

Then by "basic formula", 60x = 50(x + 8)

$$\therefore x = \frac{50\times8}{10} = 40 \text{ men}$$

Example ***17 :*** **Two coal loading machines each working 12 hours per day for 8 days handles 9,000 tonnes of coal with an efficiency of 90%. While 3 other coal loading machines at an efficiency of 80 % set to handle 12,000 tonnes of coal in 6 days. Find how many hours per day each should work.**

Solution :

Here $\frac{N_1\times D_1\times R_1\times E_1}{W_1} = \frac{N_2\times D_2\times R_2\times E_2}{W_2}$

$N_1 = 2, R_1 = 12\text{h/ day} : N_2 = 3,\ R_2 = ?$

$E_1 = \frac{90}{100}$ $W_1 = 9{,}000$;

$E_2 = \frac{80}{100}$ $W_2 = 12{,}000$

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$$\Rightarrow \quad \frac{2\times8\times12\times90}{9,000\times100}=\frac{3\times6\times R_2\times80}{12,000\times100}$$

$\Rightarrow \quad R_2 = 16\text{ h / day.}$

$\therefore$ Each machine should work 16 h/ day.

WORK AND WAGES

Wages are distributed in proportion to the work done and in indirect proportion to the time taken by the individual.

Example ***18 :*** **A, B and C can do a work in 6, 8 and 12 days respectively. Doing that work together they get an amount of ₹ 1350. What is the share of B in that amount?**

Solution :

A's one day's work $=\frac{1}{6}$

B's one day's work $=\frac{1}{8}$

C's one day's work $=\frac{1}{12}$

A's share : B's share : C's share

$=\frac{1}{6}:\frac{1}{8}:\frac{1}{12}$

Multiplying each ratio by the L.C.M. of their denominators, the ratios become 4 : 3 : 2

$\therefore \quad$ B's share $=\frac{1350\times3}{9}=₹450$

Example ***19 :*** **If 6 men working 8 hours a day earn ₹ 1680 per week, then how much will 9 men working 6 hours a day earn per week ?**

Solution :

6m	8 hours	₹1680
9m	6 hours	?

$$1680\times\frac{6}{8}\times\frac{9}{6}=₹1890$$

Alternate method :

As earnings are proportional to the work done, we have

$$\frac{M_1D_1}{W_1}=\frac{M_2D_2}{W_2}\Rightarrow\frac{6\times8}{1680}=\frac{9\times6}{W_2}\Rightarrow W_2=₹1890$$

Example ***20 :*** **A can do a piece of work in 15 days and B in 20 days. They finished the work with the assistance of C in 5 days and got ₹ 45 as their wages, find the share for each in the wages.**

Solution :

A did in 5 days 1/3 of the work,

B did in 5 days 1/4 of the work.

C did in 5 days $1-\frac{1}{3}+\frac{1}{4}=\frac{5}{12}$ of the work

Since A, B, C did in 5 days 1/3, 1/4, 5/12 of the work respectively.

$$\text{A's share} = ₹\ 45\times\frac{1}{3}=₹15$$

$$\text{B's share} = ₹\ 45\times\frac{1}{4}=₹11.25$$

$$\text{C's share} = ₹\ 45\times\frac{5}{12}=₹18.75$$

Example ***21 :*** **If 8 men, working 9 hours per day can build a wall 18 meters long, 2 meters wide and 12 meters high in 10 days, how many men will be required to build a wall 32 meters long, 3 meters wide and 9 meters high by working 6 hours a day in 8 days?**

Solution :

This method is a substitute for the conventional method and can be safely employed for most of the problems.

Step 1 : Assume the thing to be found as 'X'

Step 2 : In the first place look for X's counterpart.

e.g. in the above example, X = no. of men

So X's counterpart = No. of men, given = 8.

So write X = 8x.....

Now see the direct and indirect variation or simply see by which operation more men will be required & by which fewer:

We have $X = 8\times\frac{32}{18}\times\frac{3}{2}\times\frac{9}{12}\times\frac{10}{8}\times\frac{9}{6}=30$ men

Example ***22 :*** **If 5 engines consume 6 tonnes of coal when each runs 9 hrs per day, how much coal will be needed for 8 engines, each running 10 hrs. per day, it being given that 3 engines of the former type consume as much as 4 engines of latter type ?**

Solution :

We have $X = 6\times\frac{8}{5}\times\frac{10}{9}\times\frac{3}{4}=8$ tons

Explanation :

(1) More engines more coal (> 1)

(2) More time, more coal (> 1)

(3) Latter consumes less coal than former (< 1).

In case of men working we have more time, less men (< 1) but here we have more time, more coal (> 1).

Here let W = 6 tonnes $\equiv 5\times9\times4/3$ engine hours

and let $X \equiv 8\times10\times1$ engine hours.

or $X = 6\text{ tons}\times\frac{8\times10\times1}{5\times9\times(4/3)}=8\text{ tons}$

Example ***23 :*** **A garrison of 1500 men is provisioned for 60 days. After 25 days the garrison is reinforced by 500 men, how long will the remaining provisions last?**

Solution :

Since the garrison is reinforced by 500 men, therefore, there are (1500 + 500) or 2000 men now,

since $60-25=35$ days.

$\Rightarrow$ The provisions left would last 1500 men 35 days

$\Rightarrow$ Provisions left would last 1 man 35×1500 days

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$\Rightarrow$ Provisions left would last 2000 men

$$35 \times \frac{1500}{2000} = 26.25 \text{ days}$$

Alternate method:

$1500 \times 60 = (1500 \times 25) + (2000 \times X)$

$90000 - 37500 = 2000X$

$X = 26.25$ days.

Example 24 : 40 men can cut 60 trees is 8 hrs. If 8 men leaves the job how many trees will be cut in 12 hrs?

Solution :

40 men – working 8 hrs – cut 60 trees

or, 1 man – working 1 hr – cuts $\frac{60}{40 \times 8}$ tress

Thus, 32 – working 12 hrs – cut $\frac{60 \times 32 \times 12}{40 \times 8} = 72$ trees.

Using basic concepts :

$M_1 = 40, D_1 = 8$ (As days and hrs both denote time)

$W_1 = 60$ (cutting of trees is taken as work)

$M_2 = 40 - 8 = 32, D_2 = 12, W_2 = ?$

Putting the values in the formula

$M_1 D_1 W_2 = M_2 D_2 W_1$

We have , $40 \times 8 \times W_2 = 32 \times 12 \times 60$

or, $W_2 = \frac{32 \times 12 \times 60}{40 \times 8} = 72$ trees.

Example 25 : I can finish a work in 15 days at 8 hrs a day. You can finish it in $6\frac{2}{3}$ days at 9 hrs a day. Find in how many days we can finish it working together 10 hrs a day.

Solution :

First suppose each of us works for only one hr a day.

Then I can finish the work in $15 \times 8 = 120$ days and you can finish the work in $\frac{20}{3} \times 9 = 60$ days.

But here we are given that we do the work 10 hrs a day.

Then clearly we can finish the work in 4 days.

Example 26 : A can do a work in 6 days. B takes 8 days to complete it. C takes as long as A and B would take working together. How long will it take B and C to complete the work together?

Solution :

(A + B) can do the work in $\frac{6 \times 8}{6 + 8} = \frac{24}{7}$ days

$\therefore$ C takes $\frac{24}{7}$ days to complete the work.

$\therefore$ (B + C) takes $\frac{\frac{24}{7} \times 8}{\frac{24}{7} + 8} = \frac{24 \times 8}{24 + 56} = 2\frac{2}{5}$ days

Example 27 : A group of 20 cows can graze a field 3 acres in size in 10 days. How many cows can graze a field twice as large in 8 days?

Solution :

Here, first of all, let us see how work can be defined. It is obvious that work can be measured as "acres grazed".

In the first case, there were 20 cows in the group.

They had to work for 10 days to do the work which we call W (which = 3)

$\Rightarrow \quad 20 \times 10 = 3 \quad \ldots\ldots\ldots (i)$

Do not be worried about the numerical values on either side. The point is that logically this equation is consistent as the LHS indicates "Cowdays" and the RHS indicates "Acres", both of which are correct ways of measuring work done.

