gradeup

Speed, Time and Distance Formulae

Sahi Prep Hai Toh Life Set Hai

www.gradeup.co

Speed, Time & Distance – Introduction & Concept

Speed Distance Time is one of the most popular and important topics in the Mathematics or Quants section of any competitive exam. The concept of Speed, Time and Distance is used extensively for questions relating to different topics such as motion in a straight line, circular motion, boats and streams, races, clocks, etc.

Relationship Between Speed, Time & Distance

1. **Speed = Distance/Time –** This tells us how slow or fast an object moves. It describes the distance travelled divided by the time taken to cover the distance.
2. Speed is directly Proportional to Distance and Inversely proportional to Time, Hence,
3. **Distance = Speed X Time**, and
4. **Time = Distance / Speed**, as the speed increases the time taken will decrease and vice versa.
5. While converting the speed m/s to km/hr, multiply it by 18/5.
6. While converting the speed km/hr to m/s, multiply it by 5/18.

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

Average speed:

- $\textbf{Average speed} = \frac{\textbf{Total Distance Travelled}}{\textbf{Total Time Taken}}$

- When the distance is constant: **Average speed = 2xy/(x + y)**; Where, x and y are the two speeds at which the same distance has been covered.

- When the time taken is constant: **Average speed = (x + y)/2**; Where, x and y are the two speeds at which we travelled for the same time.

- If the **distance covered is constant** (in each part of the journey, then the average speed is Harmonic Mean of the values).

- If the **time taken is constant** (in each part of the journey then the average speed is Arithmetic Mean of the values).

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

If two people are running on a circular track having perimeter P, with speeds a and b,

- The time for their first meeting = P / (a +b) (when they are running in opposite directions)
- The time for their first meeting = P / (|a - b|) (when they are running in the same direction)

Some important points:

- 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,

$$\mathbf{t = \sqrt{xy}}$$

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

- A and B started at a time towards each other. After crossing each other, they took T1 hours and T2 hours respectively to reach their

destinations. If they travel at constant speeds S1 and S2 respectively all over the journey, then

$$\frac{S1}{S2} = \sqrt{\frac{T2}{T1}}$$

Trains:

Two trains of length L1 and L2 travelling at a speed of S1 and S2 cross each other in a time

$= \frac{L1 + L2}{S1 + S2}$ (if they are going in opposite direction)

$= \frac{L1 + L2}{|S1 - S2|}$ (if they are going in same direction)

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.
- The direction against the stream is called upstream.
- If the speed of boat downstream is x km/hr and speed of the boat upstream is y km/hr, then

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

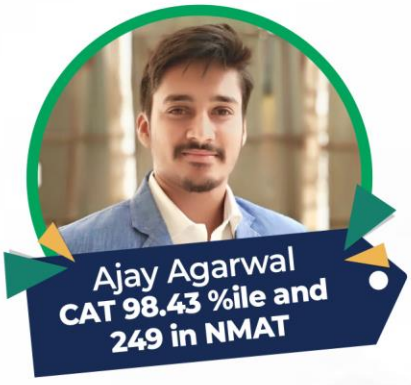
  $\textbf{Rate of stream} = \frac{x - y}{2}$ km/hr

gradeup

Gradeup Achievers' Corner

Bharath Reddy
CAT 99.92 %ile

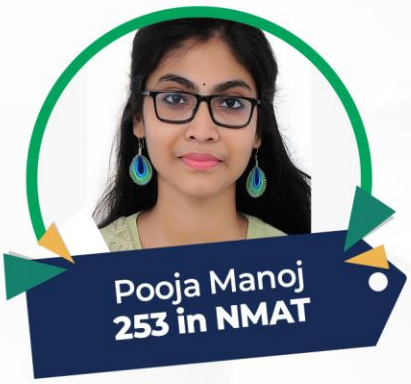
Lalit Singhal
CAT 99.1 %ile



Ajay Agarwal
CAT 98.43 %ile and 249 in NMAT

Simran Dhawan
CAT 98.3 %ile

Vijay Chitlangia
269 in NMAT



Pooja Manoj
253 in NMAT

Nishith Bhat
243 in NMAT

Nayanika Sharma
250 in NMAT