

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 .

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

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

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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