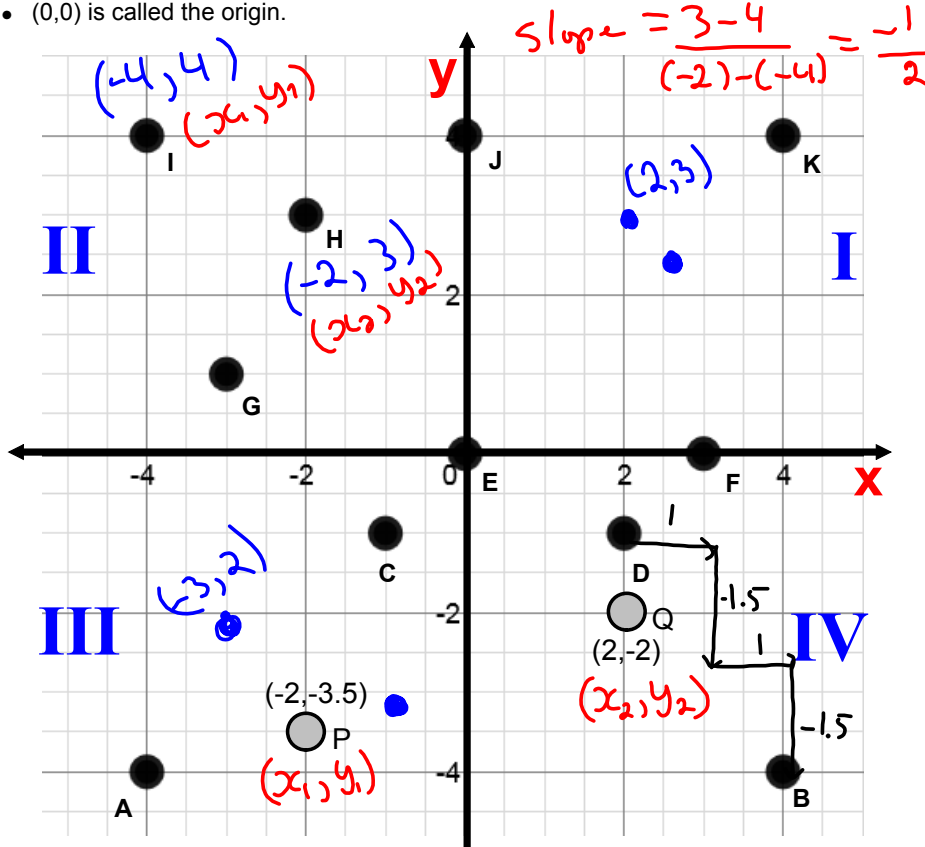


Before we continue with our motion analysis unit, we need to learn/review a math concept called slope.

Slope is a measure of how range values change with the domain values (i.e. how the y-values get larger or smaller as the x-values get larger).

Review of Plotting Points and Graphs

- Used to visualize mathematical relationships.
- 2 axes divide grid into four quadrants: I, II, III, IV
- Coordinates are written as (x,y) and called an order pair or points.
- (0,0) is called the origin.



Slope = Rise/Run

Rise = change in y - values

Run = change in x - values

$$slope = \frac{y_2 - y_1}{x_2 - x_1}$$

Example: Calculate the slope between P & Q.

$$P \rightarrow (x_1, y_1) = (-2, -3.5) \quad Q \rightarrow (x_2, y_2) = (2, -2)$$

$$Slope = \frac{y_2 - y_1}{x_2 - x_1} = \frac{(-2) - (-3.5)}{(2) - (-2)} = \frac{1.5}{4} = 0.38$$

Example: Calculate the slope between D & B.

