Time and Work

Important Rules and Formulae

Rule 1 If a person can do a piece of work in 'n' days he will do $\frac{1}{n}$ of the work in one day.

e.g., If Sneh can do a piece of work in 20 days, then she will do 1/20th of the work in one day.

Also, if Raj can do $\frac{1}{10}$th of work in a hour, then he can finish the work in 10 h.

Rule 2 If a number of persons doing a piece of job is increased (or decreased) in a certain ratio, the time needed to do the same work will be decreased (or increased) in the same ratio.

Example 1. Raj can do a piece of work in 20 days and Rohan can do it in 12 days. How long will they take if both work together?

(a) $5\frac{1}{2}$ days (b) $7\frac{1}{2}$ days (c) $3\frac{1}{2}$ days (d) $9\frac{1}{2}$ days

Sol. (b) Raj's one day's work $= \frac{1}{20}$

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

$\therefore$ (Raj + Rohan)'s one day's work $= \frac{1}{20} + \frac{1}{12} = \frac{3+5}{60} = \frac{8}{60}$

$\therefore$ Number of day's taken by Raj and Rohan together to complete the work

$= \frac{60}{8}$ days or $7\frac{1}{2}$ days

Example 2. 24 men can complete a given job in 40 days. Then, the number of men required to complete the job in 24 days is

(a) 20 men (b) 24 men
(c) 32 men (d) 40 men

Sol. (d) Here, we have to complete the job in less days so more men should be employed.

So that work $= 24 \times 40$

and in case second $= 24 \times x$

So, $24 \times 40 = 24 \times x \Rightarrow x = 40$ men

Example 3. A and B can do a piece of work in 72 days, B and C in 120 days and A and C in 90 days. In what time can A alone do it?

(a) 90 days (b) 100 days
(c) 110 days (d) None of these

Sol. (d) One day's work of A and B $= \frac{1}{72}$ ...(i)

One day's work of B and C $= \frac{1}{120}$ ...(ii)

One day's work of A and C $= \frac{1}{90}$ ...(iii)

On adding Eqs. (i), (ii) and (iii), we have

One day's work of $2(A+B+C) = \frac{1}{72} + \frac{1}{120} + \frac{1}{90} = \frac{1}{30}$

$\therefore$ One day's work of $(A+B+C) = \frac{1}{30 \times 2} = \frac{1}{60}$

A's one day's work $= \frac{1}{60} - \frac{1}{120} = \frac{1}{120}$

Hence, A alone will complete the work in 120 days.

Rule 3 If Rajeev is twice as good as a workman as Sudhir, then Rajeev take one half of the time taken by Sudhir to do a certain piece of work.

Points to be Remember

□ In the problems related to time and work it is always considered that a man works at uniform rate.

□ Wages for a piece of work are paid in proportion to the work done by the workers.

□ If 'm' men or 'n' women can do a piece of work in 'a' days, then x men and y women can do the same work in $\dfrac{1}{\dfrac{x}{m \times a} + \dfrac{y}{n \times a}}$ day.

Example 4. A is twice as good workman as B and together they finish a piece of work in 14 days. In how many days A alone finish the work?

(a) 18 days (b) 21 days (c) 27 days (d) 31 days

Sol. (b) Here, as A is twice as good as B so ratio of 1 day's work of A and B $= 2 : 1$

$(A+B)$'s 1 day's work $= \frac{1}{14}$

Divide $\frac{1}{14}$ in the ratio 2 : 1, we get

A's 1 day's work $= \dfrac{2}{3} \times \dfrac{1}{14} = \dfrac{1}{21}$

So, A alone can finish the work in 21 days.

Example 5. 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?

(a) 3 days   (b) 7 days
(c) 12 days   (d) 15 days

Sol. (c) Here, 3 men's work = 4 women's work

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

$\therefore$ 1 man reaps $\dfrac{1}{129}$ of the field in 1 day.

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

$\therefore$ 1 woman reaps $\dfrac{1}{172}$ of the field in 1 day.

$\therefore$ 7 men and 5 women reap $\left(\dfrac{7}{129} + \dfrac{5}{172}\right)$ of the field in 1 day or

$\dfrac{1}{12}$ of the field in 1 day.

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

Rule 4 (For problems on pipes and cistern)
If there are two taps A and B taken 'a' and 'b' hours, respectively to fill a tanker, then the two taps together fill $\left(\dfrac{1}{a} + \dfrac{1}{b}\right)$ part of the tank in an hour and the entire tanker is filled in $\dfrac{ab}{a+b}$ hours.

