

1.1 Motion: A First Look

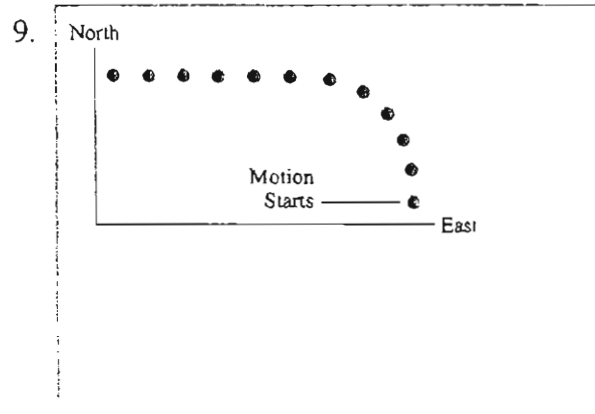
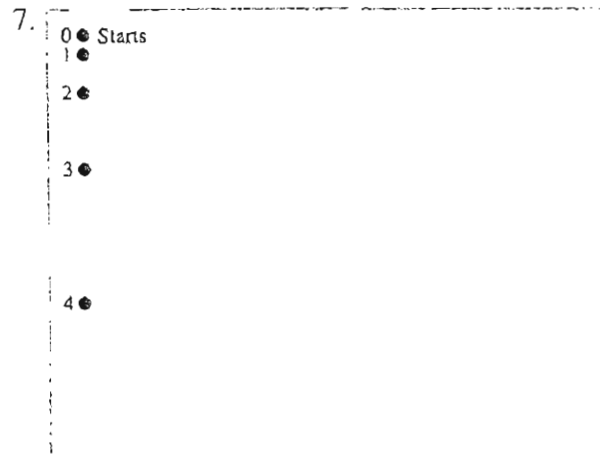
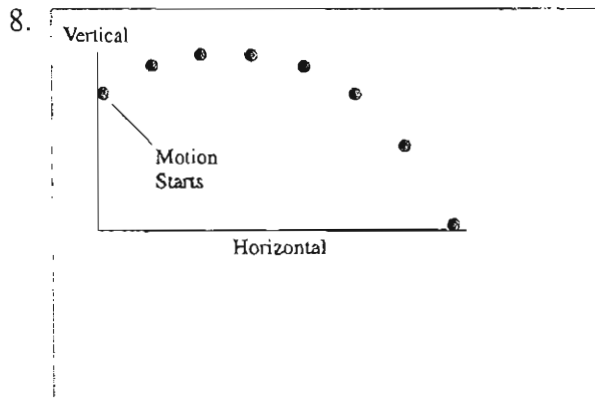
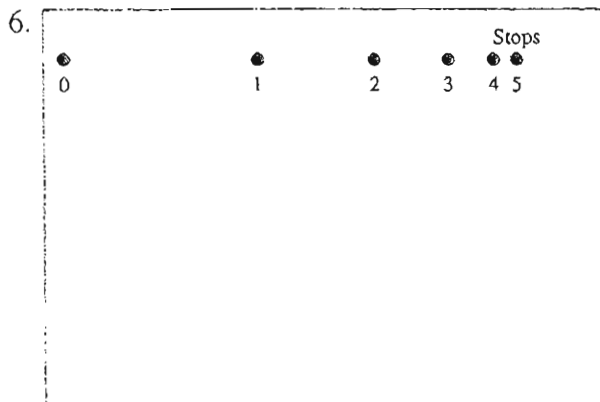
Exercises 1–5: Draw a motion diagram for each motion described below.

- Use the particle model to represent the object as a particle.
- Six to eight dots are appropriate for most motion diagrams.
- Number the positions in order, as shown in Figure 1.4 in the text.
- Be neat and accurate!

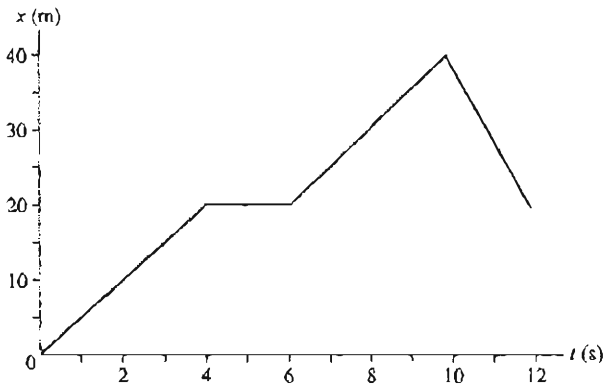
1. A car accelerates forward from a stop sign. It eventually reaches a steady speed of 45 mph.

2. An elevator starts from rest at the 100th floor of the Empire State Building and descends, with no stops, until coming to rest on the ground floor. (Draw this one *vertically* since the motion is vertical.)

Exercises 6–9: For each motion diagram, write a short description of the motion of an object that will match the diagram. Your descriptions should name *specific* objects and be phrased similarly to the descriptions of Exercises 1 to 5. Note the axis labels on Exercises 8 and 9.