← Point #1
 D → (2, -1)
 B → (4, -4)
 ↑ point #2

$$Slope = \frac{y_2 - y_1}{x_2 - x_1} = \frac{(-4) - (-1)}{(4) - (2)} = \frac{-3}{2} = -1.5$$

1. What points have an y -value of -2 ? _____
2. What points have an x -value of 0 ? _____
3. Place a dot at $(2,3)$ and $(-3,-2)$.
4. What points form the corners of a perfect square? _____
5. Going from G to H: _____ up and _____ right.
6. Going from H to J: _____ up and _____ right.
7. Going from E to D: _____ down and _____ right.
8. Going from I to C: _____ down and _____ right.
9. Calculate the slope for questions 5 - 8. (slope = rise/run)
10. Place a dot 3 units to the right and 1 unit up from point A.
11. Place a dot 2.5 units to the right and 1.5 units down from point J.
12. Calculate the slope between points: I & G, A & D, C & D, I & F, A & J, and H & B.

$$I \rightarrow G \Rightarrow \frac{\text{rise}}{\text{run}} = \frac{-3}{1} = \boxed{-3}$$

$$A \rightarrow D: \frac{3}{12} = \frac{1}{4} = \boxed{0.25}$$

$$C \rightarrow D: \frac{0}{3} = \boxed{0}$$

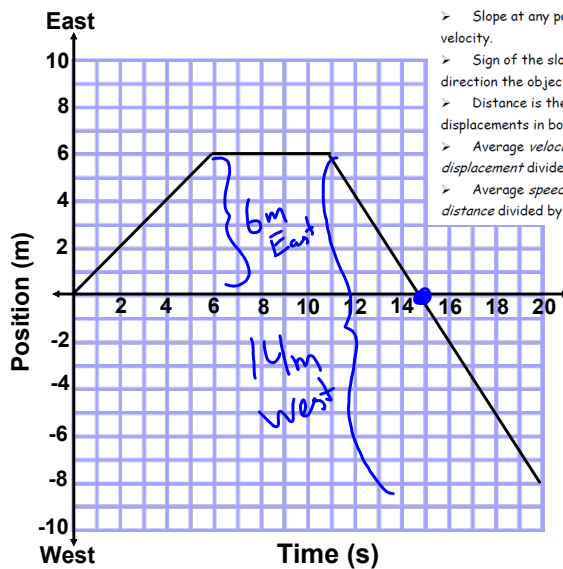
$$I \rightarrow F: \frac{-4}{7} = \boxed{-0.6}$$

$$A \rightarrow J: \frac{8}{4} = \boxed{2}$$

$$H \rightarrow B: \frac{-7}{6} = \boxed{-1.2}$$



Analyzing Position - Time Graphs



- > Slope at any point is the instantaneous velocity.
- > Sign of the slope indicates the direction the object is travelling.
- > Distance is the sum of the displacements in both directions.
- > Average velocity is the object's displacement divided by the time.
- > Average speed is the object's distance divided by the time.

Examples

1. What was the object's position at the 4 second mark? 10 s mark? 18s mark?

$$2s \rightarrow 2m [E] ; 10s \rightarrow 6m [E] ; 18s \rightarrow 5m [W] \rightarrow -5m [E]$$

2. Calculate the distance traveled during the first 14 seconds.

$$\text{dist East} + \text{dist West} = 6m [E] + 5m [W] = 11m$$

3. Calculate the average speed during the first 14 seconds.

$$v_{sp} = \frac{d}{t} = \frac{11m}{14s} = 0.78 m/s$$

4. Calculate the average velocity during the first 14 seconds.

$$\vec{v}_{avg} = \frac{\vec{d}}{t} = \frac{\text{position}}{\text{time}} = \frac{1m}{14s} = 0.07 m/s$$

5. Calculate the instantaneous velocity at the 16 second mark.

$$v = \frac{\text{rise}}{\text{run}} (\text{slope}) = \frac{-6m}{4s} = -1.5 m/s [E]$$