Now the field is twice as large. Hence the new equation is

$\Rightarrow \quad C \times 8 = 6 \quad \ldots\ldots\ldots (ii)$

Just divide (ii) by (i) to get the answer.

$$\frac{8C}{200} = \frac{6}{3}$$

$\Rightarrow \quad 8C = 2 \times 200 \Rightarrow \quad C = \frac{400}{8} = 50$ cows.

Hence, there were 50 cows in the second group.

PIPES AND CISTERNS

The same principle of Time and Work is employed to solve the problems on Pipes and Cisterns. The only difference is that in this case, the work done is in terms of filling or emptying a cistern (tank) and the time taken is the time taken by a pipe or a leak (crack) to fill or empty a cistern respectively.

Inlet

A pipe connected with a tank (or a cistern or a reservoir) is called an inlet, if it fills it.

Outlet

A pipe connected with a tank is called an outlet, if it empties it.

- If a pipe can fill a tank in x hours, then the part filled in 1 hour $= \frac{1}{x}$
- If a pipe can empty a tank in y hours, then the part of the full tank emptied in 1 hour $= \frac{1}{y}$.
- If a pipe can fill a tank in x hours and another pipe can empty the full tank in y hours, then the net part filled in 1 hour, when both the pipes are opened $= \left(\frac{1}{x} - \frac{1}{y}\right)$.

  $\therefore$ Time taken to fill the tank, when both the pipes are opened $= \frac{xy}{y - x}$.

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- If a pipe can fill a tank in x hours and another can fill the same tank in y hours, then time taken to fill the tank $= \frac{xy}{y+x}$, when both the pipes are opened.
- If a pipe fills a tank in x hours and another fills the same tank is y hours, but a third one empties the full tank in z hours, and all of them are opened together, then net part filled in 1 hr $= \left[\frac{1}{x}+\frac{1}{y}-\frac{1}{z}\right]$

  $\therefore$ Time taken to fill the tank $= \frac{xyz}{yz+xz-xy}$ hours.
- A pipe can fill a tank in x hrs. Due to a leak in the bottom it is filled in y hrs. If the tank is full, the time taken by the leak to empty the tank $= \frac{xy}{y-x}$ hrs.
- A cistern has a leak which can empty it in X hours. A pipe which admits Y litres of water per hour into the cistern is turned on and now the cistern is emptied in Z hours. Then the capacity of the cistern is $\frac{X+Y+Z}{Z-X}$ litres.
- A cistern is filled by three pipes whose diameters are X cm., Y cm. and Z cm. respectively (where $X < Y < Z$). Three pipes are running together. If the largest pipe alone will fill it in P minutes and the amount of water flowing in by each pipe is proportional to the square of its diameter, then the time in which the cistern will be filled by the three pipes is $\left[\frac{PZ^2}{X^2+Y^2+Z^2}\right]$ minutes.
- If one filling pipe A is n times faster and takes X minutes less time than the other filling pipe B, then the time they will take to fill a cistern, if both the pipes are opened together, is $\left[\frac{nX}{(n^2-1)}\right]$ minutes. A will fill the cistern in $\left(\frac{X}{n-1}\right)$ minutes and B will take to fill the cistern $\left(\frac{nX}{n-1}\right)$ minutes.

  Here, A is the faster filling pipe and B is the slower one.
- Two filling pipes A and B opened together can fill a cistern in t minutes. If the first filling pipe A alone takes *X* minutes more or less than t and the second fill pipe B along takes *Y* minutes more or less than t minutes, then t is given by $t = \sqrt{xy}$ minutes.

Example ***28 :*** **A pipe can fill a cistern in 6 hours. Due to a leak in its bottom, it is filled in 7 hours. When the cistern is full, in how much time will it be emptied by the leak?**

Solution :

Part of the capacity of the cistern emptied by the leak in one hour $= \left(\frac{1}{6}-\frac{1}{7}\right) = \frac{1}{42}$ of the cistern.

The whole cistern will be emptied in 42 hours.

Example ***29 :*** **Three pipes A, B and C can fill a cistern in 6 hrs. After working together for 2 hrs, C is closed and A and B fill the cistern in 8 hrs. Then find the time in which the cistern can be filled by pipe C.**

Solution :

A + B + C can fill in 1 hr $= \frac{1}{6}$ of cistern.

A + B + C can fill in 2 hrs $= \frac{2}{6} = \frac{1}{3}$ of cistern.

Remaining part $= \left(1-\frac{1}{3}\right) = \frac{2}{3}$ is filled by A + B in 8 hrs.

$\therefore$ (A + B) can fill the cistern in $\frac{8\times3}{2} = 12$ hrs.

Since (A + B + C) can fill the cistern in 6 hrs.

$\therefore$ C = (A + B + C) − (A + B) can fill the cistern in $\frac{12\times6}{12-6}$ hrs = 12 hrs

Example ***30 :*** **Pipe A can fill a tank in 20 hours while pipe B alone can fill it in 30 hours and pipe C can empty the full tank in 40 hours. If all the pipes are opened together, how much time will be needed to make the tank full?**

Solution :

By direct formula,

The tank will be fill in $= \frac{20\times30\times40}{30\times40+20\times40-20\times30}$

$= \frac{120}{7} = 17\frac{1}{7}$ hrs

Example ***31 :*** **Three pipes A, B and C can fill a tank in 6 minutes, 8 minutes and 12 minutes, respectively. The pipe C is closed 6 minutes before the tank is filled. In what time will the tank be full ?**

Solution :

Let it takes t minutes to completely fill the tank.

Now, $\frac{t}{6}+\frac{t}{8}+\frac{t-6}{12} = 1$

or $\frac{4t+3t+2t-12}{24} = 1$

or $9t - 12 = 24$

or $9t = 36 \Rightarrow t = 4$ min

Example ***32 :*** **If three taps are opened together, a tank is filled in 12 hrs. One of the taps can fill it in 10 hrs and another in 15 hrs. How does the third tap work?**

Solution :

We have to find the nature of the third tap, whether it is a filler or a waste pipe.

Let it be a filler pipe which fills in x hrs.

Then, $\frac{10\times15\times x}{10\times15+10x+15x} = 12$

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or, $150x = 150 \times 12 + 25x \times 12$

or $-150x = 1800 \quad \therefore \quad x = -12$

–ve sign shows that the third pipe is a waste pipe which vacates the tank in 12 hrs.

Example ***34 :*** **A and B can fill a cistern in 7.5 minutes and 5 minutes respectively and C can carry off 14 litres per minute. If the cistern is already full and all the three pipes are opened, then it is emptied in 1 hour. How many litres can it hold?**

Solution :

If the capacity is L litres, water filled in 1 hour = Water removed in 1 hour.

$$L + \frac{L}{7\frac{1}{2}} \times 60 + \frac{L}{5} \times 60 = 14 \times 60$$

$$\therefore \quad L + \frac{2L}{15} \times 60 + 12L = 14 \times 60 \Rightarrow L + 8L + 12L = 14 \times 60$$

$\Rightarrow \quad 21L = 14 \times 60$ or $L = 40$ litres.

So the capacity of the cistern is 40 litres.

Example ***35:*** **A cistern can be filled by two taps A and B in 25 minutes and 30 minutes respectively can be emptied by a third in 15 minutes. If all the taps are turned on at the same moment, what part of the cistern will remain unfilled at the end of 100 minutes ?**

Solution :

We have $\frac{1}{25} + \frac{1}{30} - \frac{1}{15} = \frac{1}{150}$ part filled in 1 minute

Hence, $1 - 100\left(\frac{1}{150}\right)$ = 1/3rd of the tank is unfilled after 100 minutes.

Example ***36 :*** **A cistern can be filled by two pipes filling separately in 12 and 16 min. respectively. Both pipes are opened together for a certain time but being clogged, only 7/8 of the full quantity of water flows through the former and only 5/6 through the latter pipe. The obstructions, however, being suddenly removed, the cistern is filled in 3 min. from that moment. How long was it before the full flow began?**

Solution :

Both the pipes A and B can fill $\frac{1}{12} + \frac{1}{16} = \frac{7}{48}$ of the cistern in one minute, when there is no obstruction.

