

4. Position-Time Graph

- A best-fit line is a smooth curve or straight line that most closely fits the general shape outlined by the plotted data points.
- The slope of the best-fit line on a position-time graph is the object's average velocity.
- A negative slope and a positive slope on a position-time graph indicate that the object is moving in opposite directions.
- A zero slope on a position-time graph indicates that the object is not moving.

5. Calculating Average Velocity

- The relationship between average velocity, displacement, and time interval is given by the

$$\text{equation } \vec{v}_{av} = \frac{\Delta \vec{d}}{\Delta t}.$$

- The displacement can be calculated by:

$$\Delta \vec{d} = (\vec{v}_{av})(\Delta t)$$

- The time interval can be calculated by:

$$\Delta t = \frac{\Delta \vec{d}}{\vec{v}_{av}}.$$

- A velocity in km/h can be converted to m/s by multiplying by 1000 and dividing by 3600.

10. (a) 2

(b) 3

(c) 1

11. The average velocity can be obtained by finding the slope of the best-fit line on a position-time graph.

12. 30 km/h is a speed zone sign since the quantity does not indicate a direction.

13. (a) The object is moving forward.

(b) The object is moving backward.

14. The mathematical relationship between average velocity, displacement, and time interval is

$$\text{given by } \vec{v}_{av} = \frac{\Delta \vec{d}}{\Delta t}.$$

15.

Concept	Symbol	Unit	Scalar or Vector?
Time interval	Δt	s	Scalar
Distance	d	m	Scalar
Displacement	$\vec{d}$	m	Vector
Speed	v	m/s	Scalar
Velocity	$\vec{v}$	m/s	Vector

16. Another common unit used for average speed or average velocity is km/h.

17. To convert 85 km/h to m/s, multiply by 1000 and divide by 3600.

$$85 \text{ km/h} = 24 \text{ m/s}$$

CHAPTER REVIEW ANSWERS

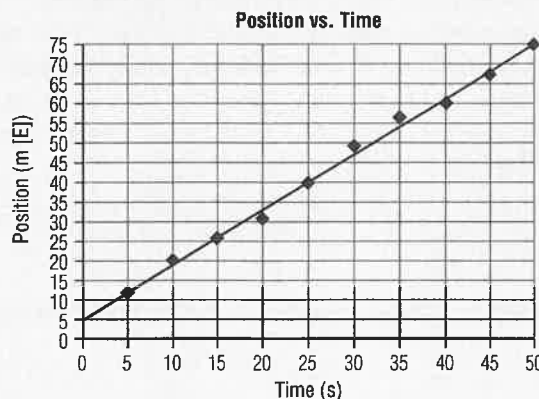
Checking Concepts

1. A vector quantity has both a magnitude and a direction, whereas a scalar quantity has a magnitude only.
2. (a) Students' answers may vary but could include time interval or distance.
(b) Students' answers may vary but could include displacement or velocity.
3. The position would be more useful since position includes not only the distance the treasure is from the starting point but also the direction.
4. It is possible to run 1.0 km and have zero displacement if the path taken by your run brings you back to where the run began.
5. Time interval is determined by subtracting the initial time from the final time.
6. The Greek letter delta (Δ) symbolizes a change in a quantity.
7. A positive sign (+) would be used to describe the opposite direction.
8. The ball's displacement during the next 2 s time interval would be 6 m [E].
9. Uniform motion is represented by a straight line on a position-time graph.

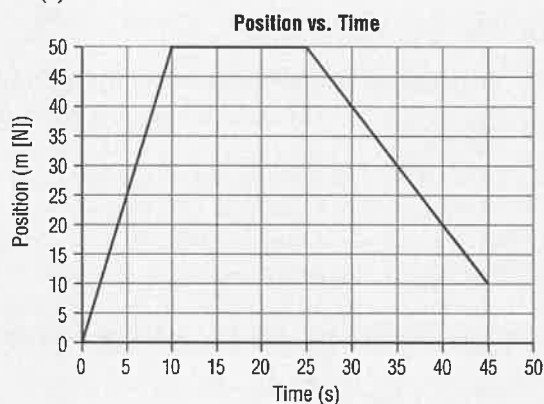
Understanding Key Ideas

18. (a) Students' answers may vary but should be approximately 1.4 m/s [E].

(b) Students' answers may vary but should be approximately 5 m [E].



19. (a)



(b) The bike's displacement after 45 s is 10 m [N].

20. Her average velocity is 8.9 m/s [S].

21. The sprinter's average velocity is 8.5 m/s [forward].

22. The boat's displacement would be 250 m [S].

23. The height above the ground would be 230 m.

Apply Your Understanding

24. (a) No, it was not likely that Terry Fox's average velocity was the same every day. This is evident in the fact that he ran different distances each day. Also, the weather and road conditions were different each day.
- (b) On average, Terry Fox ran 38 km each day.
- (c) Running at an average forward velocity of 10 km/h, it would take 540 hours to run the distance that Terry Fox ran.

Pause and Reflect Answer

Many motions are very close to being uniform. This is especially true when the time interval is kept very small. Assuming that the motion is uniform simplifies the analysis of the object's motion. This would allow scientists to predict the location of the object at any future time.