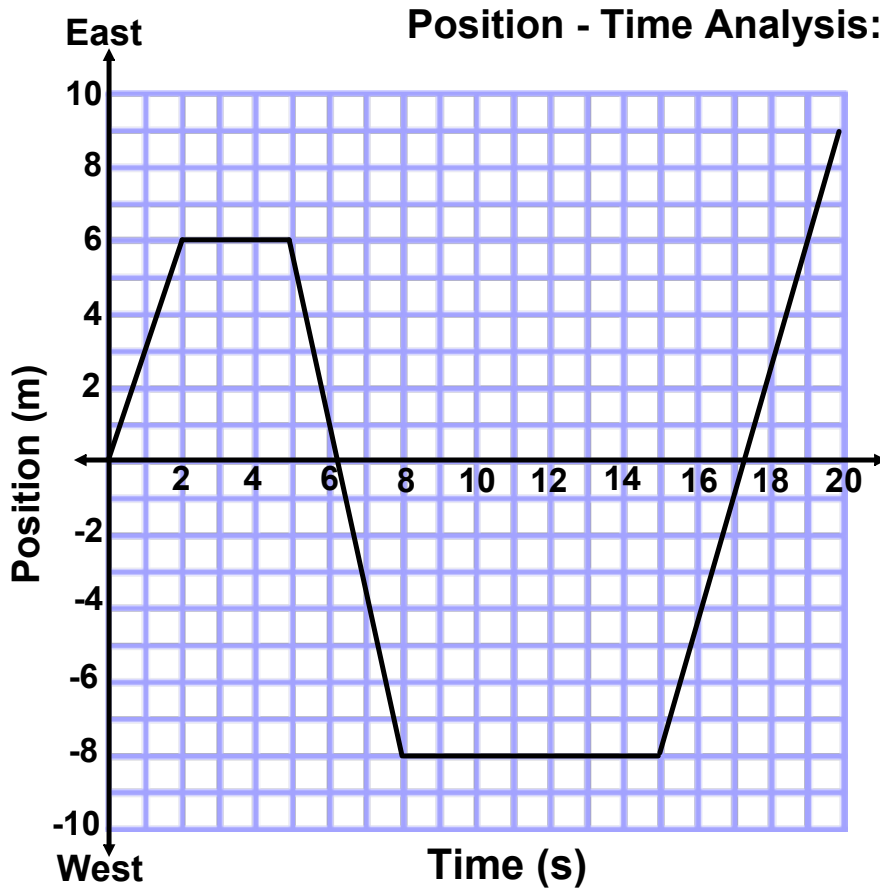
6. Calculate the object's total distance traveled and final position.

$$\vec{d} = \text{position} = -8m \quad d = 6m [E] + 14m [W] = 20m$$

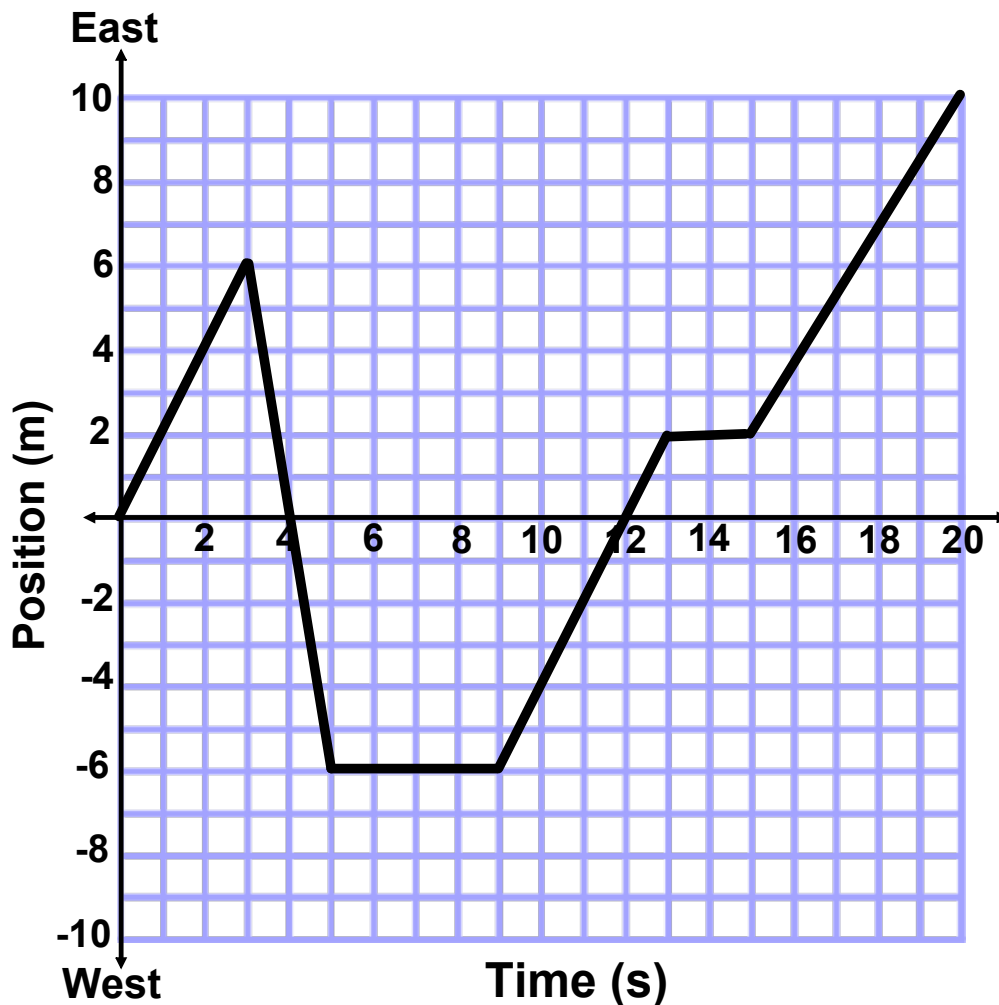
7. Calculate the object's average speed and velocity for the full 20 seconds.