With obstruction, both the pipes can fill

$\frac{1}{12} \times \frac{7}{8} + \frac{1}{16} \times \frac{5}{6} = \frac{7}{96} + \frac{5}{96} = \frac{1}{8}$ of the cistern in one minute.

Let the obstructions were suddenly removed after x minutes.

$\therefore$ With obstruction, $\frac{x}{8}$ of the cistern could be filled in

x minutes and so the remaining $1 - \frac{x}{8} = \frac{8-x}{8}$ of the cistern was filled without obstruction in 3 minutes, i.e. In one minute, $\frac{8-x}{24}$ of the cistern was filled.

$$\Rightarrow \frac{8-x}{24} = \frac{7}{48} \Rightarrow 16 - 2x = 7 \Rightarrow x = 4.5$$

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EXERCISE

1. A garrison of 500 men had provisions for 27 days. After 3 days a reinforcement of 300 men arrived. For how many more days will the remaining food last now?
(a) 15 (b) 16
(c) $17\frac{1}{2}$ (d) 18

2. A man is twice as fast as a woman. Together the man and the woman do the piece of work in 8 days. In how many days each will do the work if engaged alone?
(a) man-14 days, woman-28 days
(b) man-12 days, woman-24 days
(c) man-10 days, woman-20 days
(d) None of these

3. A contractor undertakes to built a wall in 50 days. He employs 50 people for the same. However, after 25 days he finds that only 40% of the work is complete. How many more men need to be employed to complete the work in time?
(a) 25 (b) 30
(c) 35 (d) 20

4. *A* is 30% more efficient than *B*. How much time will they take to complete a job working together, which *A* alone could have done in 23 days?
(a) 11 days (b) 13 days
(c) $20\frac{3}{17}$ days (d) None of these

5. A tyre has two punctures. The first puncture alone would have made the tyre flat in 9 minutes and the second alone would have done it in 6 minutes. If air leaks out at a constant rate, how long does it take both the punctures together to make it flat?
(a) $1\frac{1}{2}$ minutes (b) $3\frac{1}{2}$ minutes
(c) $3\frac{3}{5}$ minutes (d) $4\frac{1}{4}$ minutes

6. *A* can do a piece of work in 10 days, while *B* alone can do it in 15 days. They work together for 5 days and the rest of the work is done by *C* in 2 days. If they get Rs 450 for the whole work, how should they divide the money ?
(a) ₹225, ₹150, ₹ 75
(b) ₹250, ₹100, ₹100
(c) ₹200, ₹150, ₹100
(d) ₹175, ₹175, ₹100

7. A garrison had provision for a certain number of days. After 10 days, $\frac{1}{5}$ of the men leave and it is found that the provisions will now last just as long as before. How long was that?
(a) 15 days (b) 25 days
(c) 35 days (d) 50 days

8. A machine P can print one lakh books in 8 hours, machine Q can print the same number of books in 10 hours while machine R can print them in 12 hours. All the machines are started at 9 a.m. while machine P is closed at 11 a.m. and the remaining two machines complete the work. Approximately at what time will the work be finished?
(a) 11:30 a.m. (b) 12 noon
(c) 12:30 p.m. (d) 1 p.m.

9. If 5 engines consume 6 metric tonnes of coal when each is running 9 hours a day, how many metric tonnes of coal will be needed for 8 engines, each running 10 hours a day, it being given that 3 engines of the former type consume as much as 4 engines of the latter type?
(a) $3\frac{1}{8}$ (b) 8
(c) $8\frac{8}{9}$ (d) $6\frac{12}{25}$

10. Three men, four women and six children can complete a work in seven days. A woman does double the work a man does and a child does half the work a man does. How many women can complete this work in 7 days?
(a) 7 (b) 8
(c) 12 (d) Cannot be determined

11. 12 men can complete a piece of work in 4 days, while 15 women can complete the same work in 4 days. 6 men start working on the job and after working for 2 days, all of them stopped working. How many women should be put on the job to complete the remaining work, if it is to be completed in 3 days?
(a) 15 (b) 18
(c) 22 (d) Data inadequate

12. A contract is to be completed in 46 days and 117 men were set to work, each working 8 hours a day. After 33 days, 4/7 of the work is completed. How many additional men may be employed so that the work may be completed in time, each man now working 9 hours a day?
(a) 80 (b) 81
(c) 82 (d) 83

13. *A* can build up a wall in 8 days while *B* can break it in 3 days. *A* has worked for 4 days and then *B* joined to work with *A* for another 2 days only. In how many days will *A* alone build up the remaining part of wall?
(a) $13\frac{1}{3}$ days (b) $7\frac{1}{3}$ days
(c) $6\frac{1}{3}$ days (d) 7 days

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14. Suresh can finish a piece of work by himself in 42 days. Mahesh, who is $\frac{1}{5}$ times more efficient as Suresh, requires X days to finish the work by working all by himself. Then what is the value of X ?
(a) 25 days (b) 30 days
(c) 35 days (d) 20 days

15. If a family of 9 men in Indore spends ₹ 16380 in a year, what must be the expenses of 8 men in Calcutta who live in the same style for 7 months, assuming that the prices at calcutta are 3/5th of what they are in Indore ?
(a) ₹5096 (b) ₹5460
(c) ₹4879 (d) ₹5224

16. The work done by a man, a woman and a child is in the ratio of 3 : 2 : 1. There are 20 men, 30 women and 36 children in a factory. Their weekly wages amount to ₹ 780, which is divided in the ratio of work done by the men, women and children. What will be the wages of 15 men, 21 women and 30 children for 2 weeks ?
(a) ₹585 (b) ₹292.5
(c) ₹1170 (d) ₹900

17. In a fort there was sufficient food for 200 soldiers for 31 days. After 27 days 120 soldiers left the fort. For how many extra days will the rest of the food last for the remaining soldiers?
(a) 12 days (b) 10 days
(c) 8 days (d) 6 days

18. Carpenter A can make a chair in 6 hours, carpenter B in 7 hours and carpenter C in 8 hours. If each carpenter works for 8 hours per day, how many chairs will be made in 21 days?
(a) 61 (b) 67
(c) 73 (d) 79

19. Two pipes can fill a cistern in 14 and 16 hours respectively. The pipes are opened simultaneously and it is found that due to leakage in the bottom, 32 minutes extra are taken for the cistern to be filled up. If the cistern is full, in what time would the leak empty it ?
(a) 110 h (b) 112 h
(c) 115 h (d) 100 h

20. Two pipes A and B can fill a cistern in 10 and 15 minutes respectively. Both fill pipes are opened together, but at the end of 3 minutes, 'B' is turned off. How much time will the cistern take to fill?
(a) 6 min (b) 8 min
(c) 10 min (d) 12 min

21. Two pipes A and B can fill a tank in 15 and 12 hours respectively. Pipe B alone is kept open for $\frac{3}{4}$ of time and both pipes are kept open for remaining time. In how many hours, the tank will be full?
(a) 18 h (b) 20 h
(c) 10 h (d) 13.5 h

22. A tap can fill a tank in 16 minutes and another can empty it in 8 minutes. If the tank is already 1/2 full and both the taps are opened together, will the tank be filled or emptied? How long will it take before the tank is either filled or emptied completely as the case may be?
(a) Emptied; 16 min (b) Filled; 8 min
(c) Emptied; 8 min (d) Filled; 12 min

23. A cistern has three pipes, A, B and C. The pipes A and B can fill it in 4 and 5 hours respectively and C can empty it in 2 hours. If the pipes are opened in order at 1, 2 and 3 a.m. respectively, when will the cistern be empty?
(a) 3 p.m. (b) 4 p.m.
(c) 5 p.m. (d) 6 p.m.