Example 6. Pipe A can fill a tank in 45 h and pipe B can fill it in 36 h. If both the pipes are opened in the empty tank. In how many hours will it be full?

(a) 10 h   (b) 15 h
(c) 20 h   (d) 28 h

Sol. (c) Part filled A in 1 h $= \dfrac{1}{45}$

Part filled by B in 1 h $= \dfrac{1}{36}$

Part filled by (A + B) together in 1 h

$= \dfrac{1}{45} + \dfrac{1}{36}$

$= \dfrac{9}{180} = \dfrac{1}{20}$

$\therefore$ The tank will be full in 20 h.

Shortcut Method
The tank will be filled when both A and B pipes are open in

$= \dfrac{45 \times 36}{45 + 36}$

$= \dfrac{1620}{81} = 20$ h

Points to be Remember

□ If a pipe fills a tank in 'a' hours, then in 1 h only $\dfrac{1}{a}$ of the tank is filled.

□ If a pipe can fill a tank in a_1 hours and another can empty the filled tank in a_2 hours, then in one hour $\left(\dfrac{1}{a_1} - \dfrac{1}{a_2}\right)$ of the tank is filled (when both pipes are open) and time taken will be $\left(\dfrac{a_1 a_2}{a_2 - a_1}\right)$ hours.

Rule 5 If a pipe can fill a tank in 'a' hours and another can fill the tank in 'b' hours but a third pipe empties the filled tank in 'c' hours, then in one hour $\left(\dfrac{1}{a} + \dfrac{1}{b} - \dfrac{1}{c}\right)$ of the tank will be filled (when all the three pipes are open) and time taken to fill the tank will be $\dfrac{abc}{bc + ac - ab}$ hours.

Example 7. 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. In how much time the tank is full?

(a) 60 min   (b) 90 min
(c) 115 min   (d) None of these

Sol. (a) Part filled by pipe A in 1 min $= \dfrac{1}{36}$

Part filled by pipe B in 1 min $= \dfrac{1}{45}$

$\therefore$ Total water dropped in the tank in 1 min $= \dfrac{1}{36} + \dfrac{1}{45}$

Water leaked out in 1 min by $C = \dfrac{1}{30}$

$\therefore$ Total tank filled in min $= \dfrac{1}{45} + \dfrac{1}{36} - \dfrac{1}{30} = \dfrac{4 + 5 - 6}{180} = \dfrac{1}{60}$

Hence, the tank will be filled in 60 min.

Shortcut Method
Here, $a = 36, b = 45, c = 30$

So, time taken to fill the tank will be $= \dfrac{abc}{ac + bc - ab}$

$= \dfrac{36 \times 45 \times 30}{36 \times 30 + 45 \times 30 - 36 \times 45} = 60$ min

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Points to be Remember

□ $\dfrac{M_1 D_1 H_1}{W_1 W_{a_1}} = \dfrac{M_2 D_2 H_2}{W_2 W_{a_2}}$, where M_1, M_2 are the number of men, D_1, D_2 the number of days, H_1, H_2 are the number of hours, W_1, W_2 are the works and W_{a_1}, W_{a_2} are the wages.

□ If M_1 men had provision for P_1 days and after P_2 days, M_2 men joined or left, then the provision, now last for D days, is given as
$$D = \dfrac{M_1 (P_1 - P_2)}{M_1 \pm M_2}$$ (+ if men joined, − if men left).

□ If x_1 men or y_1 women can reap a field in D Days, then x_2 men and y_2 women would reap it in $\dfrac{D(x_1 - y_1)}{x_2 y_1 + x_1 y_2}$ days.

Exercise

1. Ravi alone does a piece of work in 2 days and Rajesh does it in 6 days. In how many days will the two do it together?
   - (a) $1\frac{1}{2}$ days
   - (b) 4 days
   - (c) 2 days
   - (d) 3 days

2. X can do $\frac{3}{4}$ of a work in 12 days. In how many days X can finish the 1/2 work?
   - (a) 8 days
   - (b) 16 days
   - (c) 12 days
   - (d) 24 days

3. Ravi can build a wall in the same time in which Mahesh and Suresh together do it. If Ravi and Mahesh together could do it in 10 days and Suresh alone in 15 days. In what time Mahesh alone do it?
   - (a) 30 days
   - (b) 40 days
   - (c) 50 days
   - (d) 60 days

4. Four taps can individually fill a cistern of water in 1 h, 2 h, 3 h and 6 h, respectively. If all the four taps are opened simultaneously, the cistern can be filled in how many minutes? **(CDS 2011 I)**
   - (a) 20
   - (b) 30
   - (c) 35
   - (d) 40

