TIME AND WORK

The problem on Time and Work are based on the calculation of time required by a given number of workforce (which may include men, women and children) to complete the given period of time. Thus, it can be said that the problems on time and work fall in two categories:

(*i*) To find the time required to complete a given job.

(*ii*) To find the work done in given period of time.

- It is important to consider the capacity of a man doing work in terms of the part of the work he can do in one day. For instance, if a man can do a piece of work in 6 days, then 1/6th of work is done in one day. The whole work can be finished in 6 days.
- Again, if *A* can do a work in 4 days and *B* in 7 days, the ratio of the work done by *A* and *B* in the same time is 7 : 4.
- If *A* is twice as good a workman as *B*. *A* will take half of the time taken by *B* to do certain piece of work. It means the ratio of the work done by *A* and *B* is 2 : 1.

Wages are paid in proportion to units of job done by each in the same time.

All the above points can be summarized as given below :

If '*M*' number of people take' *D*' days to complete the given job, the total number of 'Man-Days' required to complete the given job are given by the product of '*M*' and '*D*'. This product '*MD*' now remains unchanged. Thus, if '*M*' changes into 'M_1', '*D*' will change into 'D_1' in such a way that $MD = M_1D_1$. Similarly, if '*D*' changes to 'D_2' '*M*' will change to 'M_2' in such a way that $MD = M_2D_2$.

1. This is the basic relationship and all-in one formula. We can also derive :
2. More men-less days and conversely, more days-less men.
3. More men-more work and conversely, more work-more men.
4. More days-more work and conversely, more work-more days.
5. Number of days required to complete the given work $= \frac{\text{Total work}}{\text{One day's work}}$

Note : Since the total work is assumed to be One (unit), the number of days required to complete the given work would be the reciprocal of the one day's work.

Sometimes the problems on Time and Work can be solved using proportional rule :

(Man × Day × Hour × 1/work) in one situation = (Man × Day × Hour × 1/work) in another situation.

EXERCISE

1. *A* can do a piece of work in 25 days and *B* can finish it in 20 days. They work together for 5 days and then *A* goes away. In how many days will *B* finish the work?

(*a*) 10 days (*b*) 11 days

(*c*) 20 days (*d*) $33\frac{1}{11}$ days

(*e*) None of these

2. *A* can do a piece of work in 25 days which *B* alone can do in 20 days. *A* started the work and

was joined by B after 10 days. The work lasted for :

(*a*) 15 days (*b*) $12\frac{1}{2}$ days

(*c*) $16\frac{1}{2}$ days (*d*) $14\frac{2}{9}$ days

(*e*) None of these

3. A can do a piece of work in 40 days. He worked at it for 5 days and B finished the remaining work in 21 days. In how many days can A and B together finish the work?

(*a*) 13 days (*b*) 15 days

(*c*) $6\frac{2}{3}$ days (*d*) $18\frac{1}{7}$ days

(*e*) None of these

4. A is thrice as good a workman as B. Together they can do a job in 15 days. In how many days B will finish it alone?

(*a*) 60 days (*b*) 45 days

(*c*) 20 days (*d*) 40 days

(*e*) None of these

5. A can do a work in 8 days and B in 6 days. A and B can do the work on alternate days. If A begins the work, then the work can be finished in how many days?

(*a*) 5 days (*b*) 7 days

(*c*) $6\frac{3}{4}$ days (*d*) $7\frac{1}{2}$ days

(*e*) None of these

6. A can do a piece of work in 6 days and B alone can do it in 8 days. A and B undertook to do it for ₹ 320 and with the help of C they finished it in 3 days. How much is paid to C?

(*a*) ₹ 80 (*b*) ₹ 60

(*c*) ₹ 37.50 (*d*) ₹ 40

(*e*) None of these

7. A, B, C are employed to do a piece of work for ₹ 529. A and B together are supposed to do 19/23 of the work, what should C be paid?

(*a*) ₹ 82 (*b*) ₹ 92

(*c*) ₹ 437 (*d*) ₹ 300

(*e*) None of these

8. Eight children and 12 men complete a certain piece of work in 9 days. Each child takes twice the time taken by a man to finish the work. In how many days will 12 men finish the same work?

(*a*) 8 days (*b*) 15 days

(*c*) 9 days (*d*) 12 days

(*e*) None of these

9. A cistern can be filled by pipes A and B in 12 minutes and 16 minutes respectively. When full, the tank can be emptied by a third pipe C in 8 minutes only. If all the taps be turned on at the same time, the cistern will be full in :

(*a*) 20 min (*b*) 24 min

(*c*) 36 min (*d*) 48 min

(*e*) None of these

10. If 30 men working 7 hours a day can do a piece of work in 18 days, in how many days will 21 men working 8 hours a day do the same piece of work?

(*a*) 25 days (*b*) 20 days

(*c*) $22\frac{1}{2}$ days (*d*) 30 days

(*e*) None of these

EXPLANATORY ANSWERS

1. (*b*) : $(A + B)$'s 5 days' work $= (1/25 + 1/20) \times 5$
$= 9/20$

Remaining work $= 1 - 9/20 = 11/20$

B will finish it in $= \frac{11}{20} \times 20 = 11$ days.

2. (*e*) : A's 10 days' work $= 10/25 = 2/5$

Remaining work $= 1 - 2/5 = 3/5$

$(A + B)$'s 1 day's work $= 1/25 + 1/20 = 9/100$

So, $(A + B)$ complete 3/5 of the work in

$= \frac{100}{9} \times \frac{3}{5} = 6\frac{2}{3}$ days

So, work lasted for $= 10 + 6\frac{2}{3} = 16\frac{2}{3}$ days.

3. (*b*) : A's 5 days' work $= 5/40 = 1/8$

Remaining work $= 1 - 1/8 = 7/8$

B can do a piece of work in $= \frac{8}{7} \times 21$

$= 24$ days

i.e., $A = 1/40$, $B = 1/24$

So, $(A + B)$ can complete the work in

$= \frac{40 \times 24}{40 + 24} = 15$ days.

4. (*a*) : $A = 3B$

So $(A + B)$'s 1 day's work $= 1/15$

$4B$'s 1 day's work $= 1/15$

B's 1 day work $= 1/15 \times 4 = 1/60$

So, B alone will complete the work in 60 days.

5. (*b*) : **Trick :** Numbers of days $= \frac{8 + 6}{2} = 7$ days.

6. (*d*) : C's share of work $= 1 - \left(\frac{3}{6} + \frac{3}{8}\right) = \frac{1}{8}$

So, C's share $= \frac{1}{8} \times 320 = ₹ 40$.

7. (*b*) : **Trick :** C's share $= 529 \times (1 - 19/23)$

$= 529 \times 4/23 = ₹ 92$

8. (*d*) : **Trick :** 2 children = 1 man

So, (8 children + 12 men) = 16 men

So, 12 men will complete the same work

in $\frac{16 \times 9}{12} = 12$ days.

9. (*d*) : (A + B + C)'s 1 min work

$= \frac{1}{12} + \frac{1}{16} - \frac{1}{8}$

$= \frac{4 + 3 - 6}{48} = \frac{1}{48}$

Hence, cistern will full in 48 min.

10. (*c*) : **Trick :** Man × Day × hours

Number of days $= \frac{30 \times 18 \times 7}{21 \times 8}$

$= 22\frac{1}{2}$ days.