Robot Motion Maps

Predict three motion graphs from one trip

PHY.1.7 "Design different scenarios, and predict graph shapes for distance/time, velocity/time, and acceleration/time graphs."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the sentence that tells what a distance-time graph's slope means, circle the sentence that tells what a velocity-time graph's slope means, and number the four time intervals in the table. Use those clues to predict the robot's graphs.

A Robot in the Hallway

1. A small delivery robot rolls forward along a straight hallway. Its trip begins at the start line, and a sensor records speed at the boundaries of four equal time intervals. The table gives those readings. Assume speed changes at a constant rate within each interval and joins smoothly from one interval to the next.

ROBOT SPEED READINGS

Time interval (s)	Speed at start (m/s)	Speed at end (m/s)
0 to 2	0	4
2 to 4	4	4
4 to 6	4	0
6 to 8	0	0

2. On a distance-time graph, time runs across the bottom and total distance traveled runs upward. The slope tells you speed: a steeper line means more distance added each second. When speed changes steadily, this graph bends rather than forming a straight segment. Since the robot never reverses, its total distance cannot decrease.

3. A velocity-time graph places signed velocity on the vertical axis. Here the robot always faces and moves forward, so its velocity equals its speed. The slope of that graph gives acceleration; a horizontal velocity segment has zero acceleration. On an acceleration-time graph, a constant acceleration appears as a horizontal segment, above or below zero according to its sign.

2 ANSWER WITH EVIDENCE

Use the passage

1. From 0 to 2 s, what shape would the robot's distance-time graph have? Explain using the speed readings.

2. From 2 to 4 s, what shape would the velocity-time graph have, and where would it sit relative to zero?

3. From 4 to 6 s, describe the acceleration-time graph's shape, position relative to zero, and value.

4. How does the distance-time graph from 6 to 8 s compare with its shape from 4 to 6 s?

3 YOUR TURN

Your own words

Invent a different three-stage trip along a straight path with no reversal. Give each stage a time span and starting and ending speed, then describe the distance-time, velocity-time, and acceleration-time graph shapes in the table.

STAGE, TIME, AND SPEEDS	DISTANCE-TIME SHAPE	VELOCITY-TIME SHAPE	ACCELERATION-TIME SHAPE

Robot Motion Maps

PART 1 · READ AND MARK

Underline the sentence that tells what a distance-time graph's slope means, circle the sentence that tells what a velocity-time graph's slope means, and number the four time intervals in the table. Use those clues to predict the robot's graphs. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	From 0 to 2 s, what shape would the robot's distance-time graph have? Explain using the speed readings.	**It rises and curves upward, growing steeper as speed increases from 0 to 4 m/s.**
2	From 2 to 4 s, what shape would the velocity-time graph have, and where would it sit relative to zero?	**It is a horizontal segment at 4 m/s, above zero.**
3	From 4 to 6 s, describe the acceleration-time graph's shape, position relative to zero, and value.	**It is a horizontal segment below zero at −2 m/s^2, since velocity changes by −4 m/s in 2 s.**
4	How does the distance-time graph from 6 to 8 s compare with its shape from 4 to 6 s?	**From 4 to 6 s, it rises but becomes less steep. From 6 to 8 s, it is horizontal because the robot has stopped.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

STAGE, TIME, AND SPEEDS	DISTANCE-TIME SHAPE	VELOCITY-TIME SHAPE	ACCELERATION-TIME SHAPE
0 to 3 s; 1 to 3 m/s	Rises, curving upward	Straight rise above zero	Horizontal above zero
3 to 5 s; 3 to 3 m/s	Straight rise	Horizontal above zero	Horizontal at zero
5 to 7 s; 3 to 1 m/s	Rises, curving downward	Straight fall, staying above zero	Horizontal below zero

Accept equivalent descriptions of increasing or decreasing steepness. In the open task, speeds must stay nonnegative and match at stage boundaries; each graph shape must agree with the stated speed change.