5. 7 men and 8 boys can do a piece of work in 2 days. 4 men and 12 boys can do 29/56 of the same work in 1 day. In how many days will 1 man do this work?
   - (a) 24 days
   - (b) 25 days
   - (c) 27 days
   - (d) 28 days

6. 2 men undertake to do a job for ₹ 1400. One can do it alone in 7 days and the other in 8 days. With the assistance of a boy they finish the work in 3 days. How should the money be divided?
   - (a) ₹ 600, ₹ 525, ₹ 275
   - (b) ₹ 550, ₹ 500, ₹ 350
   - (c) ₹ 650 ₹ 470 ₹ 280
   - (d) None of the above

7. A group of workers engaged in plastering a wall completed $\frac{1}{2}$ of the work in one day and $\frac{1}{4}$ of the remaining work the next day. If still 45 sq m of wall remained to be plastered. What was the area of the wall?
   - (a) 300 sq m
   - (b) 120 sq m
   - (c) 240 sq m
   - (d) 180 sq m

8. 'X' completes a job in 2 days and 'Y' completes it in 3 days and 'Z' takes 4 days to complete it. If they work together and get ₹ 3900 for the Job, then how much amount does 'Y' get? **(CDS 2011 I)**
   - (a) ₹ 1800
   - (b) ₹ 1200
   - (c) ₹ 900
   - (d) ₹ 800

9. In an army camp ration is available for 100 soldiers for 10 days. After 2 days, 60 soldiers joined. Then, for how many more days will the remaining ration last? **(CDS 2009 II)**
   - (a) 7 days
   - (b) 6 days
   - (c) 5 days
   - (d) 4 days

10. A and B can do a piece of work in 8 days, B and C can do the same work in 12 days. If A, B and C can complete the same work in 6 days. In how many days can A and C complete the same work? **(CDS 2009 I)**
    - (a) 8 days
    - (b) 10 days
    - (c) 12 days
    - (d) 16 days

11. Two pipes A and B can separately fill a tank in 12 min and 15 min, respectively. Both the pipes are opened together. But 4 min after the start pipe A is turned off. How much time it will take to fill the tank?
    - (a) 11 min
    - (b) 6 min
    - (c) 12 min
    - (d) 8 min

12. A can do a piece of work in 24 days. If B is 60% more efficient than A, then B can complete the work in **(CDS 2010 II)**
    - (a) 17 days
    - (b) 18 days
    - (c) 15 days
    - (d) 12 days

13. An amount is sufficient to pay A's wages for 21 days and B's wages for 28 days. The amount is sufficient to pay wages to both for
    - (a) 22 days
    - (b) 26 days
    - (c) $24\frac{1}{2}$ days
    - (d) 12 days

14. The mess charges for 35 students for 24 days in ₹ 6300. In how many days will the mess charges be ₹ 3375 for 25 students? **(CDS 2009 III)**
    - (a) 12
    - (b) 15
    - (c) 18
    - (d) 21

15. A, B and C working together take 30 min to address a pile of envelopes. A and B together would take 40 min, A and C together would take 45 min. How long would each take working alone?
    - (a) A : 72 min, B : 90 min, C : 120 min
    - (b) A : 42 min, B : 90 min, C : 120 min
    - (c) A : 72 min, B : 90 min, C : 100 min
    - (d) A : 72 min, B : 80 min, C : 120 min

16. Ravi and Sneh working separately can finish a job in 8 and 12 h, respectively. If they work for an hour alternately, Rani beginning at 9:00 am. When will the job be finished?
    - (a) 7 : 30 pm
    - (b) 7 : 00 pm
    - (c) 6 : 30 pm
    - (d) 6 : 00 pm

17. If m men can do a job in p days, then (m + r) men can do the job in how many days? **(CDS 2008 II)**
    - (a) $(p + r)$
    - (b) $\frac{mp}{m+r}$
    - (c) $\frac{p}{m+r}$
    - (d) $\frac{m+r}{p}$

18. 42 men take 25 days to dig a pond. If the pond would have to be dug in 14 days, then what is the number of men to be employed? **(CDS 2007 I)**
    - (a) 67
    - (b) 75
    - (c) 81
    - (d) 84

19. Ram can do a piece of work in 6 days and Shyam can finish the same work in 12 days. How much work will be finished, if both work together for 2 days? **(CDS 2008 I)**
    - (a) One-fourth of the work
    - (b) One-third of the work
    - (c) Half of the work
    - (d) Whole of the work

20. A and B can do given work in 8 days; B and C can do the same work in 12 days and A, B, C complete it in 6 days. In how many days can A and C finish it?
    - (a) 12
    - (b) 8
    - (c) 14
    - (d) 16