2. The position-versus-time graph below shows the position of an object moving in a straight line for 12 seconds.



a. What is the position of the object at 2 s, 6 s, and 10 s after the start of the motion?

At 2 s:

At 6 s:

At 10 s:

b. What is the object's velocity during the first 4 s of motion?

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c. What is the object's velocity during the interval from $t = 4$ s to $t = 6$ s?

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d. What is the object's velocity during the four seconds from $t = 6$ s to $t = 10$ s?

.....

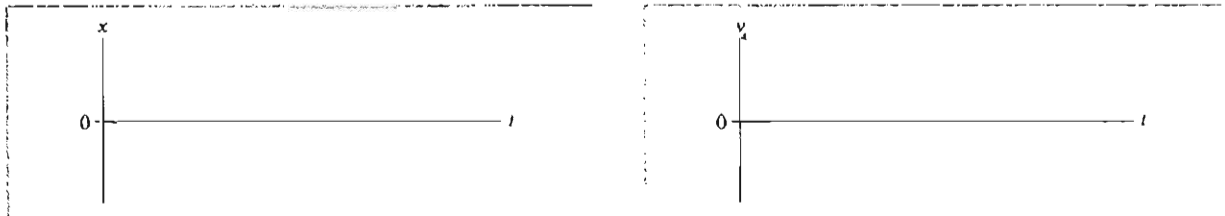
e. What is the object's velocity during the final two seconds from $t = 10$ s to $t = 12$ s?

.....

f. Draw a motion diagram below to represent the entire 12 s of motion.

.....

7. Draw both a position-versus-time graph *and* a velocity-versus-time graph for an object that is at rest at $x = 1$ m.



8. The figure shows six frames from the motion diagram of two moving cars, A and B.



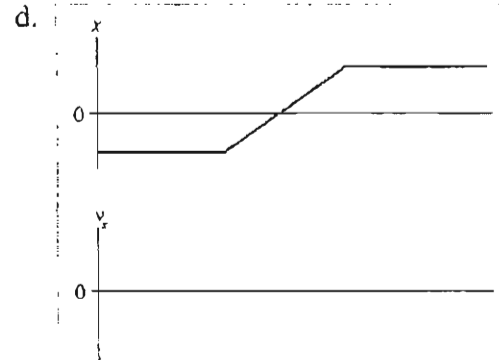
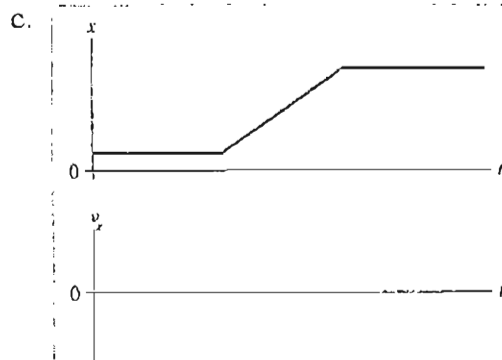
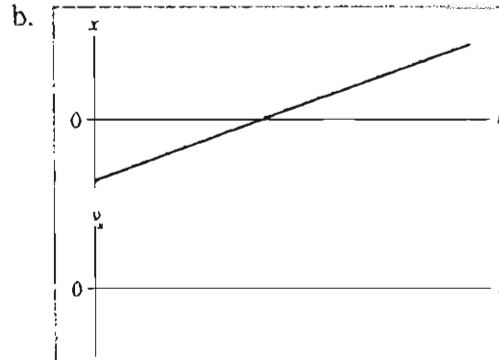
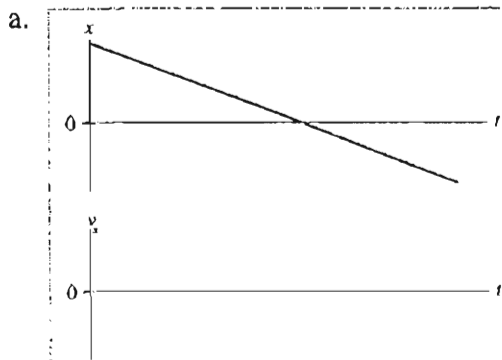
- a. Draw both a position-versus-time graph and a velocity-versus-time graph. Show the motion of *both* cars on each graph. Label them A and B.



- b. Do the two cars ever have the same position at one instant of time?
If so, in which frame number (or numbers)?

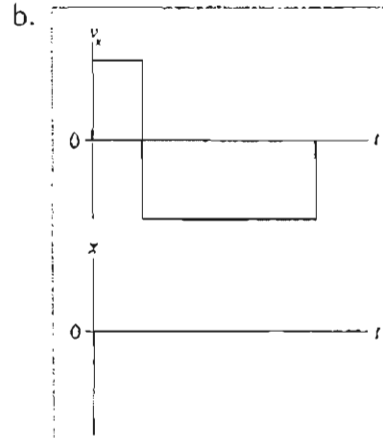
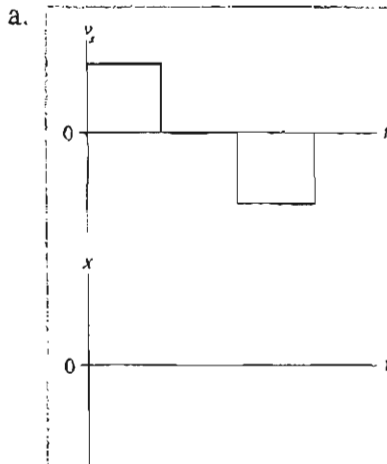
Draw a vertical line through your graphs of part a to indicate this instant of time.

