Constant velocity

What you should know:
1. You should distinguish between a **scalar** and a **vector**:
    a. know the difference between distance and displacement.
    b. know the difference between speed and velocity.
    c. know the difference between average and instantaneous speed and velocity.

2. You should be able to determine the **average velocity** of an object in two ways:
    a. determining the **slope** of an **x** vs **t** graph.
    b. using the equation $v = \Delta x/\Delta t$

3. You should be able to determine the **displacement** of an object in two ways:
    a. finding the area under a **v** vs **t** graph.
    b. using the equation $\Delta x = vt$

4. Given an **x** vs **t** graph, you should be able to:
    a. describe the motion of the object (starting position, direction of motion, velocity)
    b. draw the corresponding **v** vs **t** graph
    c. determine the average velocity of the object (slope).
    d. write the mathematical model which describes the motion.

5. Given a **v** vs **t** graph, you should be able to:
    a. describe the motion of the object (direction of motion, how fast)
    b. draw the corresponding **x** vs **t** graph
    c. determine the displacement of the object (area under curve).
    d. write a mathematical model to describe the motion.

Questions

1. Choose correct answer: To measure *displacement*, or change in position **Δx**,
    A) measure every meter moved
    B) take the final position minus the initial position only.

2. True or False: An object can be moving for 10 seconds and still have zero displacement.

3. True or False: It is possible for an object to move for 10 seconds at a high speed and end up with negative displacement.

4. George drives 1920 kilometers in 32 hours and returns home by the same route in the same amount of time.
   A) Determine his average speed.

B) Determine his average velocity.

5. A cross-country skier moves from location A to location B to location C to location D. Each *leg* of the back-and-forth motion takes 1 minute to complete; the total time is 3 minutes.
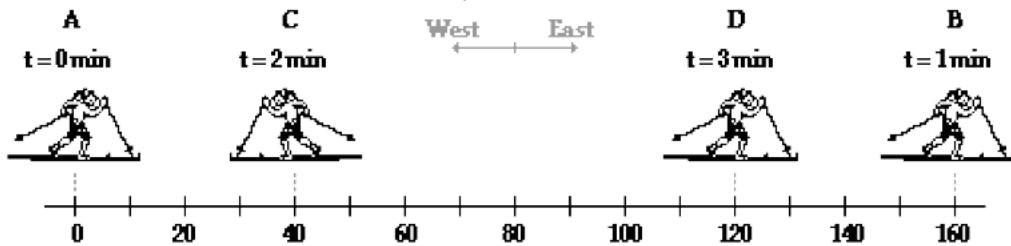

A) What is the distance traveled by the skier during the three minutes of recreation?

B) What is the net displacement of the skier during the three minutes of recreation?

C) What is the displacement during the second minute (from 1 min. to 2 min.)?

D) What is the displacement during the third minute (from 2 min. to 3 min.)?