$$v_{sp} = \frac{d}{t} = \frac{20m}{20s} = 1.0 m/s$$

$$\vec{v}_{avg} = \frac{\vec{d}}{t} = \frac{-8m}{20s} = -0.4 m/s$$

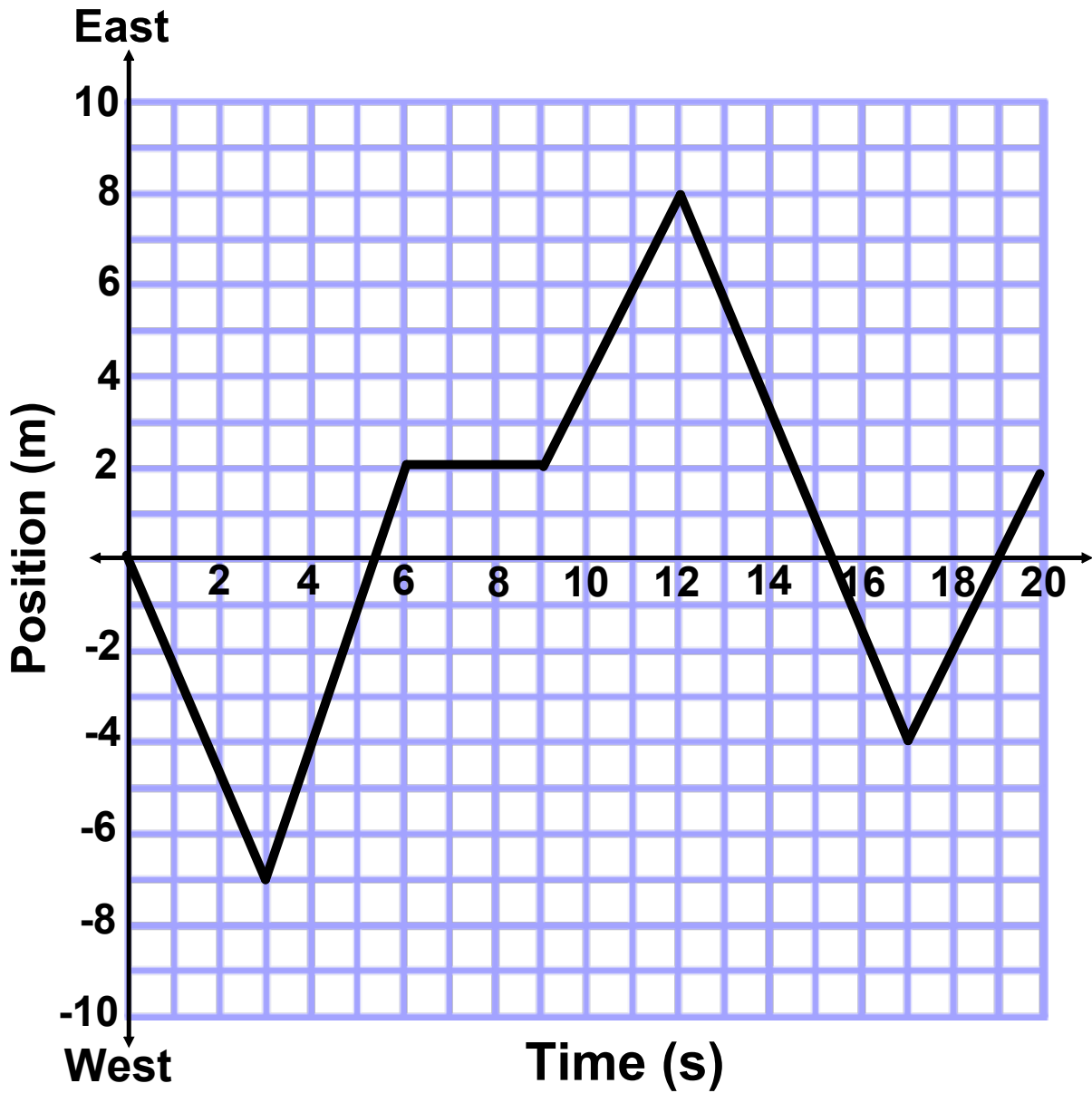


1. Calculate the instantaneous velocity at 1, 6 and 20 seconds.
2. Calculate the distance covered during the first 8 seconds.
3. What was the position at 3, 10, and 18 seconds.
4. During which time interval was the highest speed obtained?
5. Other than the start, at what times was the object back at the origin?
6. During what time interval(s) was the object traveling west?
7. Calculate the average speed and velocity during the first 6 seconds.
8. How long was the object not moving?
9. During what time intervals was the object east of the starting position but traveling west?
10. During what time intervals was the object west of the starting position but traveling east?
11. Calculate the average speed and average velocity for the entire 20 seconds.



1. Calculate the instantaneous velocity at 4 s, 10 s, and 18 second marks.
2. At what time(s) did the object return to the starting point?
3. For how many seconds was the object not moving?
4. At what time(s) during the first 5 seconds did the object change direction?
5. During what time interval(s) was the object positioned east but moving west?
6. How many seconds did it take the object to travel a distance of 6 m? 20 m?
7. Calculate the average speeds from question 5.
8. At what time(s) was the object 3 m [W] of the starting point? 2 m [E]?
9. During what time interval did the object have the greatest speed?