24. A tank is filled in 5 hours by three pipes A, B and C. The pipe C is twice as fast as B and B is twice as fast as A. How much time will pipe A alone take to fill the tank?
(a) 20 h (b) 25 h
(c) 35 h (d) Cannot be determined

25. Three pipes A, B and C can fill a tank from empty to full in 30 minutes, 20 minutes and 10 minutes respectively. When the tank is empty, all the three pipes are opened. A , B and C discharge chemical solutions P, Q and R respectively. What is the proportion of solution R in the liquid in the tank after 3 minutes?
(a) $\frac{5}{11}$ (b) $\frac{6}{11}$
(c) $\frac{7}{11}$ (d) $\frac{8}{11}$

26. A hot pipe takes 3 minutes longer to fill a tank than the cold pipe. Together they take 6 minutes 40 seconds. Time taken by the cold pipe alone to fill the tank is
(a) 6 min (b) 18 min
(c) 9 min (d) 12 min

27. 4 pipes each of 3 cm diameter are to be replaced by a single pipe discharging the same quantity of water. What should be the diameter of the single pipe, if the speed of water is the same?
(a) 2 cm (b) 4 cm
(c) 6 cm (d) 8 cm

28. An outlet pipe empties a tank which is full, in 10 hours. If the inlet pipe is kept open, which lets water in at the rate of 8 litres/minute, the outlet pipe would take 6 hours longer. Find the capacity of the tank.
(a) 8600 litres (b) 200 litres
(c) 12800 litres (d) 11200 litres

29. If two pipes function simultaneously, the reservoir is filled in 12 hours .One pipe fills the reservoir 10 hours faster than the other .How many hours does the faster pipe take to fill the reservoir?
(a) 10 (b) 20
(c) 30 (d) 40

30. A volcanic crater (conical) has a base diameter 125 m and is 10 m deep. It rains very heavily and the crater gets filled up in 4 hours. Find the rate of water flow in the crater.

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(a) 500000 litres/hour (b) 600000 litres/hour
(c) 408000 litres/hour (d) 612000 litres/hour

31. Two pipes A and B can fill a tank in 36 min. and 45 min. respectively. A waste pipe C can empty the tank in 30 min. First A and B are opened. After 7 min., C is also opened. In how much time, the tank is full?
(a) 60 min (b) 30 min
(c) 39 min (d) 13 min

32. A water tank has three taps A, B and C. A fills four buckets in 24 minutes, B fills 8 buckets in 1 hour and C fills 2 buckets in 20 minutes. If all the taps are opened together a full tank is emptied in 2 hours. If a bucket can hold 5 litres of water, what is the capacity of the tank?
(a) 120 litres (b) 240 litres
(c) 180 litres (d) 60 litres

33. A sum of ₹ 25 was paid for a work which A can do in 32 days, B in 20 days, B and C in 12 days and D in 24 days. How much did C receive if all the four work together?
(a) ₹ $\frac{14}{3}$ (b) ₹ $\frac{16}{3}$
(c) ₹ $\frac{15}{3}$ (d) ₹ $\frac{17}{3}$

34. 12 men and 16 boys can do a piece of work in 5 days, 13 men and 24 boys can do it in 4 days. Then the ratio of daily work done by a man to that of a boy is
(a) 2 : 1 (b) 3 : 1
(c) 3 : 2 (d) 5 : 4

35. A ship 55 km. from the shore springs a leak which admits 2 tonnes of water in 6 min ; 80 tonnes would suffer to sink her, but the pumps can throw out 12 tonnes an hour. Find the average rate of sailing that she may just reach the shore as she begins to sink.
(a) 5.5 km/h (b) 6.5 km/h
(c) 7.5 km/h (d) 8.5 km/h

36. A group of men decided to do a job in 4 days. But since 20 men dropped out every day, the job completed at the end of the 7th day. How many men were there at the beginning?
(a) 240 (b) 140
(c) 280 (d) 150

37. One man and six women working together can do a job in 10 days. The same job is done by two men in 'p' days and by eight women in p + 5 days. By what percentage is the efficiency of a man greater than that of a woman?
(a) 300% (b) 500%
(c) 600% (d) 700%

38. The total number of men, women and children working in a factory is 18. They earn ₹ 4000 in a day. If the sum of the wages of all men, all women and all children is in the ratio of 18 : 10 : 12 and if the wages of an individual man, woman and child is in the ratio 6 : 5 : 3, then how much a woman earn in a day?
(a) ₹ 400 (b) ₹ 250
(c) ₹ 150 (d) ₹ 120

39. *A* can do a job in 3 days less time than *B*. *A* works at it alone for 4 days and then *B* takes over and completes it. If altogether 14 days were required to finish the job, then in how many days would each of them take alone to finish it?
(a) 17 days, 20 days (b) 12 days, 15 days
(c) 13 days, 16 days (d) None of these

40. Seventy-five men are employed to lay down a railway line in 3 months. Due to certain emergency conditions, the work was to be finished in 18 days. How many more men should be employed to complete the work in the desired time?
(a) 300 (b) 325
(c) 350 (d) 375

41. 12 men construct 1.5 km of road in 7 days. 28 men will construct 12 km of roads in
(a) 20 days (b) 24 days
(c) 28 days (d) 38 days

42. *X* and *Y* can do a piece of work in 30 days. They work together for 6 days and then *X* quits and *Y* finishes the work in 32 more days. In how many days can *Y* do the piece of work alone?
(a) 30 days (b) 32 days
(c) 34 days (d) 40 days

43. A garrison of '*n*' men had enough food to last for 30 days. After 10 days, 50 more men joined them. If the food now lasted for 16 days, what is the value of *n*?
(a) 200 (b) 240
(c) 280 (d) 320

44. Consider the following statements :
I. If 18 men can earn ₹ 1440 in 5 days, then 10 men can earn ₹1280 in 6 days.
II. If 16 men can earn ₹1120 in 7 days, then 21 men can earn ₹ 800 in 4 days.
Which of the above statements is/are correct?
(a) Only I (b) Only II
(c) Both I and II (d) Neither I nor II

45. 2 men and 1 woman can complete a piece of work in 14 days, while 4 women and 2 men can do the same work in 8 days. If a man gets ₹ 90 per day, what should be the wages per day of a woman ?
(a) ₹ 48 (b) ₹ 60
(c) ₹ 72 (d) ₹ 135

46. *X* can complete a job in 12 days. If *X* and *Y* work together, they can complete the job in $6\frac{2}{3}$ days. *Y* alone can complete the job in
(a) 10 days (b) 12 days
(c) 15 days (d) 18 days

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47. A swimming pool 70m long, 44m wide and 3 m deep is filled by water flowing from a pipe at the rate of 30800 cm^3/s. The time taken to fill the swimming pool is
(a) 71/2 h (b) 80 h
(c) 250/3 h (d) None of these

48. X can do a piece of work in 25 days. Y is 25% more efficient than X. The number of days taken by Y is
(a) 15 (b) 20
(c) 21 (d) 30

49. A can do a piece of work in 'x' days and B can do the same work in '$3x$' days, To finish the work together they take 12 days. What is the value of 'x'?
(a) 8 (b) 10
(c) 12 (d) 16

50. A, B and C can do a peice of work individually in 8, 10 and 15 days, respectively. A and B start working but A quits after working for 2 days. After this, C joins B till the completion of work. In how many days will the work be completed?
(a) 53/9 days (b) 34/7 days
(c) 85/13 days (d) 53/10 days

51. How many men will be required to plough 100 acres of land in 10 days, if 10 men require 8 days to plough 20 acres of land?
(a) 30 (b) 40
(c) 50 (d) 60

52. Pipe A can fill a tank in 3 h but there is a leakage also, due to which it takes 3.5 h for the tank to be filled. How much time will the leakage take in emptying the tank, if the tank is filled initially?
(a) 21 h (b) 20 h
(c) 18 h (d) 10.5 h

53. A is thrice as efficient as B and hence completes a work in 40 days less than the number of days taken by B. What will be the number of days taken by both of them when working together ?
(a) 22.5 days (b) 15 days
(c) 20 days (d) 18 days

54. If 10 persons can dig 8 ft trench in 12 days, then how many days will 8 persons take to dig 6 ft trench?
(a) 10 days (b) 10.25 days
(c) 11 days (d) 11.25 days

