

# Tips, Formulae and shortcuts for Time, Speed & Work

**By**

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# Time, Speed, Distance and Work

## Tips by CRACKU.IN

- Time, Distance and Work is the most important topic for all Competitive examinations.
- The questions from this topic varies from easy to difficult.
- This formula sheet covers the most importance tips that helps you to answer the questions in a easy, fast and accurate way.

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# Cracku Tip 1 – Time, Speed, Distance & Work

$$\text{Distance} = \text{Speed} \times \text{Time}$$

$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}}$$

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## Cracku Tip 2 – Time, Speed, Distance & Work

If the ratio of the speeds of A and B is  $a : b$ , then

- The ratio of the times taken to cover the same distance is  $1/a : 1/b$  or  $b : a$ .
- The ratio of distance travelled in equal time intervals is  $a : b$

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## Cracku Tip 3 – Time, Speed, Distance & Work

- Average speed =  $\frac{\text{Total Distance travelled}}{\text{Total Time taken}}$
- If a part of a journey is travelled at speed  $S_1$  km/hr in  $T_1$  hours and remaining part at speed  $S_2$  km/hr in  $T_2$  hours then,

$$\text{Total distance travelled} = S_1 T_1 + S_2 T_2 \text{ km}$$

$$\text{Average speed} = \frac{S_1 T_1 + S_2 T_2}{T_1 + T_2} \text{ km/hr}$$

## Cracku Tip 4 – Time, Speed, Distance & Work

- In a journey travelled with different speeds, if the distance covered in each stage is constant, the average speed is the harmonic mean of the different speeds.
- Suppose a man covers a certain distance at  $x$  km/hr and an equal distance at  $y$  km/hr

Then the average speed during the whole journey is  $\frac{2xy}{x+y}$  km/hr

## Cracku Tip 5 – Time, Speed, Distance & Work

- In a journey travelled with different speeds, if the time travelled in each stage is constant, the average speed is the arithmetic mean of the different speeds.
- If a man travelled for certain time at the speed of  $x$  km/hr and travelled for equal amount of time at the speed of  $y$  km/hr then

The average speed during the whole journey is  $\frac{x+y}{2}$  km/hr

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## Cracku Tip 6 – Time, Speed, Distance & Work

### Constant distance :

Let the distances travelled in each part of the journey be  $d_1, d_2, d_3$  and so on till  $d_n$  and the speeds in each part be  $s_1, s_2, s_3$  and so on till  $s_n$ .

If  $d_1 = d_2 = d_3 = \dots = d_n = d$ , then the average speed is the harmonic mean of the speeds  $s_1, s_2, s_3$  and so on till  $s_n$ .

### Constant time :

Let the distances travelled in each part of the journey be  $d_1, d_2, d_3$  and so on till  $d_n$  and the time taken for each part be  $t_1, t_2, t_3$  and so on till  $t_n$ .

If  $t_1 = t_2 = t_3 = \dots = t_n = t$ , then the average speed is the arithmetic mean of the speeds  $s_1, s_2, s_3$  and so on till  $s_n$ .

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## Cracku Tip 7 – Time, Speed, Distance & Work

### ***Circular Tracks :***

If two people are running on a circular track with speeds in ratio  $a:b$  where  $a$  and  $b$  are co-prime, then

- They will meet at  $a+b$  distinct points if they are running in opposite direction.
- They will meet at  $|a-b|$  distinct points if they are running in same direction

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# Cracku Tip 8 – Time, Speed, Distance & Work

## ***Circular Tracks :***

If two people are running on a circular track having perimeter  $l$ , with speeds  $m$  and  $n$ ,

- The time for their first meeting =  $l / (m + n)$   
(when they are running in opposite directions)
- The time for their first meeting =  $l / (|m - n|)$   
(when they are running in the same direction)

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## Cracku Tip 9 – Time, Speed, Distance & Work

If a person P starts from A and heads towards B and another person Q starts from B and heads towards A and they meet after a time 't' then,

$$t = \sqrt{x*y}$$

where x = time taken (after meeting) by P to reach B and  
y = time taken (after meeting) by Q to reach A.