E) Calculate the average speed (in m/min) and the average velocity (in m/min) of the skier during the three minutes of recreation.
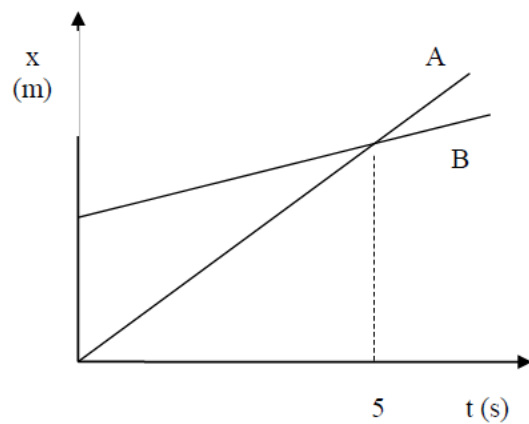
6. Write the equation of this motion.
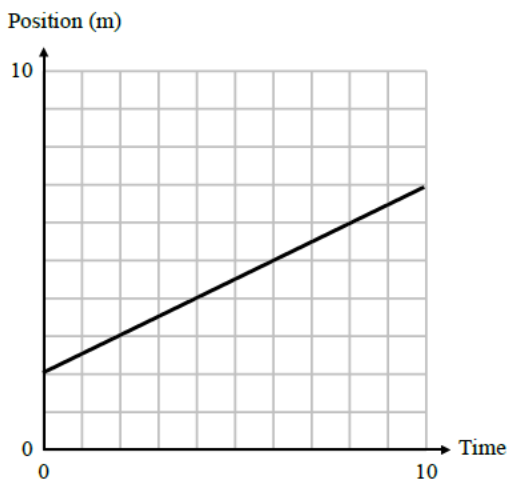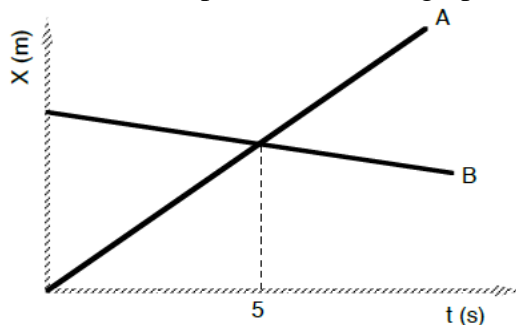
7. Write the equation of this motion.
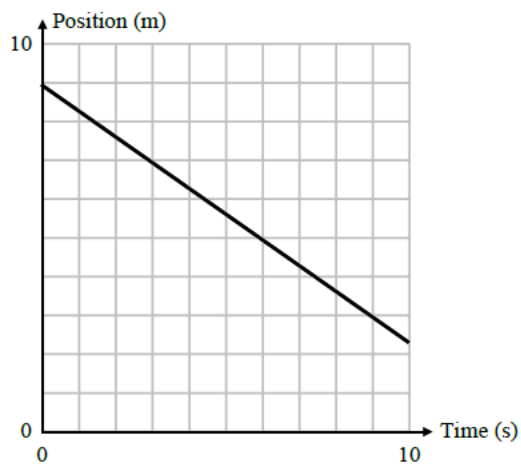
8. Consider the position vs. time graph below for cyclists A and B.

a) Do the cyclists start at the same point? If not, which is ahead?

b) At t = 7 s, which cyclist is ahead?

c) Which cyclist is traveling faster at t = 3 s? How do you know?
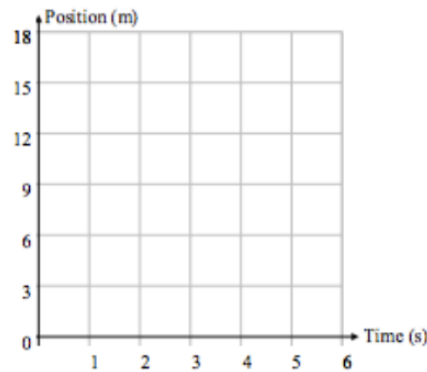
d) At what time cyclist A catch up with cyclist B?

9. Consider the position vs. time graph below for cyclists A and B.

a) Which cyclist has the greater speed?

b) Which cyclist traveled greater distance?

10. Using the Data Table below, plot a graph and write the corresponding equation of the motion.

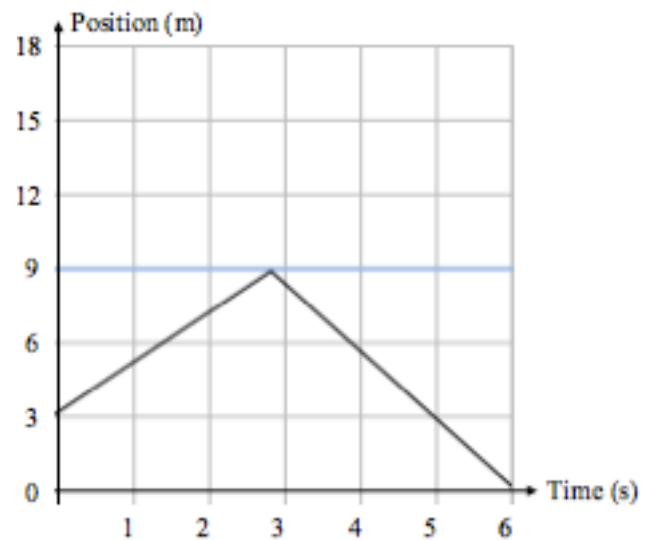| Time (s)	Position (m)
0	15
1	12
2	9
3	6
4	3
5	0

11. The graph at below shows the motion of a girl on a jet ski moving in a straight line.

a) What is the total distance she travels?