21. If a work can be completed by A in 30 days and by B in 60 days. Then, the number of days taken by them to complete the work, working together is
    - (a) 25
    - (b) 45
    - (c) 50
    - (d) 20

22. P and Q can do a job in 2 days. Q and R can do it in 4 days and P and R in 12/5 days. What is the number of days required for P alone to do the job? **(CDS 2009 II)**
(a) 5/2   (b) 3   (c) 14/5   (d) 6

23. 76 ladies complete a job in 33 days. Due to some reason some ladies did not join the work and therefore it was completed in 44 days. The number of ladies who did not report for the work is   **(CDS 2011 II)**
(a) 17   (b) 18   (c) 19   (d) 20

24. A and B can complete a task in 30 days when working together. After A and B have been working together for 11 days. B is called away and A all by himself completes the task in next 28 days. Had A been working alone, the number of days taken by him to complete the task would have been
(a) $47\dfrac{3}{11}$ (b) $42\dfrac{1}{9}$ (c) $53\dfrac{7}{11}$ (d) $44\dfrac{4}{19}$

25. $\dfrac{1}{48}$ of a work is completed in half a day by 5 persons.
Then, $\dfrac{1}{40}$ of the work can be completed by 6 persons in how many days?   **(CDS 2010 I)**
(a) 1   (b) 2   (c) 3   (d) $\dfrac{1}{2}$

26. 9 men finish one-third work in 10 days. The number of additional men required for finishing the remaining work in 2 more days will be
(a) 78   (b) 81   (c) 55   (d) 30

27. If 10 persons can do a job in 20 days. Then, 20 persons with the twice efficiency can do the same job in
(a) 10   (b) 20   (c) 5   (d) 15

28. A person walks a distance in 114 days, when he rests 9 h a day. How long will he take to walk twice the distance, if he walks twice as fast and rests twice as long each day as before?   **(CDS 2009 II)**
(a) 57 days   (b) 228 days   (c) 285 days   (d) 324 days

29. 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   **(CDS 2011 I)**
(c) Both I and II   (d) Neither I nor II

30. If one man or two women or three boys can do a piece of work in 55 days, then one man, one woman and one boy will do it in how many days?   **(CDS 2008 II)**
(a) 20 days   (b) 30 days   (c) 40 days   (d) 50 days

31. If x men can do a work in z days. Then, the number of days taken by (x + y) men to do this is
(a) $\dfrac{xy}{(x+z)}$ (b) $\dfrac{xz}{(x+y)}$ (c) $\dfrac{(x+y)z}{x}$ (d) $\dfrac{x(x+y)}{z}$

32. A person can do a job as fast as his two sons working together. If one son does the job in 6 days and the other in 12 days, how many days does it take the father to do the job?   **(CDS 2007 I)**
(a) 9 days   (b) 6 days   (c) 4 days   (d) 3 days

33. If 18 men earn ₹ 1440 in 5 days, how many men can earn ₹ 1920 in 8 days?   **(CDS 2007 II)**
(a) 10   (b) 12   (c) 15   (d) 18

34. A can finish a work in 8 days and B can do it in 12 days. After A had worked for 3 days, B also joins A to finish the remaining work. In how many days will the remaining work be finished?   **(CDS 2007 II)**
(a) 2 days   (b) 3 days   (c) 4 days   (d) 5 days

35. A cistern normally takes 5 h to be filled by a tap. But because of a leak, takes 1 h more. In how many hours will the leak empty a full cistern?
(a) 12 h   (b) 30 h   (c) 15 h   (d) 8 h

36. 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?   **(CDS 2011 I)**
(a) 200   (b) 240   (c) 280   (d) 320

37. A, B and C can do a piece 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?   **(CDS 2011 II)**
(a) 53/9 days   (b) 34/7 days
(c) 85/13 days   (d) 53/10 days

Answers

1. (a)	2. (a)	3. (d)	4. (b)	5. (d)	6. (a)	7. (b)	8. (b)	9. (c)	10. (a)
11. (b)	12. (c)	13. (d)	14. (c)	15. (a)	16. (c)	17. (b)	18. (b)	19. (c)	20. (b)
21. (d)	22. (b)	23. (c)	24. (d)	25. (d)	26. (b)	27. (c)	28. (c)	29. (d)	30. (b)
31. (b)	32. (c)	33. (c)	34. (b)	35. (b)	36. (a)	37. (d)			

Hints and Solutions

1. Amount of work done by Ravi $= \dfrac{1}{2}$

   Amount of work done by Rajesh $= \dfrac{1}{6}$

   Total amount of work done by both $= \dfrac{1}{2} + \dfrac{1}{6} = \dfrac{2}{3}$

   $\therefore$ Both will take $\dfrac{3}{2}$ days or $1\dfrac{1}{2}$ days.

