Time, Speed, Distance & Work

Tip 1

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

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

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

While converting the Speed in m/s to km/hr, multiply it by 3.6.
It is because 1 m/s = 3.6 km/hr

Tip 2

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

Tip 3

- Average speed = $\dfrac{\text{Total Distance travelled}}{\text{Total Time taken}}$

- 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,

  Total distance travelled = $S_1T_1 + S_2T_2$ km

  $$\text{Average speed} = \frac{S_1T_1 + S_2T_2}{T_1 + T_2} \text{ km/hr}$$

- If D_1 km is travelled at speed of S_1 km/hr, and D_2 km is travelled at speed of S_2 km/hr then,

  $$\text{Average Speed} = \frac{D_1 + D_2}{\frac{D_1}{S_1} + \frac{D_2}{S_2}} \text{ km/hr}$$

Tip 4

- 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

Tip 5

- 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

Tip 6

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 $d_1 = d_2 = d_3 = \ldots = d_n = d$, 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 $t_1 = t_2 = t_3 = \ldots = t_n = t$, then the average speed is the arithmetic mean of the speeds s_1, s_2, s_3 and so on till s_n.

Tip 6

Clocks

In a well functioning clock, both the hands meet after every 720 / 11 Mins.

It is because relative speed of minute hand with respect to hour hand = 11/2 degrees per minute.

Tip 7

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

Tip 8

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)

Tip 9

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.

Tip 10

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

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

Tip 11

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

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

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

Tip 12

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

$$\frac{M_1H_1D_1}{W_1} = \frac{M_2H_2D_2}{W_2}$$

Tip 13

BOATS & 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**.

Tip 14

BOATS & 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 m/s = 3.6 km/h

- While converting km/hr into m/sec, we multiply by 5/18

Tip 15

PIPES & 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

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

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