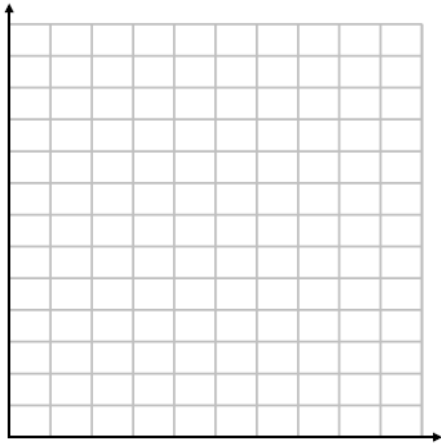b) What is her total displacement?

c) What is her average speed?

d) What is her average velocity?

12. This data table shows information about two toy cars that were raced side-by-side.

t (s)	x_1 (m)	x_2 (m)
0	0	0
1	0.5	1
2	1.0	2
3	1.5	3
4	2.0	4
5	2.5	5
6	3.0	6
7	3.5	7
8	4.0	8
9	4.5	9
10	5.0	10

a) Draw a graph of position of both cars on the same graph.
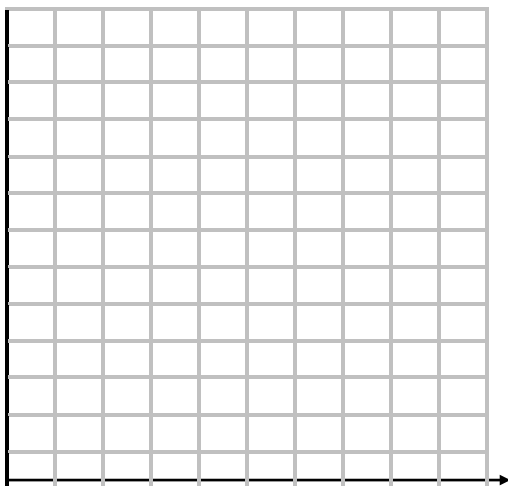
b) Find the velocity of each toy car. Show your work.

c) Write the equation of the motion of each car.

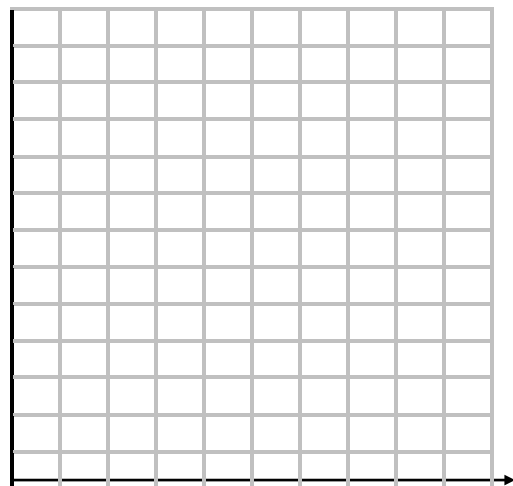13. Use the table below to answer the following questions.

t (s)	x (m)
0	2
1	4
2	6
3	8
4	10

A) Draw position-time and velocity-time graphs for the object on the graphs below.

Position (m)
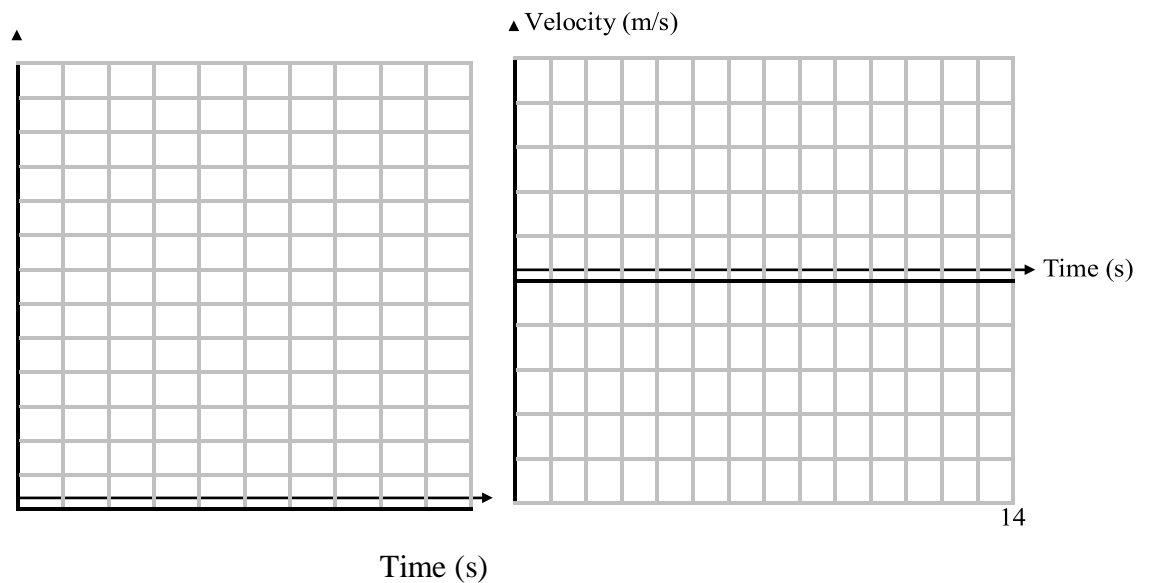
Velocity (m/s)

