Speed, Time, and Distance - Concepts and Formulas

1. Speed Formula

Definition: Speed is the distance traveled per unit of time.

Formula: Speed = Distance / Time

Other forms:

Time = Distance / Speed

Distance = Speed x Time

Example: An object covers a distance of 60 km in 2 hours.

Speed = 60 / 2 = 30 km/hr.

2. Average Speed (Different Distances and Speeds)

When a man covers two distances D1 and D2 at speeds S1 and S2, his average speed is:

Average Speed = (D1 + D2) / (D1/S1 + D2/S2)

Example: A man covers 20 km at 10 km/hr and another 30 km at 20 km/hr.

Total distance = 20 + 30 = 50 km.

Total time = (20/10) + (30/20) = 3.5 hrs.

Average speed = 50 / 3.5 = 14.29 km/hr.

3. Average Speed (Same Distance, Different Speeds)

When a man travels from P to Q at S1 and returns at S2:

Average Speed = (2 x S1 x S2) / (S1 + S2)

Example: A man travels 60 km at 30 km/hr and returns at 20 km/hr.

Average speed = (2 x 30 x 20) / (30 + 20) = 24 km/hr.

4. Crossing Times (Two Men Traveling Towards Each Other)

If two men A and B travel from P and Q, and after crossing, A takes T1 time to reach Q and B takes T2 to reach P:

Ratio of Speeds = sqrt(T2 / T1)

Example: Two men meet, and A takes 9 hours to finish while B takes 16 hours.

Speed ratio = sqrt(16 / 9) = 4:3.

5. Change in Time Due to Speed Variation

If a man travels at (n/m) of his usual speed:

Change in time = ((m/n) - 1) x usual time

Example: A man's usual speed covers a distance in 5 hours. If his speed is reduced to 2/3:

Change in time = ((3/2) - 1) x 5 = 2.5 hrs.

6. Same Distance, Different Speeds and Times

When a man covers the same distance D at two different speeds S1 and S2 with respective times T1 and T2:

D = S1 x T1 = S2 x T2

Example: A man covers 100 km at 50 km/hr in 2 hours and at 25 km/hr in 4 hours. Both scenarios satisfy D = 100 km.

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7. Stoppage Time Per Hour

When a body moves at S1 km/hr without stoppage and S2 km/hr with stoppage:

Stoppage time per hour = ((S1 - S2) / S1) x 60 minutes

Example: A train moves at 60 km/hr without stoppage but averages 45 km/hr due to stoppages.

Stoppage time per hour = ((60 - 45) / 60) x 60 = 15 minutes.