55. The efficiency of P is twice that of Q, whereas the efficiency of P and Q together is three times that of R. If P, Q and R work together on a job, in what ratio should they share their earnings? **(CDS)**
(a) 2 : 1 : 1 (b) 4 : 2 : 1
(c) 4 : 3 : 2 (d) 4 : 2 : 3

56. Two pipes A and B can fill a tank in 60 minutes and 75 minutes respectively. There is also an outlet C. If A, B and C are opened together, the tank is full in 50 minutes. How much time will be taken by C to empty the full tank? **(CDS)**
(a) 100 minutes (b) 110 minutes
(c) 120 minutes (d) 125 minutes

57. A and B are two taps which can fill a tank individually in 10 minutes and 20 minutes respectively. However, there is a leakage at the bottom, which can empty a filled tank in 40 minutes. If the tank is empty initially, how much time will both the taps take to fill the tank with leakage? **(CDS)**
(a) 2 minutes (b) 4 minutes
(c) 5 minutes (d) 8 minutes

58. If 4 men working 4 hours per day for 4 days complete 4 units of work, then how many units of work will be completed by 2 men working for 2 hours per day in 2 days? **(CDS)**
(a) 2 (b) 1
(c) $\frac{1}{2}$ (d) $\frac{1}{8}$

59. If m persons can paint a house in d days, how many days will it take for (m +2) persons to paint the same house? **(CDS)**
(a) md+2 (b) md−2
(c) $\frac{m+2}{md}$ (d) $\frac{md}{m+2}$

60. Water is filled in a container in such a manner that its volume doubles every 5 minutes. If it takes 30 minutes for the container to be full, in how much time will it be one–fourth full? **(CDS)**
(a) 7.5 minutes (b) 15 minutes
(c) 20 minutes (d) 17.5 minutes

61. A river 2.5 m deep and 45 m wide is flowing at the speed of 3.6 km/h. The amount of water that runs into the sea per minute is **(CDS)**
(a) 6650 m^3 (b) 6750 m^3
(c) 6850 m^3 (d) 6950 m^3

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HINTS & SOLUTIONS

1. (a) Let the remaining food will last for x days.
500 men had provision for (27 – 3) = 24 days.
(500 + 300) men had provisions for x days.
More men, Less days (Indirect Proportion)
$\therefore 800 : 500 :: 24 : x = (800 \times x) = (500 \times 24)$
$\Rightarrow x = \left(\frac{500 \times 24}{800}\right) = 15$

2. (b) Let the man alone do the work in x days.
Then, the woman alone do the work in 2x days.
Their one day's work = $\frac{1}{8}$ th part of whole work
i.e. $\frac{1}{x} + \frac{1}{2x} = \frac{1}{8}$
$\Rightarrow x = 12$ days
$\therefore$ man takes 12 days and woman takes $2x = 24$ days.

Alternate Method :-
Let man can finish work in x days and is twice efficient than woman.
Man can finish the work in
$\frac{2x}{2+1} = 8 \Rightarrow x = 12$ days
Woman can finish the work in $2 \times 2 = 24$ days

3. (a) 50 men complete 0.4 work in 25 days.
Applying the work rule, $m_1 \times d_1 \times w_2 = m_2 \times d_2 \times w_1$
we have,
$50 \times 25 \times 0.6 = m_2 \times 25 \times 0.4$
or $m_2 = \frac{50 \times 25 \times 0.6}{25 \times 0.4} = 75$ men
Number of additional men required = (75 – 50) = 25

4. (b) Ratio of times taken by A and B = 100 : 130 = 10 : 13.
Suppose B takes x days to do the work.
Then, $10 : 13 :: 23 : x \Rightarrow x = \left(\frac{23 \times 13}{10}\right) \Rightarrow x = \frac{299}{10}$.
A's 1 day's work = $\frac{1}{23}$; B's 1 days work = $\frac{10}{299}$.
(A + B)'s 1 day's work = $\left(\frac{1}{23} + \frac{10}{299}\right) = \frac{23}{299} = \frac{1}{13}$.
$\therefore$ A and B together can complete the job in 13 days.

Alternate Method :-
A is 1.3 times efficient than B
A and B complete the work in $\left(\frac{23 \times 1.3}{1.3+1}\right) = 13$ days

5. (c) 1 minute's work of both the punctures = $\left(\frac{1}{9} + \frac{1}{6}\right) = \frac{5}{18}$.
So, both the punctures will make the tyre flat in
$\frac{18}{5} = 3\frac{3}{5}$ minutes

Alternate Method :-
both the Punctures will make the tyre flat in
$\left(\frac{6 \times 9}{6+9}\right) = \frac{54}{15} = 3\frac{3}{5}$ minutes

6. (a) Work done by *A* and *B* in 5 days = $\left(\frac{1}{10} + \frac{1}{15}\right) \times 5 = \frac{5}{6}$
Work remaining = $1 - \frac{5}{6} = \frac{1}{6}$
$\therefore$ *C* alone can do the work in $6 \times 2 = 12$ days
Ratio of their share work = $\frac{5}{10} : \frac{5}{15} : \frac{2}{12} = 3 : 2 : 1$
Share of wages = ₹225, ₹150, ₹75.

7. (d) Initially, let there be x men having food for y days.
After 10 days, x men had food for (y – 10) days. Also,
$\left(x - \frac{x}{5}\right)$ men had food for y days.
$\therefore x(y-10) = \frac{4x}{5} \times y \Rightarrow 5xy - 50x = 4xy \Rightarrow xy - 50x = 0$
$\Rightarrow x(y-50) = 0 \Rightarrow y - 50 = 0 \Rightarrow y = 50$

8. (d) (P + Q + R)'s 1 hour's work = $\left(\frac{1}{8} + \frac{1}{10} + \frac{1}{12}\right) = \frac{37}{120}$
Work done by P, Q and R in 2 hours = $\left(\frac{37}{120} \times 2\right) = \frac{37}{60}$.
Remaining work = $\left(1 - \frac{37}{60}\right) = \frac{23}{60}$
(Q + R)'s 1 hour's work = $\left(\frac{1}{10} + \frac{1}{12}\right) = \frac{11}{60}$
Now, $\frac{11}{60}$ work is done by Q and R in 1 hour.
So, $\frac{23}{60}$ work will be done by Q and R in $\left(\frac{60}{11} \times \frac{23}{60}\right) = \frac{23}{11}$ hours = 2 hours.
So, the work will be finished approximately 2 hours after 11 a.m. i.e., around 1 p.m.

9. (b) Let the required quantity of coal be x metric tonnes.
More engines, More coal (Direct Proportion)
More hours per day, More work (Direct Proportion)
More rate, More coal (Direct Proportion)

Engines	5 : 8	
Hours per day	9 : 10	:: 6 : x
Rate	$\frac{1}{3} : \frac{1}{4}$	

$\therefore \left(5 \times 9 \times \frac{1}{3} \times x\right) = \left(8 \times 10 \times \frac{1}{4} \times 6\right)$
$\Rightarrow 15x = 120 \Leftrightarrow x = 8$

10. (a) Let 1 woman's 1 day's work = *x*.
Then, 1 man's 1 day's work = $\frac{x}{2}$

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and 1 child's 1 day's work $= \frac{x}{4}$.

So, $\left(\frac{3x}{2}+4x+\frac{6x}{4}\right)=\frac{1}{7}\Rightarrow x=\left(\frac{1}{7}\times\frac{4}{28}\right)=\frac{1}{49}$.

$\therefore$ 1 woman alone can complete the work in 49 days.
So, to complete the work in 7 days, women required

$$=\left(\frac{49}{7}\right)=7$$

11. (a) 1 man's 1 day's work $= \frac{1}{48}$

1 woman's 1 day's work $= \frac{1}{60}$

6 men's 2 day's work $= \left(\frac{6}{48}\times 2\right)=\frac{1}{4}$

Remaining work $= \left(1-\frac{1}{4}\right)=\frac{3}{4}$

Now, $\frac{1}{60}$ work is done in 1 day by 1 woman.