Time (s)

Time (s)

b) Write mathematical expressions that represent the relationships between position and time and between velocity and time for the object.

c) Describe what the area under the line in velocity-time graph represents.

14. Use the position-time data below to answer the following questions.

t (s)	x (m)
0	0
1	2
2	4
3	4
4	7
5	10
6	10
7	10
8	5
9	0

A) Construct a position vs. time graph and a velocity vs. time graph for this data.

Velocity (m/s)

Time (s)

14

Time (s)

b) Determine the displacement from t = 3.0 s to 5.0 s using the velocity-time graph.

c) Determine the displacement from t = 7.0 s to 9.0 s using the velocity-time graph.

6

15. Sketch the **position vs. time graph** and the **velocity vs. time graph** corresponding to the following descriptions of the motion of an object.
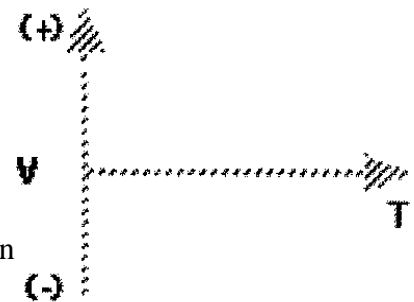
A) The object is moving away from the origin at a constant (steady) speed.
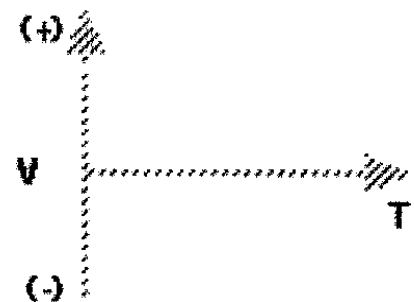
(+)

V ┊·····················

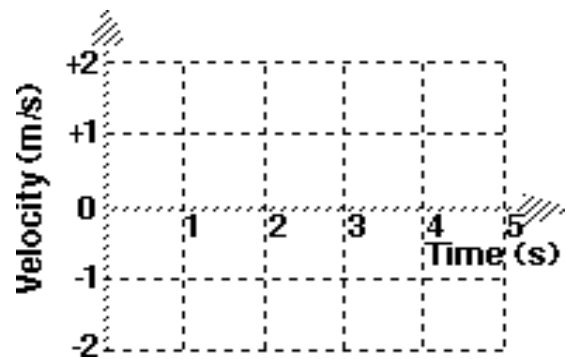(-)   T
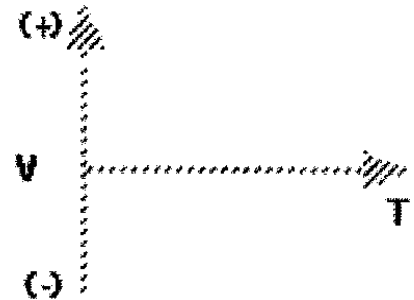
B) The object is standing still.

(+)

V ┊····················

(-)   T
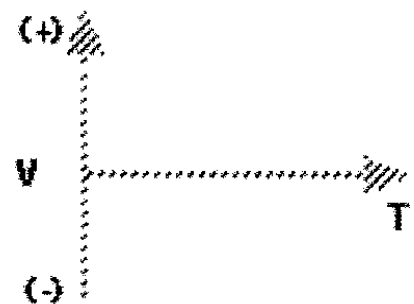
C) The object moves towards the origin at a steady speed,

(+)

V ┊·····················

D)The object moves away from the origin at a steady speed, then moves back towards the origin at the same speed.