2. $\because$ X can do $\dfrac{3}{4}$ of work in 12 days.

   $\therefore$ X can do 1 work in $\dfrac{12 \times 4}{3}$ days.

   $\therefore$ X can do $\dfrac{1}{2}$ work in $\dfrac{12 \times 4 \times 1}{3 \times 2} = 8$ days

3. Here, let days taken by Ravi, Mahesh and Suresh be A, B and C

   $$\dfrac{1}{A} = \dfrac{1}{B} + \dfrac{1}{C} \qquad \text{...(i)}$$

   and $\quad \dfrac{1}{A} + \dfrac{1}{B} = \dfrac{1}{10} \qquad \text{...(ii)}$

   and $\quad \dfrac{1}{C} = \dfrac{1}{15} \qquad \text{...(iii)}$

   From Eqs. (i) and (iii)

   $\therefore \quad \dfrac{1}{A} - \dfrac{1}{B} = \dfrac{1}{C} = \dfrac{1}{15} \qquad \text{...(iv)}$

   From Eqs. (ii) and (iv)

   $\Rightarrow \quad \dfrac{2}{A} = \dfrac{1}{10} + \dfrac{1}{15} = \dfrac{1}{6} \therefore A = 12$

   Subtracting Eq. (iv) from Eq. (ii),

   $\dfrac{2}{B} = \dfrac{1}{10} - \dfrac{1}{15} = \dfrac{1}{30} \therefore B = 60$

   $\therefore$ Mahesh alone do it in 60 days.

4. Required time $= \dfrac{1}{\dfrac{1}{1} + \dfrac{1}{2} + \dfrac{1}{3} + \dfrac{1}{6}} = \dfrac{6}{6+3+2+1}$

   $= \dfrac{6}{12}$ h or $\dfrac{6}{12} \times 60 = 30$ min

5. Let the man does it in 'a' days and the boy in 'b' days.

   $\therefore \quad \dfrac{7}{a} + \dfrac{8}{b} = \dfrac{1}{2} \qquad \text{...(i)}$

   $\dfrac{4}{a} + \dfrac{12}{b} = \dfrac{29}{56} \qquad \text{...(ii)}$

   From Eqs. (i) and (ii)

   $\dfrac{52}{b} = \dfrac{29}{8} - 2 = \dfrac{13}{8} \therefore b = 32$

   Put in Eq. (i)

   $\dfrac{7}{a} + \dfrac{8}{32} = \dfrac{1}{2}$

   $\dfrac{7}{a} = \dfrac{1}{2} - \dfrac{1}{4} = \dfrac{1}{4} \therefore a = 28$

   So, a man will do it in 28 days.

6. Let the boy completes the work in x days, thus according to the condition

   $$\dfrac{1}{7} + \dfrac{1}{8} + \dfrac{1}{x} = \dfrac{1}{3}$$

   or $\quad \dfrac{1}{x} = \dfrac{1}{3} - \dfrac{1}{8} - \dfrac{1}{7} = \dfrac{11}{168}$

   $\therefore \quad x = \dfrac{168}{11}$ days

   So, money is to be shared in the ratio

   $\dfrac{1}{7} : \dfrac{1}{8} : \dfrac{11}{168}$ or $24 : 21 : 11$

   Thus, A's amount $= \dfrac{24}{56} \times 1400 = ₹ 600$

   B's amount $= \dfrac{21}{56} \times 1400 = ₹ 525$

   Boy's amount $= \dfrac{11}{56} \times 1400 = ₹ 275$

7. Let 'a' be the area to be plastered.

   Here, the work completed on the first day $= \dfrac{x}{2}$ m^2 the work

   complete on the second day

   $= \dfrac{1}{4} \times \dfrac{x}{2} = \dfrac{x}{8}$

   $\therefore \quad x - \dfrac{x}{2} - \dfrac{x}{8} = 45 \; x = 120 \, \text{m}^2$

8. Ratio of work done by X, Y and Z $= \dfrac{1}{2} : \dfrac{1}{3} : \dfrac{1}{4} = 6 : 4 : 3$

   Now, ratio in their amount $= 6 : 4 : 3$

   $\therefore \quad$ Part of Y $= \dfrac{4}{6+4+3} \times 3900 = ₹ 1200$

9.

