LESSON MAKER PRO

Motion in Numbers

Find changes in position and velocity from data.

HIGH SCHOOL · PHY.1.6

PHY.1.6 "Design and mathematically/graphically analyze quantitative data to explore displacement, velocity, and acceleration of various objects. Use probe systems, video analysis, graphical analysis software, digital spreadsheets..."

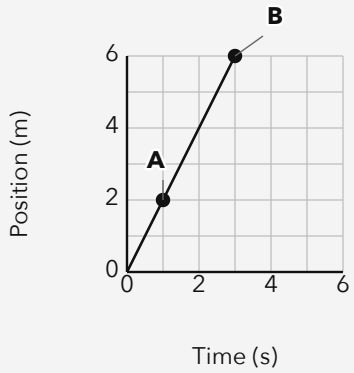
NAME _____ DATE _____

FIND THE RATE

Displacement is final position minus initial position. Average velocity is displacement divided by elapsed time. Acceleration is change in velocity divided by elapsed time. Keep the sign of each change.

WORKED EXAMPLE

Find the average velocity from A to B.



1. Displacement: 6 - 2 = 4 m.
2. Elapsed time: 3 - 1 = 2 s.
3. Average velocity: 4 / 2 = 2 m/s.

Answer: 2 m/s

PRACTICE 4 problems

1 An object's position changes from 12 m at 4 s to 28 m at 8 s. Find its displacement.

ANSWER _____

2 An object's position changes from 24 m at 4 s to 8 m at 12 s. Find its average velocity.

ANSWER _____

3 An object's velocity changes from 4 m/s at 4 s to 20 m/s at 8 s. Find its acceleration.

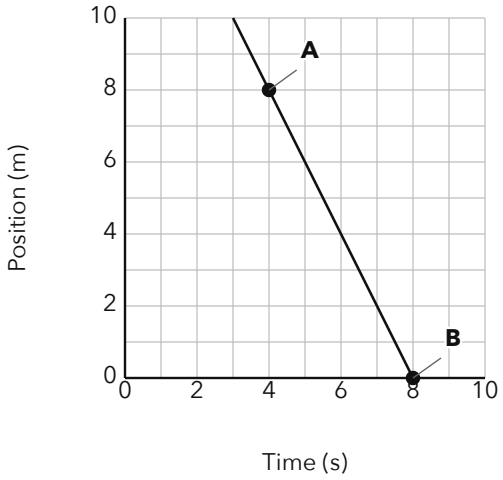
ANSWER _____

4 An object's velocity changes from 28 m/s at 4 s to 12 m/s at 8 s. Find its acceleration.

ANSWER _____

APPLY IT Show your work

1 A bike-share app plots a rider's position. From A to B, find the rider's displacement and average velocity.



ANSWER _____

2 Video analysis gives these velocities for a skateboarder. Find the acceleration between the two times.

SKATEBOARD VIDEO DATA

Time (s)	Velocity (m/s)
4	8
10	26

ANSWER _____

CHALLENGE One step up

A scooter's velocity is 8 m/s at 4 s, 24 m/s at 8 s, and 8 m/s at 12 s. Find the acceleration from 4 to 8 s and from 8 to 12 s. In one sentence, explain why the acceleration calculated from 4 to 12 s misses part of the motion.

WORK SPACE AND ANSWER

ANSWER KEY

Motion in Numbers

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	An object's position changes from 12 m at 4 s to 28 m at 8 s. Find its displacement.	**+16 m**
2	An object's position changes from 24 m at 4 s to 8 m at 12 s. Find its average velocity.	**-2 m/s**
3	An object's velocity changes from 4 m/s at 4 s to 20 m/s at 8 s. Find its acceleration.	**+4 m/s^2**
4	An object's velocity changes from 28 m/s at 4 s to 12 m/s at 8 s. Find its acceleration.	**-4 m/s^2**

PART 2 · APPLY IT

1. **Displacement: -8 m; average velocity: -2 m/s.** Displacement is 0 - 8 = -8 m. Elapsed time is 8 - 4 = 4 s, so average velocity is -8 / 4 = -2 m/s.
2. **+3 m/s^2** Velocity changes by 26 - 8 = 18 m/s over 10 - 4 = 6 s. Acceleration is 18 / 6 = 3 m/s^2.

CHALLENGE

4 to 8 s: +4 m/s^2; 8 to 12 s: -4 m/s^2. The acceleration from 4 to 12 s is 0 m/s^2, which hides the increase and decrease in velocity.

Accept answers without a plus sign for positive values. Negative values show a change in the negative direction of the chosen axis.