9. Below are four position-versus-time graphs. For each, draw the corresponding velocity-versus-time graph directly below it. A vertical line drawn through both graphs should connect the velocity v_x at time t with the position s at the *same* time t . There are no numbers, but your graphs should correctly indicate the *relative* speeds.



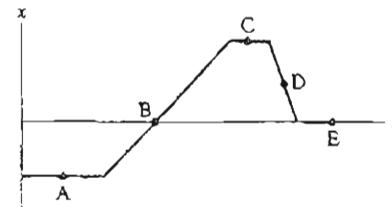
10. Below are two velocity-versus-time graphs. For each:
- Draw the corresponding position-versus-time graph.
 - Give a written description of the motion.

Assume that the motion takes place along a horizontal line and that $x_0 = 0$.



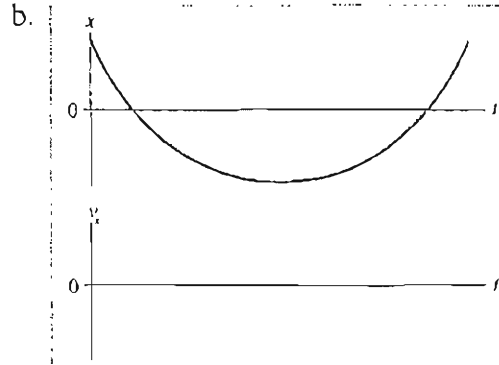
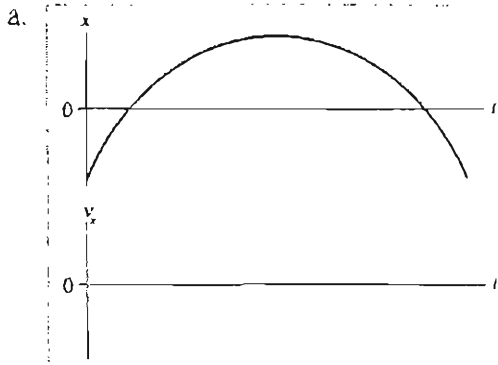
11. The figure shows a position-versus-time graph for a moving object. At which lettered point or points:

- Is the object moving the slowest?
- Is the object moving the fastest?
- Is the object at rest?
- Does the object have a constant nonzero velocity?
- Is the object moving to the left?



2.3 Motion with Changing Velocity

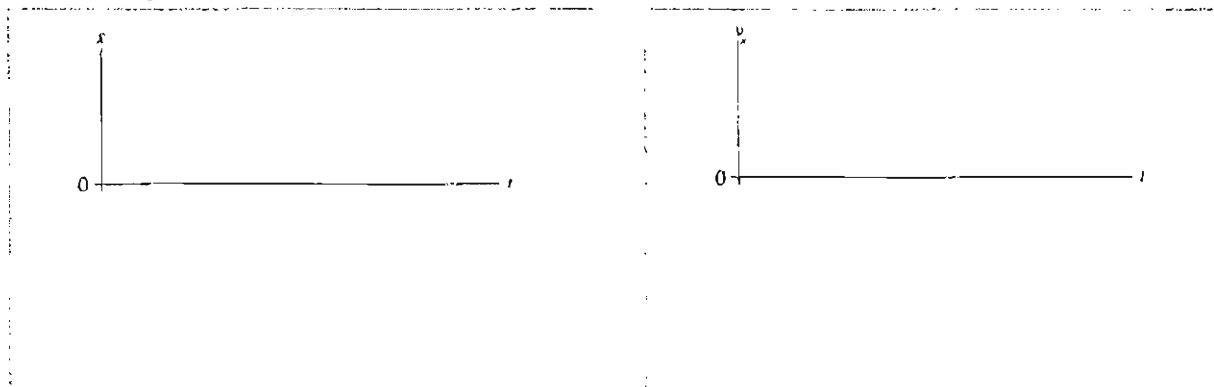
12. Below are two position-versus-time graphs. For each, draw the corresponding velocity-versus-time graph directly below it. A vertical line drawn through both graphs should connect the velocity v_x at time t with the position x at the *same* time t . There are no numbers, but your graphs should correctly indicate the *relative* speeds.



13. The figure shows six frames from the motion diagram of two moving cars, A and B.



a. Draw both a position-versus-time graph and a velocity-versus-time graph. Show *both* cars on each graph. Label them A and B.



b. Do the two cars ever have the same position at one instant of time?

If so, in which frame number (or numbers)?

Draw a vertical line through your graphs of part a to indicate this instant of time.

c. Do the two cars ever have the same velocity at one instant of time?

If so, between which two frames?