Soldiers	Days
100 ↑	8 ↓
160	x

   $\Rightarrow \dfrac{160}{100} = \dfrac{8}{x} \Rightarrow x = \dfrac{8 \times 100}{160} = 5 \text{days}$

10. Number of days taken by A and B to do the work = 8

    Number of days taken by B and C to do the work = 12

    A's and B's one day work $= \dfrac{1}{8}$

    B's and C's one day work $= \dfrac{1}{12}$

    Number of days taken by A's, B's and C's to do the work = 6

    A's, B's and C's one day work $= \dfrac{1}{6}$

    B's one day work $= \dfrac{1}{8} + \dfrac{1}{12} - \dfrac{1}{6} = \dfrac{1}{24}$

    A's and C's one day work $= \dfrac{1}{6} - \dfrac{1}{24} = \dfrac{3}{24} = \dfrac{1}{8}$

    Hence, A and C can do the work in 8 days.

11. Part of tank filled by A in a minute $= \dfrac{1}{12}$

Part of tank filled by B in a minute $= \dfrac{1}{15}$

∴ Total part filled in a minute $= \dfrac{1}{12} + \dfrac{1}{15} = \dfrac{3}{20}$

∴ Part filled in 4 min $= \dfrac{4 \times 3}{20} = \dfrac{3}{5}$

Now,   remaining part $= 1 - \dfrac{3}{5} = \dfrac{2}{5}$

∴ Greater part, More time

$$\dfrac{1}{15} : \dfrac{2}{5} :: 1 : x$$

⇒ $\dfrac{x}{15} = \dfrac{2}{5} \Rightarrow x = 6$ min

12. A's one day's work $= \dfrac{1}{24}$

∴ B's one day work $= 160\%$ of $\dfrac{1}{24} = \dfrac{160}{100} \times \dfrac{1}{24} = \dfrac{1}{15}$

∴ B will take 15 days to finish the work.

13. Let the total amount be x.

Here, A's one day's wage $= \dfrac{x}{21}$

B's one day's wage $= \dfrac{x}{28}$

∴   A's and B's wages $= \dfrac{x}{21} + \dfrac{x}{28} = \dfrac{x}{12}$

∴ The amount is sufficient to pay 12 days wages to both.

14. By given condition,

$$35 \times 24 : 25 \times x :: 6300 : 3375$$

⇒ $35 \times 24 \times 3375 = 25 \times x \times 6300$

⇒ $x = \dfrac{35 \times 24 \times 3375}{25 \times 6300} = 18$

15. Here, $\dfrac{1}{A} + \dfrac{1}{B} + \dfrac{1}{C} = \dfrac{1}{30}$ ...(i)

$\dfrac{1}{A} + \dfrac{1}{B} = \dfrac{1}{40}$ ...(ii)

and $\dfrac{1}{A} + \dfrac{1}{C} = \dfrac{1}{45}$ ...(iii)

From Eqs. (i) and (ii),

$$\dfrac{1}{C} = \dfrac{1}{30} - \dfrac{1}{40} = \dfrac{1}{120}$$

$$\dfrac{1}{A} = \dfrac{1}{45} - \dfrac{1}{C} = \dfrac{1}{45} - \dfrac{1}{120} = \dfrac{1}{72}$$

$$\dfrac{1}{B} = \dfrac{1}{40} - \dfrac{1}{A} = \dfrac{1}{40} - \dfrac{1}{72} = \dfrac{1}{90}$$

So, A alone will address in 72 min, B alone will address in 90 min, C alone will address in 120 min.

16. Capacity of Rani and Sneh per hour $= \dfrac{1}{8}$ and $\dfrac{1}{12}$, respectively.

Total work done by them in 1 h $= \dfrac{1}{8} + \dfrac{1}{12} = \dfrac{5}{24}$ per h

∴ Full work $= 1 \times \dfrac{48}{5} = 9$ h, then $\dfrac{1}{6}$ of work will left and now turn is of Sneh. Sneh will do the remaining work in 30 min.
Total time taken $= 8$ h and 30 min
Time $= 9 + 9$ h and 30 min $= 18 : 30$ h $= 6 : 30$ pm

17.

Men	Days
m ↑ $(m+r)$	p ↓ x

∴ $\dfrac{x}{p} = \dfrac{m}{m+r}$

⇒ $x = \dfrac{mp}{m+r}$ days

18. Let x be the number of men to be employed.

Men	Days
42 ↓ x	25 ↑ 14

∴ $\dfrac{x}{42} = \dfrac{25}{14} \Rightarrow x = 75$

19. Since, Ram can do a piece of work in 6 days.

∴ One day's work of Ram $= \dfrac{1}{6}$

Shyam can finish the same work in 12 days.

