Time and Work

Work is always considered as an entire value or one. There exists an analogy between the time-speed-distance problems and work. Work based problems are more or less related to time speed and distance.

Important Formulae:

1) Work from days:
If a person can do a work in 'n' days, then person's 1 day work = 1 / n

2) Days from work:
If a person's 1 day work is equal to 1/n , then the person can finish the work in 'n' days.

3) Number of Days = $\frac{\text{Total Work}}{\text{Work Done in 1 Day}}$

Quick Tricks & Tips:

1) Ratio:

If 'A' is 'x' times as good a workman as 'B', then
a) Ratio of work done by A & B in equal time = x: 1
b) Ratio of time taken by A & B to complete the work = 1: x. This means that 'A' takes ($1/x^{th}$) time as that of 'B' to finish same amount of work.

For example,
if A is twice good a workman as B, then it means that

a) A does twice as much work as done by B in equal time i.e. A:B = 2:1
b) A finishes his work in half the time as B

2) Combined Work:

a) If 'A' and 'B' can finish the work in 'x' & 'y' days respectively, then

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

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

(A + B)'s one day work = $\frac{1}{x} + \frac{1}{y} = \frac{(x + y)}{xy}$

Together, they finish the work in $\frac{xy}{(x + y)}$ **days.**

b) If 'A', 'B' & 'C' can complete the work in x, y & z days respectively, then

(A + B+ C) 's 1 day work = $\frac{1}{x} + \frac{1}{y} + \frac{1}{z} = \frac{(xy + yz + xz)}{xyz}$

Together, they complete the work in $\frac{xyz}{xy + yz + xz}$ **days.**

c) If **A can do a work in 'x' days** and if the same amount of work is done by **A & B together in 'y' days,** then

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

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

B's one day work = $\frac{1}{y} - \frac{1}{x} = \frac{x - y}{xy}$

So, 'B' alone will take $\frac{xy}{x - y}$ days.

d) If **A & B** together perform some part of work in **'x' days**, **B & C** together perform it in **'y' days** and **C & A** together perform it in **'z' days**, then

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

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

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

$\frac{1}{x} + \frac{1}{y} + \frac{1}{z}$ = 2(A+B+C)'s 1 one day work

Now, we have at hand (A + B + C)'s one day work = $\frac{\left(\frac{1}{x} + \frac{1}{y} + \frac{1}{z}\right)}{2}$

A+ B+ C) will together complete the work in $\frac{2}{\left(\frac{1}{x} + \frac{1}{y} + \frac{1}{z}\right)}$ days

If **A works alone,** then **deduct A's work** from the **total work of B & C** to find the **time taken by A alone.**

For A working alone, time required =A's work - (A+B+C)'s combined work

$= \frac{2}{\left(\frac{1}{x} - \frac{1}{y} + \frac{1}{z}\right)}$

$= \frac{2xyz}{[xy + yz - zx]}$ days

Similarly,

- If B works alone, then time required = $\frac{2xyz}{(-xy + yz + zx)}$

- If C works alone, then time required = $\frac{2xyz}{(xy - yz + zx)}$

3) Man -Work -Hour related problems:

Remember that $\frac{M\ D\ H\ E}{W}$ = Constant

Where,
M: Number of Men
D: Number of Days
H: Number of Hours
W: Amount of Work done
E: Efficiency

If men are fixed, work is proportional to time. If work is fixed, time is inversely proportional to men. Thus,

$$\frac{M1 \times T1 \times E1}{W1} = \frac{M2 \times T2 \times E2}{W2}$$

Once you have understood the following simple things, this chapter will become extremely easy for you.

a) Work and time are directly proportional to each other
b) Number of men and time are inversely proportional to each other
c) And, work can be divided into equal parts i.e. if a task is finished in 10 days, in one day you will finish ($1/10^{th}$) part of the work.