(-)

(+)

V ┊·················

(-)   T

16. Draw the velocity vs. time graph for an object whose motion produced the distance vs. time graphs shown below at left.
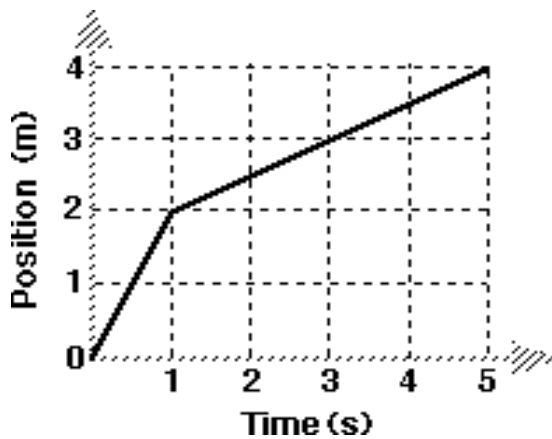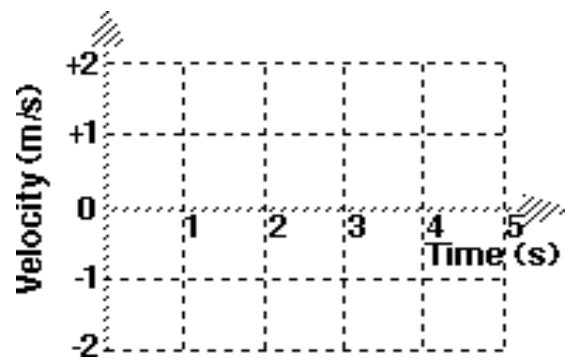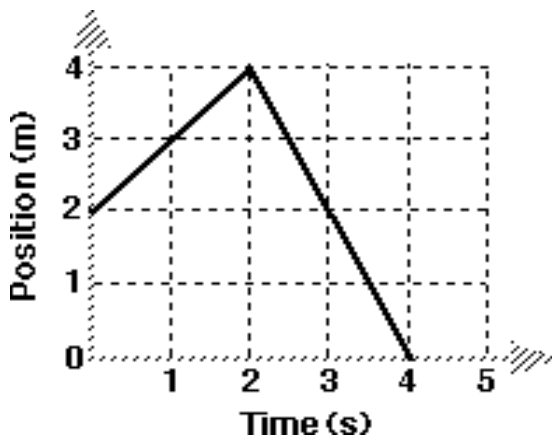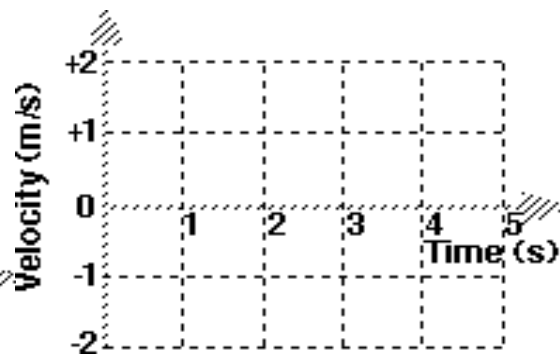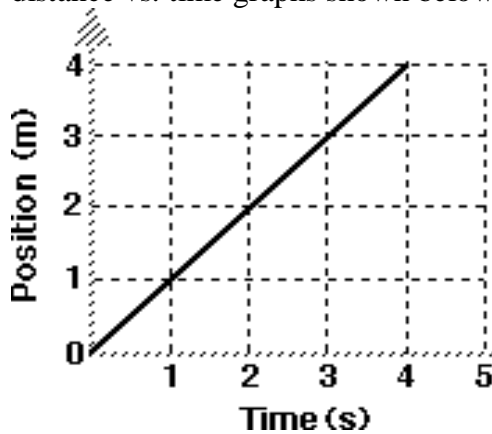
17. For many graphs, both the **slope** of the line and the **area** between the line and the horizontal axis have physical meanings.
a) What does the slope of a position time graph tell you about the motion of an object?

b) Looking at the velocity time graphs, determine the units for a square of area on the graph.

c) What does the area under the velocity-time graph tell you about the motion of an object?

18. For each of the graphs below find average speed and average velocity.

A

B

C

D

E

F