Step by step guide_Relative Speeds of Objects Moving in the Same Direction

Pre-Class Preparation

- Gather materials: toy cars, strings, stopwatches, measuring tapes, recording sheets.
- Identify a suitable straight pathway (at least 10 meters long).
- Mark starting and finishing lines clearly with tape or chalk.
- Test the toy car to ensure it moves smoothly when pulled.
- Prepare group assignments (3-4 students per group).
- Write formulas on the board: Speed = Distance / Time, Relative Speed = Faster Speed - Slower Speed.

Phase 1: Problem-Solving and Discovery (15 minutes)

[0-2 minutes] Introduction

[SAY] "Good morning, class! Today we are going to learn about relative speed. Has anyone ever noticed how when you're in a car on the highway, some cars seem to pass you slowly while others zoom by quickly? That's because of relative speed!"

[SAY] "We will conduct an experiment with a toy car and a walking student to discover how relative speed works."

[2-3 minutes] Group Formation and Material Distribution

[DO] Divide students into groups of 3-4.

[DO] Distribute materials: toy car, string, stopwatch, measuring tape, recording sheet.

[SAY] "Each group will have a toy car, string, stopwatch, and measuring tape. One person will walk, one will pull the toy car, and the others will observe and record times."

[3-5 minutes] Explain the Activity

[SAY] "Here are the steps:"

[WRITE on board] Steps 1-12 from the anchor activity.

[SAY] "Both the student and the toy car will start at the same time and move in the same direction. We want to see who reaches the finish line first and calculate their speeds."

[5-12 minutes] Conduct the Experiment

[DO] Circulate among groups, ensuring they follow the steps correctly.

[DO] Assist with measurements and timing.

[ASK] "What did you notice? Who moved faster?"

[ASK] "How can we calculate the speed of each participant?"

[12-15 minutes] Group Sharing and Discussion

[SAY] "Let's hear from each group. What were your results?"

[DO] Record sample results on the board.

[ASK] "If the toy car is moving faster than the student, how can we describe how much faster?"

[LISTEN] to student responses and guide them toward the concept of relative speed.

Phase 2: Structured Instruction (10 minutes)

[15-17 minutes] Introduce Relative Speed Concept

[SAY] "Excellent observations! What you discovered is called relative speed. Relative speed tells us how fast one object is moving compared to another object."

[WRITE on board] "Relative Speed = Speed of Faster Object - Speed of Slower Object"

[SAY] "When two objects are moving in the same direction, we subtract the slower speed from the faster speed to get the relative speed."

[17-20 minutes] Work Through a Sample Calculation

[SAY] "Let's use one group's data as an example."

[WRITE on board] Example: Student took 10 seconds to cover 10 meters. Toy car took 5 seconds to cover 10 meters.

[SAY] "First, we calculate individual speeds:"

[WRITE] "Speed of student = 10m / 10s = 1 m/s"

[WRITE] "Speed of toy car = 10m / 5s = 2 m/s"

[SAY] "Now, the relative speed:"

[WRITE] "Relative speed = 2 m/s - 1 m/s = 1 m/s"

[SAY] "This means the toy car is moving 1 meter per second faster than the student."

[20-23 minutes] Unit Conversion

[SAY] "Sometimes speeds are given in km/h, but distances are in meters. We need to convert km/h to m/s."

[WRITE on board] "To convert km/h to m/s, multiply by 1000/3600 (or divide by 3.6)"

[SAY] "For example, 36 km/h = 36 × (1000/3600) = 10 m/s"

[23-25 minutes] Time to Overtake Formula

[SAY] "If one object starts ahead, we can calculate how long it takes for the faster object to overtake."

[WRITE on board] "Time = Distance / Relative Speed"

Phase 3: Practice and Application (10 minutes)

[25-27 minutes] Worked Example 2.10.8

[SAY] "Let's work through Example 2.10.8 from your textbook together."

[READ] "A cyclist is riding at 12 km/h, and a motorcycle is moving at 20 km/h on the same road in the same direction. If the cyclist starts 100 meters ahead of the motorcycle, how long will it take for the motorcycle to overtake the cyclist?"

[ASK] "What is the first step?"

[LISTEN] to responses.

[WRITE on board] "Step 1: Find relative speed = 20 km/h - 12 km/h = 8 km/h"

[WRITE] "Step 2: Convert to m/s = 8 × (1000/3600) = 2.22 m/s"

[WRITE] "Step 3: Time = 100m / 2.22 m/s ≈ 45 seconds"

[27-30 minutes] Worked Example 2.10.9

[SAY] "Now let's try Example 2.10.9."

[DO] Work through the car and truck problem step by step, inviting student participation.

[30-35 minutes] Independent Practice

[SAY] "Now it's your turn to practice. Work on Exercise 1 from your textbook."

[DO] Circulate and provide assistance as needed.

[DO] Select 2-3 students to share their solutions on the board.

Phase 4: Assessment (5 minutes)

[35-38 minutes] Exit Ticket

[SAY] "Before we end today's lesson, please complete the exit ticket individually. This will help me understand what you've learned."

[DO] Distribute exit ticket with 4 questions.

[SAY] "You have 3 minutes to complete this. Show all your work."

[38-40 minutes] Closure

[SAY] "Excellent work today! We discovered that relative speed helps us understand how fast one object is moving compared to another. When objects move in the same direction, we subtract their speeds. Tomorrow, we will explore what happens when objects move in different directions."

[DO] Collect exit tickets.

[SAY] "For homework, complete Exercises 2-5 from your textbook. See you tomorrow!"

Teaching Tips

- Emphasize the importance of consistent units (all km/h or all m/s).
- Use real-world examples: cars on a highway, runners in a race, trains on parallel tracks.
- Address common misconception: Students may add speeds instead of subtracting when objects move in the same direction.
- Visual aids help: Draw diagrams showing two objects moving in the same direction with arrows indicating speeds.
- Connect to prior knowledge: Review speed = distance / time before introducing relative speed.
- Encourage students to check if their answers make sense (e.g., time should be positive).

Common Student Errors to Watch For

- Adding speeds instead of subtracting when objects move in the same direction.
- Forgetting to convert units (mixing km/h and m/s).
- Using the wrong formula (confusing relative speed with average speed).
- Dividing distance by speed instead of dividing distance by relative speed.
- Not understanding that the faster object will eventually overtake the slower one.