2. Relative Speed

Time, Speed & Distance — Study Notes (Part 2 of 6)

What is Relative Speed?

Relative speed is the speed of one moving object as seen from another moving object — it removes the need for a fixed reference point. It is essential whenever BOTH objects are in motion.

Same direction: Relative Speed = S1 − S2
Opposite direction: Relative Speed = S1 + S2

Worked Example — Cat and Rat

A cat and a rat are 10 m apart. The rat moves at 2 m/sec and the cat at 3 m/sec.

Same Direction (rat runs away from the cat)

Every second, the gap closes by (3 − 2) = 1 m/sec.
Time to catch the rat = Distance / Relative Speed = 10 / (3−2) = 10 sec

Opposite Direction (rat runs toward the cat)

Relative speed = 3 + 2 = 5 m/sec.
Time to meet = 10 / 5 = 2 sec

Objects moving in the SAME direction → subtract speeds. Objects moving in OPPOSITE directions → add speeds. This single rule underlies trains, boats, races, and 'two people walking' problems alike.

More Worked Examples

Example 1 — Objects Stationary

You need to cover 120 km at an average speed of 40 km/hr. How long will it take?
Time = Distance / Speed = 120/40 = 3 hrs

Example 2 — Moving Toward Each Other (Opposite Direction)

Your speed = 40 km/hr, friend's speed = 20 km/hr, distance apart = 120 km. Both walk toward each other.
Relative Speed = 40 + 20 = 60 km/hr → Time = 120/60 = 2 hrs

Example 3 — Moving in the Same Direction

Same 40 km/hr and 20 km/hr, but now travelling in the same direction, 120 km apart, chasing each other.
Relative Speed = 40 − 20 = 20 km/hr → Time = 120/20 = 6 hrs

Practice Questions

1. Two persons X and Y walk in the same direction at 6 km/hr and 6.5 km/hr respectively. If Y is currently 7.5 km ahead of X, how long will it take X to catch up?

2. Train P leaves station A at 20 km/hr at 7:00 am. Train Q leaves station B (90 km away) toward A at 25 km/hr at 8:00 am, travelling in the opposite direction. At what time do they meet?

3. Two boats travel towards each other at 10 km/hr and 5 km/hr respectively. Find the distance between them exactly 1 minute before they collide.

4. Kamal fires two shots 10 min 30 sec apart. Bala, walking towards Kamal, hears the second shot only 10 minutes after the first. If sound travels at 330 m/sec, find Bala's walking speed.

✓ Answer Key

1. 15 hours
2. 10:00 am
3. 1/4 km (0.25 km)
4. 59.4 km/hr