So, $\frac{3}{4}$ work will be done in 3 days by

$$\left(60\times\frac{3}{4}\times\frac{1}{3}\right)=15 \text{ women}$$

12. (b) Let x additional men employed.
117 men were supposed to finish the whole work in $46 \times 8 = 368$ hours

But 117 men completed $\frac{4}{7}$ of the work in $33 \times 8 = 264$ hrs

$\therefore$ 117 men could complete the work in 462 hours.

Now $(117 + x)$ men are supposed to do $\frac{3}{7}$ of the work, working 9 hours a day, in $13 \times 9 = 117$ hours, so as to finish the work in time.
i.e. $(117 + x)$ men are supposed to complete the whole work in $117\times\frac{7}{3}=273$ hours.

$\therefore$ $(117+x)\times 273=117\times 462$
$\Rightarrow$ $(117+x)\times 7=3\times 462$
$\Rightarrow$ $x+117=3\times 66=198 \Rightarrow x=81$
$\therefore$ Required number of additional men to finish the work in time = 81.

13. (b) A's one day's work $= \frac{1}{8}$th work

B's one day's work $= \frac{1}{3}$rd work

$\therefore$ A's 4 day's work $= 4\times\frac{1}{8}=\frac{1}{2}$nd work

$\therefore$ In next two days, total wall $=\frac{1}{2}+2\left(\frac{1}{8}\right)-2\left(\frac{1}{3}\right)$

$$=\frac{1}{12}\text{th wall}$$

Remaining wall $= 1-\frac{1}{12}=\frac{11}{12}$th

Now, $\frac{1}{8}$th wall is built up by A in one day.

$\therefore$ $\frac{11}{12}$th wall is built up by A in $8\times\frac{11}{12}=7\frac{1}{3}$ days.

14. (c) Suresh, working alone 42 days = 1 unit of work.
Mahesh is 1/5 times more efficient that Suresh. So Mahesh is 6/5 times as efficient as Suresh. Hence Mahesh should require 5/6th of the time, the time taken by Suresh.
Therefore time taken by Mahesh = $5/6 \times 42 = 35$ days

15. (a) The factors by which the expenses change are
$= 8/9 \times 7/12 \times 3/5 \times 16380 = 5096$ for 7 months

16. (c)

	Men	Women	Children
Work	3	2	1
Numbers	20	30	36

Ratio of wages $= (3 \times 20) : (2 \times 20) : (1 \times 36) = 5 : 5 : 3$

Total wages of men $= \frac{5}{13}\times 780 = ₹\ 300$

$\therefore$ Wages of a man = ₹ 15
Similarly, wages of woman = ₹ 10
and wages of child = ₹ 5
Total waves of 15 men, 21 women and 30 children
$= 15\times 15+21\times 10+30\times 5=585$
Total wages for 2 weeks = ₹ 1170

17. (d) After 27 days, food left $= 4 \times 200 = 800$ soldier days worth of food.
Since, now there are only 80 soldiers, this food would last for $800/80 = 10$ days.
Number of extra days for which the food lasts $= 10 - 4 = 6$ days.

18. (c) In 6 hours, number of chairs made by carpenter A = 1
$\therefore$ In (21×8) hours, number of chairs by

$A = \frac{21\times 8}{6}=28$

Similarly in (21×8) hours, number of chairs by

$B = \frac{21\times 8}{7}=24$ and number of chairs by C in (21×8)

hours $= \frac{21\times 8}{8}=21$

Hence, total number of chairs in 21 days
$= 28 + 24 + 21 = 73$

19. (b) Cistern filled by both pipes in one hour

$$=\frac{1}{14}+\frac{1}{16}=\frac{15}{112}\text{th}$$

$\therefore$ Both pipes filled the cistern in $\frac{112}{15}$hrs.

Now, due to leakage both pipes filled the cistern in

$$\frac{112}{15}+\frac{32}{60}=8 \text{ hrs}$$

$\therefore$ Due to leakage, filled part in one hour $= \frac{1}{8}$

$\therefore$ part of cistern emptied, due to leakage in one hour

$$=\frac{15}{112}-\frac{1}{8}=\frac{1}{112}$$

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$\therefore$ In 112 hrs, the leakage would empty the cistern.

20. (b) In one min, (A + B) fill the cistern $= \frac{1}{10}+\frac{1}{15}=\frac{1}{6}$th

A and B together fill the cistern in 6 minutes

In 3 min, (A + B) fill the cistern $= \frac{3}{6}=\frac{1}{2}$th

Remaining part $= 1-\frac{1}{2}=\frac{1}{2}$

$\because \frac{1}{10}$th part filled by A in one min.

$\therefore \frac{1}{2}$nd part filled by A in $10\times\frac{1}{2}=5$ min.

$\therefore$ Total time $= 3+5=8$ min.

21. (c) Let the required time be x hours, then

$$\frac{1}{12}\left(\frac{3}{4}x\right)+\frac{1}{15}\left(x-\frac{3}{4}x\right)+\frac{1}{12}\left(x-\frac{3}{4}x\right)=1$$

$$\Rightarrow \frac{x}{16}+\frac{x}{60}+\frac{x}{48}=1$$

$\Rightarrow x = 10$ hours

22. (c) If both the pumps are opened together, then the tank will be emptied because the working efficiency of pump empting is more than that of the pump filling it. Thus in 1 min net proportion of the volume of tank filled

$$=\left(\frac{1}{8}-\frac{1}{16}\right)=\frac{1}{16}$$

or the tank will be emptied in 16 min

$\Rightarrow \frac{1}{2}$ tank will be emptied in 8 min.

23. (c) Let the time be t hours after 1 a.m.

$$\therefore \quad \frac{t}{4}+\frac{(t-1)}{5}-\frac{(t-2)}{2}=0$$

$$\left(\frac{t}{4}+\frac{t}{5}-\frac{t}{2}\right)=\frac{1}{5}-1=\frac{-4}{5}$$

$\Rightarrow t = 16$

16 hours from 1 a.m. i.e. 5 p.m

24. (c) Suppose pipe A alone takes x hours to fill the tank.

Then, pipes B and C will take $\frac{x}{2}$ and $\frac{x}{4}$ hours respectively to fill the tank.

$$\therefore \frac{1}{x}+\frac{2}{x}+\frac{4}{x}=\frac{1}{5}\Rightarrow\frac{7}{x}=\frac{1}{5}\Rightarrow x = 35 \text{ h}$$

25. (b) Part filled by (A + B + C) in 3 minutes

$$=3\left(\frac{1}{30}+\frac{1}{20}+\frac{1}{10}\right)=\left(3\times\frac{11}{60}\right)=\frac{11}{20}$$

Part filled by C in 3 minutes $= \frac{3}{10}$

$\therefore$ Required ratio $= \left(\frac{3}{10}\times\frac{20}{11}\right)=\frac{6}{11}$

26. (d). Pipe 1 (Hot) $\rightarrow 3+X$, $X \rightarrow$ Pipe 2 (cold)

Together $\frac{X(X+3)}{2X+3}=6\frac{2}{3}$ min.

$$=\frac{X(X+3)}{2X+3}=6\frac{2}{3}\text{min.}=\frac{20}{3}$$

$40X+60=3X(X+3)$

$\Rightarrow 40X+60=3X^2+9X$

$\Rightarrow 3X^2-31X-60=0$

$\Rightarrow X = 12$ minutes

27. (c) Let h be the length of water column discharged in 1 hour or 1 minute.

Volume discharged by the 4 pipes = Volume discharged by the single pipe.

$4\times\pi\times(1.5)^2\times h=\pi\times(r)^2\times h$

$\therefore \quad r^2=9 \qquad \therefore r=3$, Diameter $= 6$ cm.

28. (c) Part filled by the inlet pipe in 1 hour

$$=\left(\frac{1}{10}-\frac{1}{16}\right)=\frac{6}{160}=\frac{3}{80}$$

Part filled by the inlet pipe in 1 minute

$$=\frac{3}{80\times60}=\frac{1}{1600}$$

$\therefore$ Capacity of tank $= 1600\times8 = 12800$ litres

29. (b) Let the faster pipe fills the tank in x hours.