10. Calculate the average velocity at the 4 s, 8 s, 15 s and 20 s marks.
11. Calculate the average speed for the entire 20 s trip.

Position-Time Analysis Review Assessment



Position-Time Formative Assessment

Grade: 10
Subject: Physical Science 10
Date: Nov. 2014

1 Calculate the starting velocity of the object. * Wed

A 0.43 m/s

B -0.43 m/s

C 2.3 m/s

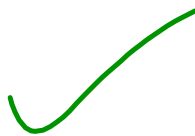
D -2.3 m/s

5

2 What direction was the object traveling from 12 to 17 seconds?

A East

B West



3 Other than the start, at what times was the object instantly back at the starting point.

A 3 s

B 5.5 s

C 7 s

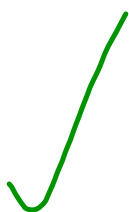
D 12 s

E 15.5 s

F 17 s

G 19 s

H 20 s



✗ Quick review

4 Calculate the distance traveled in the first 12 seconds.

A 7 m

B 8 m

C 12 m

D 22 m

$\frac{1}{2}$ * Review

5 Calculate the average velocity for the first 5.5 seconds.

A 0 m/s

B 2.5 m/s

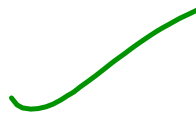
C -2.5 m/s

* Review

6 At the 14 second mark the object was positioned east but traveling west.

True

False



7 At what times did the object change direction?

A 3 s

B 5.5 s

C 7 s

D 12 s

E 15.5 s

F 17 s

G 19 s

H 20 s



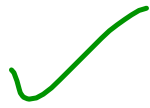
Quick
Review

8 How long did it take for the object to travel 18 m?

A 4 s

B 10 s

C 12 s

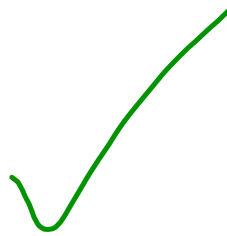


Small
Review

9 The final position of the object at 20 s is 40 m.

True

False



10 Calculate the average speed of the object for the full 20 seconds.

A 0.1 m/s

B 0.5 m/s

C 2.0 m/s



Attachments

moving-man_all.jar