

## Topic: Time and Work

In solving the problems based on time and work, we need to calculate the following parameters.

(A) **Time** :- Time taken to complete an assigned job.

(B) **Individual time** :- Time needed by single person to complete a job.

(C) **Work**:- It is the amount of work done actually.

Read more:

### 1. Work from Days:

If A can do a piece of work in  $n$  days, then A's 1 day's work =  $\frac{1}{n}$ .

### 2. Days from Work:

If A's 1 day's work =  $\frac{1}{n}$ , then A can finish the work in  $n$  days.

### 3. Ratio:

If A is thrice as good a workman as B, then:

Ratio of work done by A and B = 3 : 1.

Ratio of times taken by A and B to finish a work = 1 : 3.

## Types of Questions and its Short Tricks

**Case 1:** A complete job will be considered = 1

**Case 2:** Assume a person 'M' complete a job alone in  $t$  days, then time taken by 'M' =  $t$

**Case 3:** 1 day's work by any person  $\left(\frac{1}{\text{individual time}}\right)^{th} =$  part of total work i.e.  
 $\frac{1}{t}$

**Example:-** Ram can whitewash a building in 17 days. Find the work done by Ram in one day.

**Solution:** Here, time taken by Ram = 17 days, so 1 day's work by Ram =

$\frac{1}{17}^{th}$  part of total work.

**Case 4:** The reciprocal of 1 day's work gives the individual time. i.e., time

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$$\frac{1}{1 \text{ day's work}} \text{ i.e. } \frac{1}{t} = t$$

taken by a single persons to complete the job =

**Example:** Sunny can do  $1/5^{\text{th}}$  of an work in 1 day. In how many days can he complete the same work.

**Solution:** Time of completion by Sunny alone = individual time =

$$\frac{1}{1 \text{ day's work}} = \frac{1}{5} = 5 \text{ days}$$

Therefore , sunny can complete the job alone in 5 days.

**Case: 5:** When more than one person are working on the same piece of work then their combined 1 day's work = sum of 1 day's work by each person. i.e., if A, B and C are three persons working on a job, then (A+B+C)'s 1 day's work = A's 1 day work + B's 1 days work + C's 1 days work.

**Example:** A person 'P' can do a work in 15 days and 'Q' can do it in 20 days. What amount of work is done by P and Q together in one day?

**Solution:** (P+Q)'s 1 day work = P's 1 day work + Q's 1 day work. 1 day's

$$\text{work} = \frac{1}{\text{individual time}}$$

We can find (P+Q)'s 1 day work =  $\left(\frac{1}{15} + \frac{1}{20}\right)^{\text{th}}$  part of total work. So, 1 day work of P and Q =  $\frac{7}{60}$

**Corollary:** Work done by A in 1 day = 1 day work of (A+B+C) – (1 day work of B + 1 day work of C)

Similarly,

Work done by B in 1 day = work done by (A+B+C) in 1 day – (work done by A in 1 day + work done by C in 1 day)

**Case 6:** 1. The reciprocal of combined work done in 1 day gives the tome for completion by the persons working together.

i.e., time of completion =  $\frac{1}{\text{combined}}$  = 1 day's work.

2. It implies that if three persons, say , A, B and C are working together on

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a job, then Time for completion of work by them =  $\frac{1}{(A+B+C) \text{'s 1 day's work}}$

**Example:** Three persons Ram, Shyam and Kamal can do a job in 10 days, 12 days and 15 days respectively. In how many days can they finish the job working together?

**Solution:** Time for completion of work =  $\frac{1}{\text{combined work (A+B+C)}}$

**Now, as specified in case 5**

Combined work in 1 day = sum of individual work done by Ram, Shyam and Kamal (Ram + Shyam+Kamal)'s 1 day work = Ram's 1 day work +

Shyam's 1 day work +Kamal's 1 day work =  $\left(\frac{1}{10} + \frac{1}{12} + \frac{1}{15}\right)$ th part of work =  $\frac{1}{4}$ th part of work

Time taken to complete the work =

$$\frac{1}{\frac{1}{4}} = 4$$

4 days.

**Case 7:** Part of work done at any time 't' by one or more persons = t × (1 day's work)

**Example:** A persons 'M' can do a job in 25 days. How much of the job is done by him in 5 days?

**Solution:** Part of work done by M in 5 days = 5 × (1/25) = 1/5<sup>th</sup> part of work

**Example:** Two friends A and B can complete a piece of work in 12 days and 8 days respectively. Find the amount of work done by them in 4 days.

**Solution:** Part of work done by (A+B) in 4 days = 4 ×(A+B)'s 1 day work

$$= 4\left(\frac{1}{12} + \frac{1}{8}\right) \text{th part of work} = \frac{5}{6} \text{th}$$

**Example:** Two persons P and Q can do a piece of work individually in 10 days and 15 days respectively. If P work for 2 days and Q works for 5 days, then find the total amount of work done.

**Solution:** Part of work done by P + Q = Part of work done by P in 1 day +

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part of work done by Q in 5 days

$$= 2\left(\frac{1}{10}\right) + 5\left(\frac{1}{15}\right)$$

$$= \left(\frac{1}{5} + \frac{1}{3}\right) \text{ the part of work} = 8/15^{\text{th}}$$

**Case 8:** If more than one person are working for different time schedules to complete a piece of work, then

(i) Assume the time for completion = T

(ii) Number of days worked by each persons in found with reference to T, if not mentioned in the problem.

(iii) Sum of the parts of work done by each person = 1, since the job is complete.

**Example:** Deepak and Anil can do a piece of work in 10 days and 30 days respectively. They work together and Deepak leaves 5 day's before the work is finished. Anil finishes the remaining work alone. In how many days is the total work finished?

**Solution:** Assume the time for completion = T

Since Deepak leaves 5 days before the work is finished. So, no. of days worked by Deepak = T - 5 and Anil works, so, number of days worked by Anil = T

Deepak's work + Anil's work = 1

$$\Rightarrow \frac{T-5}{10} + \frac{T}{30} = 1$$

$$\Rightarrow T = 11.25$$

Total work is finished in 11.25 days.

**Case 9:** The ration of the work done by the two persons in the same time is the inverse ratio of their individual time.

e.g., if 'A' can do a work in 5 days and B can do in 9 days, then, in the

same time,  $\frac{\text{A's work}}{\text{B's work}} = \frac{9}{5}$  (inverse of time taken when working alone)

**Case 10:** If a person 'P' is 'n' times as good a workman as Q, individual time for

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$P = \frac{\text{individual time for Q}}{n}$  and after some time (using case 9)

**Example:** Tannu and Rekha can do a job in 12 days. Rekha alone can finish it in 36 days. In how many days can Tannu and alone finish the work?

**Solution:** (Tannu + Rekha)'s 1 days work = Tannu's 1 day work + Rekha's 1 day work

$$\Rightarrow \frac{1}{12}$$

= Tannu's 1 day work work + 1/36

Tannu's 1 day work =

$$\Rightarrow \frac{1}{12} - \frac{1}{36} = \frac{1}{18}$$

th of work. So, Tannu can finish it in 18 days.

**Trick :**

If T = 12, R = 36 then

Required time =

$$\frac{TR}{R-T} = \frac{36 \times 12}{36-12}$$

= 18 days