Then the slower pipe fills the tank in x + 10 hours.

When both of then are opened, the reservoir will be filled in $\frac{x(x+10)}{x+(x+10)}=12$

Or, $x^2-14x-120=0 \quad \therefore x=20,-6$

But x can't be – ve, hence the faster pipe will fill the reservoir in 20 hours.

30. (c) Volume of the cone $= \frac{1}{3}\times\pi R^2H = 1635.4\ m^3$

$\Rightarrow$ Rate of water flow $= \frac{1635.4}{4}=408\ m^3/h$

or 408000 litres/hour

31. (c) Part filled in 7 min. $= 7\times\left(\frac{1}{36}+\frac{1}{45}\right)=\frac{7}{20}$

Remaining part $= \left(1-\frac{7}{20}\right)=\frac{13}{20}$

Part filled by (A + B + C) in 1 min. $= \left(\frac{1}{36}+\frac{1}{45}-\frac{1}{30}\right)$

$$=\frac{1}{60}.$$

$\frac{1}{60}$ Part is filled in 1 minute $\frac{13}{20}$ Part is filled in $\left(\frac{13}{20}\times60\right)=39$ minutes

32. (b) Tap A fills 4 buckets ($4\times5=20$ litres) in 24 min.

In 1 hour tap A fills $\frac{20}{24}\times60=50$ litres

In 1 hour tap B fills $= 8\times5=40$ litres

In 1 hour tap C fills $\frac{2\times5}{20}\times60=30$ litres

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If they open together they would fill
$50+40+30=120$ litres in one hour
but full tank is emptied in 2 hours
So, tank capacity would be $120\times 2=240$ litres.

33. (b) A's one day's work $=\frac{1}{32}$

B's one day's work $=\frac{1}{20}$

(B + C)'s one day's work $=\frac{1}{12}$

$\therefore$ C's one day's work $=\frac{1}{12}-\frac{1}{20}=\frac{1}{30}$

D's one day's work $=\frac{1}{24}$

$\therefore$ (A + B + C + D)'s one day's work

$=\frac{1}{32}+\frac{1}{20}+\frac{1}{30}+\frac{1}{24}=\frac{75+120+80+100}{2400}$

$=\frac{375}{2400}=\frac{15}{96}=\frac{5}{32}$

$\therefore$ Out of $\frac{5}{32}$ of work done, $\frac{1}{30}$ of the work is done by C.

$\Rightarrow$ Out of ₹ 25 paid for the work, C will receive

₹ $\frac{1/30}{5/32}\times 25$, i.e. $\frac{1}{30}\times\frac{32}{5}\times 25$, i.e. ₹ $\frac{16}{3}$

34. (a) Let 1 man's 1 days work $=x$
1 boy's 1 day's work $=y$

$12x+16y=\frac{1}{5}$

$13x+24y=\frac{1}{4}$

Solving these two equation we get,

$x=\frac{1}{100}, y=\frac{1}{200}$

Required ratio = 2 : 1

35. (a) Rate of admission of water

$=\frac{2}{6}$ tonnes / min $=\frac{1}{3}$ tonnes/ min

Rate of pumping out of water

$=\frac{12}{60}$ tonnes/min $=\frac{1}{5}$ tonnes/ min.

Rate of accumulation $=\left(\frac{2}{6}-\frac{12}{60}\right)$ tonnes / min.

Time to accumulate 80 tonnes of water

$=\frac{\text{Amount of water}}{\text{Accumulation rate}}=\frac{80}{\left(\frac{1}{3}-\frac{1}{5}\right)}=600\text{ min.}=10\text{ hours}$

$\therefore$ Average sailing rate so as avoid sinking

$=\frac{\text{Distance}}{\text{Time}}=\frac{55}{10}$ km/ h = 5.5 km/h

36. (b) Go through option
$140\times 4=(140+120+100+\ldots+20)$
$560=560$
Alternatively: Let n be the initial number of worker then
$n\times 4=n+(n-20)+(n-40)+\ldots+(n-120)$
$4n=7n-420$
$\Rightarrow$ 3n = 420
$\Rightarrow$ n = 140 workers

37. (b) Let the work (in units) done by a man and a woman in one day be M and W respectively. Total work (in units) $=10(M+6W)=10M+60W$

$\Rightarrow$ $\frac{10M+60W}{8W}-\frac{10M+60W}{2M}=5$

$\frac{5M}{4W}-\frac{30W}{M}=\frac{5}{2}$

On putting $\frac{M}{W}=x$, we get

$\frac{5x}{4}-\frac{30}{x}=\frac{5}{2}\Rightarrow x=6$ or $\frac{M}{W}=6$

$\therefore$ The efficiency of a man is greater than that of a woman by 500%.

38. (b) Ratio of number of men, women and children

$=\frac{18}{6}:\frac{10}{5}:\frac{12}{3}=3x:2x:4x$

$\therefore (3x+2x+4x)=18$
$\therefore x=2$
Therefore, number of women = 4

Share of all women $=\frac{10}{40}\times 4000=$ ₹ 1000
$(\because 18+10+12=40)$

$\therefore$ Share of each woman $=\frac{1000}{4}=$ ₹ 250

39. (b) Let B can finish the work in x days.
Then A can finish the work in (x – 3) days.

B's one day's work $=\frac{1}{x}$th work

A's one day's work $=\frac{1}{x-3}$th work

A's 4 days' work $=\frac{4}{x-3}$th work

Remaining work $=1-\frac{4}{x-3}=\frac{x-7}{x-3}$th work

The remaining work done by B in 14 – 4 = 10 days.

Now, in 10 days, work done by B $=\frac{x-7}{x-3}$ th work

$\therefore$ In 1 day, work done by B $=\frac{1}{10}\left(\frac{x-7}{x-3}\right)$th work

and $\frac{1}{10}\left(\frac{x-7}{x-3}\right)=\frac{1}{x}$

$\Rightarrow x=15$days

$\therefore$ B will finish in 15 days and A will finish in 12 days

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40. (a) More the no. of men less time they take to complete work.
Let x men are added.

$$\frac{75}{75+x}=\frac{18}{90} \qquad \text{(Inverse Proportion)}$$

$$\Rightarrow \quad \frac{75}{75+x}=\frac{1}{5}$$

$$\Rightarrow \quad 375-75=x$$

$$\therefore \quad x=300$$

41. (b) Let the required number of days be x.
Then, more men, more km (Direct proportion)
more days, more km (Direct proportion)
men

$$\left.\begin{array}{lccc} \text{Men} & 12 & : & 28 \\ \text{Days} & 7 & : & x \end{array}\right\} :: 1.5 : 12$$

$$\therefore \quad 12\times 7\times 12=28\times x\times 1.5$$

$$x=\frac{12\times 7\times 12}{28\times 1.5}=24$$

42. (d) $(x+y)$'s 6 days' work $=\left(\frac{1}{30}\times 6\right)=\frac{1}{5}$

$$\text{Remaining work}=\left(1-\frac{1}{5}\right)=\frac{4}{5}$$

Now, $\frac{4}{5}$ work is done by y in 32 days

Whole work will be done by y in $\left(32\times\frac{5}{4}\right)=40$ days.

