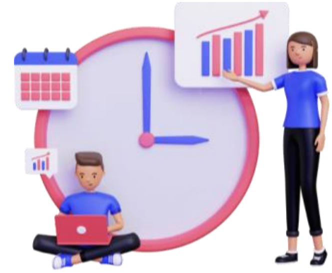
TIME & WORK



TIME : The amount of time taken by a person to complete a task is called Time.

WORK : The number of parts of work completed by a person for certain duration is called Work.

Rate of Work (or) Efficiency: It is the ratio of “1” to the total time taken by the person.

- If A completed a work in “10” days then Rate of work of A (or) A’s one day work is $\frac{1}{10}$
- If B completed a work in 12 hours , the Rate of work of B (or) B’s one hour work is $\frac{1}{12}$

Total Work Done = Number of Days × Efficiency

- **If the work is same for two persons then the amount of time taken by each person is inversely proportional to efficiency of each person,**

$$T_1 : T_2 \quad = \quad E_1 : E_2$$

- **If ‘W1’ work is done by ‘M1’ people in ‘D1’ days, working ‘T1’ hours in a day and ‘W2’ work is done by ‘M2’ people in ‘D2’ days, working ‘T2’ hours in a day, then the relation between them will be**

$$\frac{W1}{M1 \times D1 \times T1} = \frac{W2}{M2 \times D2 \times T2}$$

PROBLEMS:

1) A can do a piece of work in 10 days, then what is the efficient of A.

Ans: **Here the total work is completed in 10 days, then the efficiency of the A means A’s 1 day work ➔ A =** $\frac{1}{10}$

2) A alone can do a piece of work in 10 days, whereas B alone can do the work in 15 days. In how many days A and B together complete the work ?

Ans: **6 days**

Time × Efficiency = Work

- If total work done by two people is same, then the "LCM" of individual time taken by them is always equal to total work.

	A	B
T =	10	15
E =	3	2 (individual Efficiency)
W =	30 (LCM of '10' & '15')	

(A+B) complete work in $\frac{30}{(3+2)} = \frac{30}{5} = 6$

$(T \times E = W) \Rightarrow \left[Time = \frac{work}{Eff}\right]$

Ans: '6' days.

3) A and B together can do a piece of work in 6 days. If A can alone do the work in 18 days, then the number of days required for B to finish the work is

Ans: 9 days

	A+B	A
T	6	18
E	3	1 (Individual Efficiency)
W	18 (work)	

'B's alone efficiency = $(3-1) = 2$

$\boxed{T = \frac{\text{Work}}{\text{Eff}}} \Rightarrow \text{Time} = \frac{18}{2} = 9 \text{ days}$

4) A & B can do a job in 10 days, B & C in 15 days, and C & A in 12 days. In how many days can they finish it, if they work together ?

Ans: **8 days**

	A+B	B+C	C+A
Time	10	15	12
Eff	6	4	5
WORK	60		

LCM of 10,15,12

5	10, 15, 12
2	2, 3, 12
3	1, 3, 6
2	1, 1, 2
	1, 1, 1

LCM = $5 \times 2 \times 3 \times 2 = 60$

$A+B+B+C+C+A = 15$

$2(A+B+C) = 15$

$A+B+C = 7.5$

$\text{Time} = \frac{\text{work}}{\text{eff}} = \frac{60}{7.5} \Rightarrow \frac{60 \times 10}{75} = 8$

Ans: '8' days

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5) 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 ?

Ans: **15 days**

$A = 3B$

Time x Eff = Work

- Work done by B is $1 \times t = 1 \times t$
- Work done by A is $3 \times (t-40)$

work done by both of them is same.

$1 \times t = 3 \times (t-40)$

$t = 3t - 120$

$2t = 120$

$\boxed{t = 60}$

∴

	A	B
T	20	60
E	3	1
W	60	

→ Time taken by both of them to complete the whole work is

$T = \frac{W}{Eff}$

Ans: $T = \frac{60}{4} = 15$

6) A fort has provision for 50 days. If after 10 days, they are strengthened by 1000 men and the remaining food lasts 32 days, how many men were there in the fort initially ?

Ans: **x = 4000** (4000 men are there in the fort initially)

→ provisions for '50' days.
After '10' days the provisions will Only last for '40' days. Instead it Only last for '32' days because of addition of "1000" more men.

$$40 \times x = (x+1000) \times 32$$

$$10x = 8x + 8000$$

$$2x = 8000$$

$$\boxed{x = 4000}$$

7) 9 women can complete a piece of work in 19 days working 10 hours a day. How many days will 18 women working 5 hours a day take to complete the same piece of work ?

Ans: **19 days**

Formula ⇒ $\dfrac{W_1}{M_1 D_1 E_1} = \dfrac{W_2}{M_2 D_2 E_2}$

Here the total work done by both groups is same $[W_1 = W_2]$

$\therefore M_1 D_1 E_1 = M_2 D_2 E_2$

$9 \times 19 \times 10 = 18 \times 5 \times x$

$\cancel{9} \times 19 \times \cancel{10} = \cancel{18} \times \cancel{5} \times x$

Ans: $\boxed{x = 19}$

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8) Two pipes P & Q can fill a cistern in 24 and 32 hours respectively. If both the pipes are opened together, when the first pipe must be turned off ? so ,that the cistern may be just filled in 16 hours ?

$\dfrac{P}{24}$ $\dfrac{Q}{32}$

4 3

96

LCM of 24 & 32

4 | 24, 32
2 | 6, 8
4 | 3, 4
3 | 3, 1
| 1, 1

LCM = 96

- In one hour P & Q Together can finish '7' parts of work.
- Until '16' hours 'Q' is working
  ∴ 'Q' can complete = 16 × 3 = 48 parts
  (96 − 48) = 48 parts (remaining work)
  → This work is purely done by 'P' = $\dfrac{48}{4}$ = 12 ~~days~~ hours

∴ So, After '12' hours, Pipe P must be turned off.

9) Pipe A and Pipe B can fill a tank in 10minutes and 15 minutes and another pipe C can empty full tank in 20 minutes , if all these pipes operates simultaneously , then find the time taken to fill complete tank .

$$\frac{A}{10} \quad \frac{B}{15} \quad \frac{C}{-20}$$

$$6 \quad 4 \quad -3$$

$$60$$

$$A+B+C = \frac{60}{6+4-3} = \frac{60}{7} = 8\frac{4}{7} \text{ minutes}$$