∴ One day's work of Shyam $= \dfrac{1}{12}$

Hence, one day's work together, Ram and Shyam

$$= \dfrac{1}{6} + \dfrac{1}{12} = \dfrac{2+1}{12} = \dfrac{3}{12} = \dfrac{1}{4}$$

∴ Two day's work together $= \dfrac{1}{2}$

Thus, if they work together for 2 days, then half of the work will be complete.

20. (A + B)'s 1 day's work $= \dfrac{1}{8}$

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

(C + A)'s 1 day's work $= \dfrac{1}{x}$

∴ (A + B + C)'s 1 day's work $= \dfrac{1}{2}\left[\dfrac{1}{8} + \dfrac{1}{12} + \dfrac{1}{x}\right]$

$$\left(\dfrac{1}{6}\right) = \dfrac{1}{2}\left[\dfrac{1}{8} + \dfrac{1}{12}\right] + \dfrac{1}{2x}$$

⇒ $\dfrac{1}{x} = \dfrac{1}{3} - \left(\dfrac{1}{8} + \dfrac{1}{12}\right) = \dfrac{3}{24} = \dfrac{1}{8}$

So, C and A can do the work in 8 days.

21. A's one day's work $= \dfrac{1}{30}$

B's one day's work $= \dfrac{1}{60}$

∴ (A + B)'s one day's work

$$= \dfrac{1}{30} + \dfrac{1}{60} = \dfrac{1}{20}$$

∴ Both A and B working together can complete the job in 20 days.

22. One day work of P's and Q's $= \dfrac{1}{2}$ ...(i)

One day work of Q's and R's $= \dfrac{1}{4}$ ...(ii)

One day work of P's and R's $= \dfrac{5}{12}$ ...(iii)

On adding Eqs. (i), (ii) and (iii), we get

$$2(P+Q+R) = \dfrac{1}{2}+\dfrac{1}{4}+\dfrac{5}{12} \Rightarrow 2(P+Q+R) = \dfrac{14}{12}$$

$$\Rightarrow \qquad P+Q+R = \dfrac{7}{12} \qquad ...(iv)$$

On subtracting Eq. (ii) from Eq. (iv), we get

$$P = \dfrac{7}{12}-\dfrac{1}{4} \Rightarrow P = \dfrac{1}{3}$$

Hence, P's can do alone in 3 days.

23. Given, number of ladies, $W_1 = 76$

The number of days to complete the work, $D_1 = 33$
Let number of ladies who did not report for the work $= x$
By given condition,

$$W_2 = 76 - x \text{ and } D_2 = 44$$

$\because \qquad W_1 D_1 = W_2 D_2$

$\therefore \qquad 76 \times 33 = (76-x) \times 44$

$\Rightarrow \quad 76 - x = \dfrac{76 \times 3}{4} = 19 \times 3 \Rightarrow x = 76 - 57 = 19$

24. $(A+B)$'s one day's task $= \dfrac{1}{30}$

$\therefore (A+B)$'s 11 day's task $= \dfrac{11}{30}$

$\therefore$ Remaining work $= 1 - \dfrac{11}{30} = \dfrac{19}{30}$

$\dfrac{19}{30}$ work is done by A in 28 days.

Whole work will be done by $A = 28 \times \dfrac{30}{19} = 44\dfrac{4}{19}$ days

25. $\because \qquad \dfrac{M_1 D_1}{W_1} = \dfrac{M_2 D_2}{W_2}$ (by formula)

$\therefore \qquad \dfrac{5 \times \dfrac{1}{2}}{\dfrac{1}{48}} = \dfrac{6 \times D_2}{\dfrac{1}{40}} \Rightarrow D_2 = \dfrac{\dfrac{1}{2} \times 5 \times 48}{40 \times 6} = \dfrac{1}{2}$

26. Time taken by 9 men to finish the job $= 30$ days.

Remaining job $= 1 - \dfrac{1}{3} = \dfrac{2}{3}$

More work left so more men required (direct proportion)
[Less days, more m·. (indirect proportion)]

Work $\dfrac{1}{3} : \dfrac{2}{3} :: 9 : x$

Days $2 : 10$

$\therefore \qquad x = \dfrac{2}{3} \times 10 \times 9 \times 3 \times \dfrac{1}{2} = 90$ men

Required men $= 90 - 9 = 81$

27. Let the number of days be x.
Here, efficiency is $2 : 1$.
Person $20 : 10$
Number of days $20 : x$

$\therefore \qquad x = \dfrac{1 \times 10 \times 20}{20 \times 2} = 5$ days

28.