43. (a) $M_1 = n,\ d_1 = 30 - 10 = 20,\ M_2 = (50 + n)\ d_2 = 16$
By formula,
$M_1 d_1 = M_2 d_2$

$$\Rightarrow \quad n\times 20=(n+50)\times 16$$

$$\Rightarrow 20n=16n+800$$

$$\Rightarrow 4n=800$$

$$\Rightarrow n=200$$

44. (d) **From statement I**

$$\frac{M_1 d_1}{W_{a_1}}=\frac{M_2 d_2}{W_{a_2}}$$

Here $M_1 = 18,\ d_1 = 5 W_{a_1} = 1440$
$M_2 = 10,\ d_2 = 6,\ W_{a_2} = ?$

$$\Rightarrow \quad \frac{18\times 5}{1440}=\frac{10\times 6}{W_{a_2}}$$

$$\Rightarrow \quad W_{a_2}=\frac{10\times 6\times 1440}{18\times 5}=₹\ 960$$

But Wa_2 is given as 1280 so it is not correct.
From statement II

$$\frac{M_1 d_1}{W_{a_1}}=\frac{M_2 d_2}{W_{a_2}}$$

Here $M_1 = 16,\ d_1 = 7,\ W_{a1} = 1120$
$M_2 = 21,\ d_2 = 4,\ W_{a2} = ?$

$$\Rightarrow \quad \frac{16\times 7}{1120}=\frac{21\times 4}{W_{a_2}}$$

$$W_{a_2}=\frac{21\times 4\times 1120}{16\times 7}=3\times 280$$

$$=₹\ 840$$

Now, $Wa_2 = ₹\ 800$
So both statements are not correct.

45. (b) $M_1 D_1 = M_2 D_2$

$$\Rightarrow (2M+1W)\times 14=(4W+2M)\times 8$$

$$\Rightarrow 28M+14W=32W+16M$$

$$\Rightarrow 12M=18W$$

$$\frac{M}{W}=\frac{18}{12}=\frac{3}{2}$$

Now, a man gets ₹ 90 per day

$$\therefore \text{ 1 woman wages} = \frac{2}{3}\times \text{(wages of 1 man)}$$

$$=\frac{2}{3}\times 90=₹\ 60.$$

46. (c) X's one day's work $=\frac{1}{12}$

$$(X+Y)\text{'s one day's work} = \frac{3}{20}$$

$$\therefore \quad \text{Y's one day's work} = \frac{3}{20}-\frac{1}{12}=\frac{4}{60}=\frac{1}{15}$$

$\therefore$ Number of day's taken by Y = 15 days

47. (c) Required time taken to fill the pool

$$=\frac{\text{Volume of the pool}}{\text{Part of pool filled in 1 s}}$$

$$=\frac{70\times 44\times 3\times 100\times 100\times 100}{30800}\text{s}=300000\,\text{s}=\frac{250}{3}\text{h}$$

48. (b) Efficiency is inversely proportional to days of work required

$$\Rightarrow \quad 100\times 25=125\times \text{Days of } Y$$

$$\therefore \quad \text{Days of } Y=\frac{100\times 25}{125}=20$$

49. (d) 1 day work of $A = \frac{1}{x}$

1 day work of $B = \frac{1}{3x}$

Both A and B 1 day work $=\frac{1}{x}+\frac{1}{3x}=\frac{4}{3x}$

Work of both A and $B = \frac{1}{12}$

$$\Rightarrow \quad \frac{4}{3x}=\frac{1}{12} \Rightarrow 3x=48$$

$$\therefore \quad x=16$$

50. (d) A work in one day $= \frac{1}{8}$

B work in one day $= \frac{1}{10}$

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C work in one day $= \frac{1}{15}$

$A+B$ work in one day $= \frac{1}{8}+\frac{1}{10}=\frac{5+4}{40}=\frac{9}{40}$

$A+B$ work in two day $= \frac{2\times 9}{40}=\frac{9}{20}$

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

$B + C$ work in one day $= \frac{1}{10}+\frac{1}{15}=\frac{3+2}{30}=\frac{5}{30}=\frac{1}{6}$

So, $(B+C)$ complete a work together in 6 days.

$\because$ $\frac{11}{20}$ work together $= 6\times\frac{11}{29}=\frac{11\times 3}{10}=\frac{33}{10}$ days

$\because$ Total number of days $= 2+\frac{33}{10}=\frac{20+33}{10}=\frac{53}{10}$ days

51. (b) Here, $M_1=10, D_1=8, W_1=20$

$M_2=x(\text{let}), D_2=10, W_2=100$

$\because$ $\frac{M_1D_1}{W_1}=\frac{M_2D_2}{W_2}$

$\therefore$ $\frac{10\times 8}{20}=\frac{x\times 10}{100} \Rightarrow x=8\times 5=40$

52. (a) Time taken by pipe $A = 3h$

Due to leakage, time taken $= 3.5h = \frac{35}{10}h=\left(\frac{7}{2}\right)h$

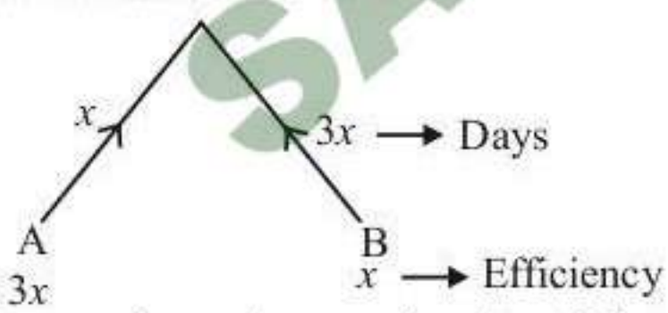
Here LCM of 3 and $\frac{7}{2}$ is 21

Here 21 is full capacity of tank

Then due to leakage tank filled by A in $1\,h = (7–6) = 1l$.

leakage takes 21 h to empty the tank

53. (b) Let efficiency of B is x



Days are inversely proportional to efficiency.

According to question

$\Rightarrow 3x - x = 40$

$\Rightarrow 2x = 40$

$\therefore x = 20$

Time taken by $A = x$ days $= 20$ days

Time taken by $B = 3x$ days $= 3 \times 20 = 60$ days

Time taken by A and B together $= \frac{20\times 60}{80} = 15$ days

54. (d) We know that

$\frac{M_1d_1}{W_1}=\frac{M_2d_2}{W_2}$

Here given $M_1 = 10$, $W_1 = 8$, $d_1 = 12$

$M_2 = 8$, $W_2 = 6$, $d_2 = ?$

$\Rightarrow$ $\frac{10\times 12}{8}=\frac{8\times d_2}{6}$

$\Rightarrow$ $d_2 = 11.25$ days

55. (a) Earning of man is directly proportinonal to their income

P		Q		$P+Q$		R
2	:	1		3	:	1
		Q	:	R		
		1		1		

Ratio of efficiency = 2 : 1 : 1

56. (a) Let pipes A, B, C fill a tank in x, y and z hrs. respectively.

Then x = 60 min, y = 75 min, z = z min

Required time to fill the tank = 50 min.

But, Required time $= \frac{xyz}{yz+zx-xy}$

$50=\frac{60\times 75\times z}{75z+60z-60\times 75}$

$\Rightarrow 5=\frac{450z}{135z-4500}$

$\Rightarrow 5(135z-4500)=450z$

$\Rightarrow 675z-4500\times 5=450z$

$\Rightarrow 675z-450z=4500\times 5$

$\Rightarrow z=\frac{4500\times 5}{225}=100$

57. (d) In 1 minute all the taps will fill the part of the tank

$=\frac{1}{10}+\frac{1}{20}-\frac{1}{40}$

$=\frac{4+2-1}{40}=\frac{5}{40}=\frac{1}{8}$

$\frac{1}{8}$ th part of tank will fill in 1 minute

Full tank will fill in $1\times 8 = 8$ minutes

58. (c) $\frac{M_1D_1H_1}{W_1}=\frac{M_2D_2H_2}{W_2}$

$\frac{4\times 4\times 4}{4}=\frac{2\times 2\times 2}{W} \Rightarrow W=\frac{1}{2}$ unit

So, option (c) is correct.

59. (d) $M_1D_1 = M_2D_2$

$(m)(d)=(m+2)D_2$

$D_2=\frac{md}{m+2}$

60. (c) After 30 minutes, the container will be full.

5 min before 30 min, the container will be half full.

10 min before 30 min, the container will be one fourth full.

$\therefore$ In (30-10) min = 20 min, the container will be one-fourth full.

61. (b) Water running per hour from the river into the sea

$= 2.5\times 45\times 3600\ m^3$.

Water running per minute from the river into the sea

$=\frac{2.5\times 45\times 3600}{60}\ m^3$

$= 2.5\times 45\times 60$

$= 6750\ m^3$

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