Step by step guide_Relative Speeds of Objects Moving in Different Directions

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 points at opposite ends 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 (Same Direction) = Faster - Slower, Relative Speed (Different Directions) = Speed 1 + Speed 2.

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

[0-2 minutes] Introduction

[SAY] "Good morning, class! Yesterday we learned about relative speed when objects move in the same direction. Today, we will explore what happens when objects move toward each other."

[SAY] "Have you ever noticed when two cars are driving toward each other on opposite sides of the road, they seem to pass very quickly? That's because their relative speed is much higher!"

[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. This time, the student and toy car will start at opposite ends and move toward each other."

[3-5 minutes] Explain the Activity

[SAY] "Here are the steps:"

[WRITE on board] Steps 1-13 from the anchor activity.

[SAY] "The key difference from yesterday is that the student and toy car start at opposite ends and move toward each other. We want to see how quickly they meet."

[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? Did they meet faster or slower than when they moved in the same direction?"

[ASK] "How can we calculate the relative speed this time?"

[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 at 2 m/s and the student is walking at 1 m/s toward each other, what is their relative speed?"

[LISTEN] to student responses and guide them toward adding the speeds.

Phase 2: Structured Instruction (10 minutes)

[15-17 minutes] Introduce Relative Speed for Different Directions

[SAY] "Excellent observations! When two objects move toward each other, we add their speeds to get the relative speed."

[WRITE on board] "Relative Speed (Different Directions) = Speed of Object 1 + Speed of Object 2"

[SAY] "Why do we add? Because both objects are closing the gap between them. The combined effect is captured by adding their speeds."

[17-20 minutes] Compare Same vs Different Directions

[SAY] "Let's compare what we learned:"

[WRITE on board] "Same direction: Relative Speed = Faster Speed - Slower Speed"

[WRITE on board] "Different directions: Relative Speed = Speed 1 + Speed 2"

[ASK] "Which scenario results in a higher relative speed?"

[LISTEN] to responses.

[SAY] "Correct! Different directions result in higher relative speed because we add the speeds."

[20-23 minutes] Time to Meet Formula

[SAY] "If two objects are moving toward each other, we can calculate how long it takes for them to meet."

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

[23-25 minutes] Work Through a Sample Calculation

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

[WRITE on board] Example: Student speed = 1 m/s, Toy car speed = 2 m/s, Distance = 10 meters.

[SAY] "Relative speed = 1 m/s + 2 m/s = 3 m/s"

[SAY] "Time to meet = 10m / 3 m/s ≈ 3.33 seconds"

Phase 3: Practice and Application (10 minutes)

[25-27 minutes] Worked Example 2.10.12

[SAY] "Let's work through Example 2.10.12 from your textbook together."

[READ] "A train left town X at 10:00 AM and traveled towards town Y at a speed of 90 km/h. A second train left town Y at 11:00 AM and traveled towards town X at 120 km/h. The distance between town X and town Y is 360 km. At what time will the two trains meet? How far from town X will they meet?"

[ASK] "What is the first step?"

[LISTEN] to responses.

[WRITE on board] "Step 1: First train traveled 1 hour before second train started = 90 km"

[WRITE] "Step 2: Remaining distance = 360 km - 90 km = 270 km"

[WRITE] "Step 3: Relative speed = 90 km/h + 120 km/h = 210 km/h"

[WRITE] "Step 4: Time to meet = 270 km / 210 km/h = 1.29 hours ≈ 1 hour 17 minutes"

[WRITE] "Step 5: Meeting time = 11:00 AM + 1:17 = 12:17 PM"

[WRITE] "Step 6: Distance from town X = 90 km + (90 km/h × 1.29 hours) = 206 km"

[27-30 minutes] Worked Example 2.10.13

[SAY] "Now let's try Example 2.10.13."

[DO] Work through the two cyclists 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 3 questions.

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

[38-40 minutes] Closure

[SAY] "Excellent work today! We discovered that when objects move toward each other, we add their speeds to find relative speed. This is different from same direction, where we subtract. Tomorrow, we will explore acceleration."

[DO] Collect exit tickets.

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

Teaching Tips
● Emphasize the difference between same direction (subtract) and different directions (add).
● Use real-world examples: trains approaching each other, cars on opposite sides of the road.
● Address common misconception: Students may subtract speeds when objects move toward each other.
● Visual aids help: Draw diagrams showing two objects moving toward each other with arrows indicating speeds.
● Create a comparison chart on the board showing both scenarios side by side.
● Encourage students to check if their answers make sense (e.g., relative speed should be higher when moving toward each other).

Common Student Errors to Watch For
● Subtracting speeds instead of adding when objects move toward each other.
● Forgetting to account for different starting times in problems.
● Using the wrong formula (confusing same direction with different directions).
● Not converting units consistently (mixing km/h and m/s).
● Calculating distance incorrectly when objects start at different times.