HW 1: - DISPLACEMENT & AVERAGE VELOCITY

1. After a tennis match, the players dash to the net to congratulate one another.
If they both run with a speed of 3m/s, are their velocities equal?

2. A mass initially at O moves 10 m to the right and then 2 m to the left.
What is the final displacement of the mass?

3. A mass initially at O, first moves 5 m to the right and then 12 m to the left. What is the total distance covered by the mass and what is its displacement?

4. An object has a displacement of —5 m. It moves a distance to the right equal to 15 m and then a distance of 10 m to the left. What is the total distance travelled and final displacement of the object?

5. A car starts out from O in a straight line and moves a distance of 20 km towards the right, and then returns to its starting position 1 h later. What is the average speed and the average velocity for this trip?

6. A motor car travels on a circular track of radius a, as shown in the figure.
When the car has travelled from P to Q its displacement from P is

A. a$\sqrt{2}$ southwest.
B. a$\sqrt{2}$ northeast.
C. 3πa/2 southwest.
D. 3πa/2 northeast.
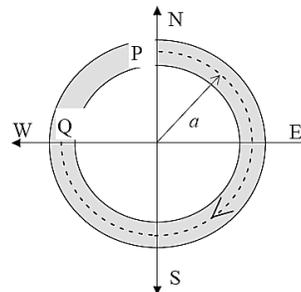
7. Juan is standing on the platform at a railway station. A train passes through the station with speed 20 ms^{-1} in the direction shown measured relative to the platform. Carmen is walking along one of the carriages of the train with a speed of 2.0 ms^{-1} measured relative to the carriage in the direction shown.
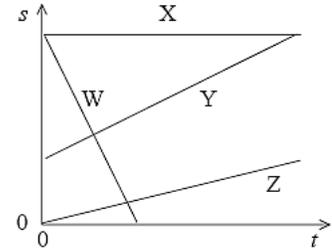Velocity is measured as positive in the direction shown on the diagram.
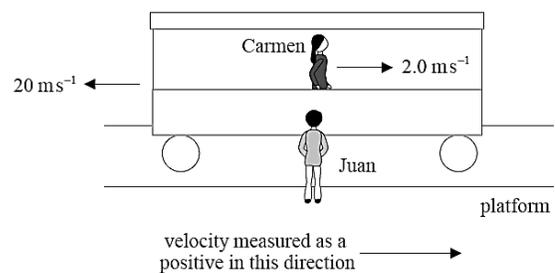
The **velocity** of Carmen relative to Juan is
A. -22 ms^{-1}.
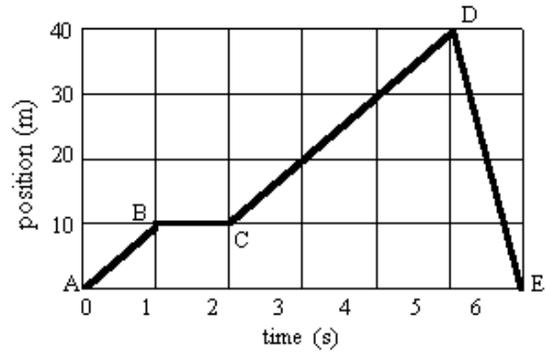B. -18 ms^{-1}.
C. +18 ms^{-1}.
D. +22 ms^{-1}.

8. Four cars W, X, Y and Z are on a straight road. The graph below shows the variation with time t of the distance s of each car from a fixed point.

Which car has the greatest speed?
A. W
B. X
C. Y
D. Z

9. An object is moving along a straight line.   The graph shows the object's position from the starting point as a function of time.

a. In which segment(s) of the graph does the object's *average velocity* (measured from $t = 0$ s) *decrease* with time?

b. What was the *instantaneous velocity* of the object at $t = 4$ s?

c. In which segments(s) of the graph does the object have the highest speed?

d. At which time (s) does the object reverse its direction of motion?