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## Cracku Tip 10 – Time, Speed, Distance & Work

A and B started at a time towards each other. After crossing each other, they took  $T_1$  hrs,  $T_2$  hrs respectively to reach their destinations. If they travel at constant speeds  $S_1$  and  $S_2$  respectively all over the journey, Then

$$\frac{S_1}{S_2} = \sqrt{\frac{T_2}{T_1}}$$

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# Cracku Tip 11 – Time, Speed, Distance & Work

## ***Trains :***

- Two trains of length  $L_1$  and  $L_2$  travelling at speeds of  $S_1$  and  $S_2$  cross each other in a time

$$= \frac{L_1 + L_2}{S_1 + S_2} \text{ (if they are going in opposite directions)}$$

$$= \frac{L_1 + L_2}{|S_1 - S_2|} \text{ (if they are going in the same direction)}$$

## Cracku Tip 12 – Time, Speed, Distance & Work

### **Work :**

- If X can do a work in 'n' days, the fraction of work X does in a day is  $1/n$
- If X can do a work in 'x' days, and Y can do a work in 'y' days,

The number of days taken by both of them together is  $\frac{x*y}{x+y}$

- If  $M_1$  men work for  $H_1$  hours per day and worked for  $D_1$  days and completed  $W_1$  work, and if  $M_2$  men work for  $H_2$  hours per day and worked for  $D_2$  days and completed  $W_2$  work, then

$$\frac{M_1 H_1 D_1}{W_1} = \frac{M_2 H_2 D_2}{W_2}$$

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## Cracku Tip 13 – Time, Speed, Distance & Work

### ***Boats and Streams :***

If the speed of water is 'W' and speed of a boat in still water is 'B'

- Speed of the boat (downstream) is  $B+W$
- Speed of the boat (upstream) is  $B-W$

The direction along the stream is called **downstream**.

And, the direction against the stream is called **upstream**.

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## Cracku Tip 14 – Time, Speed, Distance & Work

### ***Boats and Streams :***

- If the speed of the boat downstream is  $x$  km/hr and the speed of the boat upstream is  $y$  km/hr, then

$$\text{Speed of boat in still water} = \frac{x+y}{2} \text{ km/hr}$$

$$\text{Rate of stream} = \frac{x-y}{2} \text{ km/hr}$$

- While converting the speed in m/s to km/hr, multiply it by 3.6 (18/5).  
 $1 \text{ m/s} = 3.6 \text{ km/h}$
- While converting km/hr into m/sec, we multiply by 5/18



## Cracku Tip 15 – Time, Speed, Distance & Work

### ***Pipes and Cisterns :***

Inlet Pipe : A pipe which is used to fill the tank is known as Inlet Pipe.

Outlet Pipe : A pipe which can empty the tank is known as Outlet Pipe.

- If a pipe can fill a tank in 'x' hours then the part filled per hour =  $1/x$
- If a pipe can empty a tank in 'y' hours, then the part emptied per hour =  $1/y$
- If a pipe A can fill a tank in 'x' hours and pipe can empty a tank in 'y' hours, If they are both active at the same time, then

$$\text{The part filled per hour} = \frac{1}{x} - \frac{1}{y} \text{ (If } y > x \text{ )}$$

$$\text{The part emptied per hour} = \frac{1}{y} - \frac{1}{x} \text{ (If } x > y \text{ )}$$

## Cracku Tip 16 – Time, Speed, Distance & Work

- Some of the questions may consume a lot of time. While solving, write down the equations as far as possible to avoid mistakes. The few extra seconds can help you avoid silly mistakes.
- Check if the units of distance, speed and time match up. So if you see yourself adding a unit of distance like m to a unit of speed m/s, you would realize you have missed a term.
- Choose to apply the concept of relative speed wherever possible as it can greatly reduce the complexity of the problem.
- Like speed and distance, in time and work while working with terms ensure that you convert all terms to consistent units like man-hours.

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