Cart in Motion

Read position data to build and interpret motion graphs.

P.1.a "Analyze data to create and interpret graphs of position, velocity, and acceleration versus time for one-dimensional motion."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Number the table rows in the order you would plot them, then underline the sentences that explain how to find the slope of each kind of graph.

A Cart on the Track

1. A small cart rolls past tape marks on a straight laboratory track. A motion sensor records its position once per second, measured from the starting mark. The table reports the cart's readings. Before graphing, keep time on the horizontal axis and position on the vertical axis. Each row becomes one plotted point.

CART POSITION READINGS

Time (s)	Position (m)
0	0
1	1
2	4
3	9
4	16

2. The shape of a position-time graph carries information that a list of positions can hide. Between readings, divide the change in position by the elapsed time to find average velocity for that interval. A steeper upward segment indicates a larger positive velocity. Plot these interval velocities at the middle times of their intervals.

3. To examine how motion changes, place interval velocities on a velocity-time graph. Compare velocities at consecutive middle times: their difference divided by the time between them estimates acceleration. If the velocity points line up, their graph has a steady slope. The cart's numbers let you test that idea rather than guess from its path.

2 ANSWER WITH EVIDENCE

Use the passage

1. List the five points you would plot on the cart's position-time graph. Write each point as (time, position).

2. Calculate the cart's average velocity during each one-second interval.

3. List the points for a graph of interval velocity versus middle time. What shape would the plotted points make?

4. Use the first and last points of that velocity-time graph to estimate the cart's acceleration. Show the calculation.

3 YOUR TURN

Your own words

A different cart moves at 3 m/s at 0 s and gains 1 m/s every second through 4 s. On the grid, graph its velocity at each whole second, connect the points, and write one sentence stating its acceleration.



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PART 1 · READ AND MARK

Number the table rows in the order you would plot them, then underline the sentences that explain how to find the slope of each kind of graph. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	List the five points you would plot on the cart's position-time graph. Write each point as (time, position).	**(0, 0), (1, 1), (2, 4), (3, 9), (4, 16).**
2	Calculate the cart's average velocity during each one-second interval.	**From 0 to 1 s: 1 m/s; 1 to 2 s: 3 m/s; 2 to 3 s: 5 m/s; 3 to 4 s: 7 m/s.**
3	List the points for a graph of interval velocity versus middle time. What shape would the plotted points make?	**(0.5 s, 1 m/s), (1.5 s, 3 m/s), (2.5 s, 5 m/s), and (3.5 s, 7 m/s). They form a rising straight line.**
4	Use the first and last points of that velocity-time graph to estimate the cart's acceleration. Show the calculation.	**(7 m/s − 1 m/s) ÷ (3.5 s − 0.5 s) = 2 m/s².**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Plot (0 s, 3 m/s), (1 s, 4 m/s), (2 s, 5 m/s), (3 s, 6 m/s), and (4 s, 7 m/s), with time on the horizontal axis and velocity on the vertical axis; connect the points with a straight line. The cart's acceleration is 1 m/s².

Accept equivalent coordinate notation and calculations with correct units. For the open task, the velocity-time graph must rise by 1 m/s each second.