10. It is now 10:29 a.m., but when the bell rings at 10:30 a.m. Suzette will be late for French class for the third time this week. She must get from one side of the school to the other by hurrying down three different hallways. She runs down the first hallway, a distance of 35.0 m, at a speed of 3.50 m/s. The second hallway is filled with students, and she covers its 48.0-m length at an average speed of 1.20 m/s. The final hallway is empty, and Suzette sprints its 60.0-m length at a speed of 5.00 m/s. a) Does Suzette make it to class on time or does she get detention for being late again? b) Draw a distance vs. time graph of the situation.

11. An object is moving along a straight line in the positive *x* direction. The graph shows its position from the starting point as a function of time. Various segments of the graph are identified by the letters A, B, C, and D.
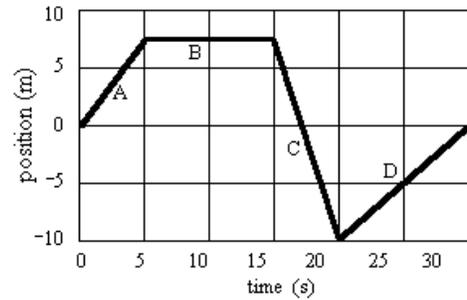
a. Which segment(s) of the graph represent(s) a *constant velocity* of +1.0 m/s?

b. What was the *instantaneous velocity* of the object at the end of the eighth second?

c. During which interval(s) did the object move in the negative *x* direction?

12. A pronghorn antelope has been observed to run with a top speed of 97 km/h. Suppose she runs 1.5 km with an average speed of 85 km/h, and then runs 0.80 km with an average speed of 67 km/h.
a. How long will it take (in seconds) the antelope to run the entire 2.3 km?
b. What is the antelope's average speed during this time?

13. A particle travels along a curved path between two points P and Q as shown. The displacement of the particle does *not* depend on
a.   the location of P.
b.   the location of Q.
c.   the distance traveled from P to Q.
d.   the shortest distance between P and Q.
e.   the direction of Q from P.

14.   For which one of the following situations will the path length equal the magnitude of the displacement?
a.   A jogger is running around a circular path.
b.   A ball is rolling down an inclined plane.
c.   A train travels 5 miles east; and then, it stops and travels 2 miles west.
d.   A ball rises and falls after being thrown straight up from the earth's surface.
e.   A ball on the end of a string is moving in a vertical circle.

15. A particle moves along the *x* axis from x_i to x_f.   Of the following values of the initial and final coordinates, which results in the displacement with the largest magnitude?
a. $x_i = 4$m, $x_f = 6$m   c. $x_i = -4$m, $x_f = 2$m   e. $x_i = -4$m, $x_f = 4$m
b. $x_i = -4$m, $x_f = -8$m   d. $x_i = 4$m, $x_f = -2$m

16. A particle moves along the *x* axis from x_i to x_f. Of the following values of the initial and final coordiantes, which results in a negative displacement?

a. x_i = 4m, x_f = 6m

b. x_i = –4m, x_f = –8m

c. x_i = –4m, x_f = 2m

d. x_i = –4m, x_f = –2m

e. x_i = –4m, x_f = 4m

17. A particle moves along the *x* axis from x_i to x_f. Of the following values of the initial and final coordinates, which results in the displacement with the largest magnitude?

a. x_i = 4m, x_f = 6m

b. x_i = –4m, x_f = –8m

c. x_i = –4m, x_f = 2m

d. x_i = 4m, x_f = –2m

e. x_i = –4m, x_f = 4m

18. A hiker travels south along a straight path for 1.5 h with an average velocity of 0.75 km/h, then travels south for 2.5 h with an average velocity of 0.90 km/h. What is the hiker's displacement for the total trip?

a. 1.1 km to the south   b. 2.2 km to the south   c. 3.4 km to the south   d. 6.7 km to the south

19. **a.** The graph shows displacement versus time.
What is the average velocity for line A?

b. The graph above shows displacement versus time.
What is the average velocity for line B?

c. The graph above shows displacement versus time.
What is the average velocity for line C?