

Motion Clues

Use distance, displacement, and direction to describe linear motion.

7.7.B “distinguish between speed and velocity in linear motion in terms of distance, displacement, and direction;”

NAME _____

DATE _____

1 READ AND MARK _____ Read it twice

YOUR JOB Underline each use of displacement or velocity that includes a direction, and circle each statement that says distance or speed has no direction.

A Trip on One Line

- ① Motion along a straight hallway, track, or road is linear motion. To describe a trip, first identify the starting point and ending point. Distance is the total length of the path traveled, without a direction. Displacement compares the ending point with the starting point. It tells how far and in which direction the object's position changed. A museum robot that rolls 6 meters east from its charging dock has traveled a distance of 6 meters and has a displacement of 6 meters east.
- ② Speed describes how quickly an object covers distance. Average speed equals total distance divided by total time, and it has no direction. Velocity also describes motion over time, but it uses displacement instead of distance and includes direction. Average velocity equals displacement divided by total time. If a cyclist rides 10 meters south in 2 seconds without turning, the average speed is 5 meters per second. The average velocity is also 5 meters per second south, because the cyclist's displacement is south.
- ③ Distance and displacement can be different even when an object stays on one straight line. Suppose a skater starts at a bench, travels 4 meters west, then travels 4 meters east back to the bench. The total distance is 8 meters. The displacement is zero because the skater finishes where the trip began. During a return trip like this, average speed can be greater than zero, while average velocity is zero. A direction is not attached to zero displacement or zero velocity.

2 ANSWER WITH EVIDENCE _____ Use the passage

- 1** A cart moves 15 meters west in 3 seconds without turning. What are its average speed and average velocity?

- 2** A walker goes 9 meters east, then 9 meters west, in 6 seconds. What are the walker's total distance and displacement?

- 3** For the walker in Question 2, what are the average speed and average velocity?

- 4** Two toy trains each move 20 meters in 4 seconds on a straight track. One moves north, and the other moves south. How are their average speeds and average velocities alike or different?

3 YOUR TURN _____ Your own words

Write a two-sentence linear-motion story in which an object changes direction once and does not end where it started. In the second sentence, give the total distance, displacement with direction, average speed, and average velocity with direction.

PART 1 • READ AND MARK

Underline each use of displacement or velocity that includes a direction, and circle each statement that says distance or speed has no direction. Accept any marking that follows this job and points at the right text.

PART 2 • ANSWERS

#	QUESTION	ANSWER
1	A cart moves 15 meters west in 3 seconds without turning. What are its average speed and average velocity?	Average speed: 5 meters per second. Average velocity: 5 meters per second west.
2	A walker goes 9 meters east, then 9 meters west, in 6 seconds. What are the walker's total distance and displacement?	Total distance: 18 meters. Displacement: 0 meters.
3	For the walker in Question 2, what are the average speed and average velocity?	Average speed: 3 meters per second. Average velocity: 0 meters per second.
4	Two toy trains each move 20 meters in 4 seconds on a straight track. One moves north, and the other moves south. How are their average speeds and average velocities alike or different?	Both trains have an average speed of 5 meters per second. Their average velocities have the same magnitude, 5 meters per second, but opposite directions: north and south.

PART 3 • YOUR TURN (SAMPLE ANSWER)

A scooter travels 9 meters east, then 3 meters west, in 4 seconds. Its total distance is 12 meters, its displacement is 6 meters east, its average speed is 3 meters per second, and its average velocity is 1.5 meters per second east.

Accept equivalent units and clear calculations. The student's story must describe motion on one line, include one change of direction, and correctly distinguish total distance from displacement and speed from velocity.