Distance	Speed	Hour per Day	Speed
$\begin{matrix}1\downarrow\\2\end{matrix}$	$\begin{matrix}1\uparrow\\2\end{matrix}$	$\begin{matrix}15\uparrow\\6\end{matrix}$	$\begin{matrix}114\downarrow\\x\end{matrix}$

$\left.\begin{matrix}1:2\\2:1\\6:15\end{matrix}\right\}\ 114:x$

$\therefore \quad 1 \times 2 \times 6 \times x = 2 \times 1 \times 15 \times 114$

$\Rightarrow \qquad x = \dfrac{2 \times 15 \times 114}{2 \times 6}$

$\Rightarrow \qquad x = 285$ days

29. I. Since, 18 men, in 5 days can earn $= ₹ 1440$

1 man, in 1 day can earn $= ₹ \dfrac{1440}{18 \times 5}$

$\therefore$ 10 men, in 6 days can earn $= \dfrac{1440}{18 \times 5} \times 6 \times 10$

$= ₹ 960 \neq ₹ 1280$

II. Since, 16 men, in 7 days can earn $= ₹ 1120$

1 man, in 1 day can earn $= \dfrac{1120}{16 \times 7}$

$\therefore$ 21 men, in 4 days can earn $= \dfrac{1120}{16 \times 7} \times 21 \times 4$

$= ₹ 840 \neq ₹ 800$

30. 1 man $= 2$ women $= 3$ boys

$\therefore$ 1 man + 1 woman + 1 boy $= 3$ boys $+ \dfrac{3}{2}$ boys + 1 boy

$\therefore$

Boys	Days
$\begin{matrix}3\\ \uparrow\\ \dfrac{11}{2}\end{matrix}$	$\begin{matrix}55\\ \downarrow\\ x\end{matrix}$

$\Rightarrow \quad \dfrac{x}{55} = \dfrac{3}{11/2} \Rightarrow x = \dfrac{3 \times 2}{11} \times 55 = 30$ days

31. Here, more men, less days so indirect proportion.
Let number of days taken now be d.

$\therefore \qquad (x+y) : x = z : d$

$\Rightarrow \qquad d = \dfrac{zx}{x+y}$

32. One day's work of first son $= \dfrac{1}{6}$

One day's work of second son $= \dfrac{1}{12}$

$\therefore$ One day's work of them working together

$$= \dfrac{1}{6} + \dfrac{1}{12} = \dfrac{2+1}{12} = \dfrac{1}{4}$$

$\therefore$ In 4 days father will finish the work.

33. $\because$ $\dfrac{M_1 D_1 H_1}{W_1} = \dfrac{M_2 D_2 H_2}{W_2}$ (formula)

$\therefore$ $\dfrac{18 \times 5 \times 1}{1440} = \dfrac{m \times 8}{1920}$

$\Rightarrow$ $m = \dfrac{1920 \times 18 \times 5}{8 \times 1440} = 15$

34. One day's work of A's $= \dfrac{1}{8}$th part

One day's work of B's $= \dfrac{1}{12}$th part

3 day's work of A's $= \dfrac{3}{8}$th part

Remaining work of A's $= 1 - \dfrac{3}{8} = \dfrac{5}{8}$th part

Together one day's work of A's and B's $= \dfrac{1}{8} + \dfrac{1}{12}$

$= \dfrac{3+2}{24} = \dfrac{5}{24}$

Number of days to finish the work $= \dfrac{5}{8} \div \dfrac{5}{24} = 3$ days

35. Part of cistern filled in one hour $= \dfrac{1}{5}$

Part of cistern empteed in one hour $= \dfrac{1}{6}$

$\therefore$ Net fillings of cistern in one hour $= \dfrac{1}{5} - \dfrac{1}{6} = \dfrac{1}{30}$ part

$\therefore$ The cistern will be full in 30 h.

36. By given condition, $n \times 30 = n \times 10 + (n + 50) \times 16$

$\Rightarrow$ $20n = 16n + 800 \Rightarrow n = \dfrac{800}{4} = 200$

37. Let the work complete in x days.

$\therefore$ By given condition,

$\dfrac{2}{8} + \dfrac{x}{10} + \dfrac{x-2}{15} = 1$

$\therefore$ $\dfrac{1}{4} + \dfrac{3x + 2x - 4}{30} = 1$

$\Rightarrow$ $\dfrac{15 + 10x - 8}{60} = 1$

$\Rightarrow$ $10x + 7 = 60$

$\Rightarrow$ $10x = 53 \Rightarrow x = \dfrac{53}{10}$ days