

## Describing Motion with Position-Time Graphs

Read from Lesson 3 of the 1-D Kinematics chapter at The Physics Classroom:

<http://www.physicsclassroom.com/Class/1DKin/U1L3a.html>

<http://www.physicsclassroom.com/Class/1DKin/U1L3b.html>

<http://www.physicsclassroom.com/Class/1DKin/U1L3c.html>

**MOP Connection:** Kinematic Graphing: sublevels 1-4 (and some of sublevels 9-11)

Motion can be described using words, diagrams, numerical information, equations, and graphs. Describing motion with graphs involves representing how a quantity such as the object's position can change with respect to the time. The key to using position-time graphs is knowing that the slope of a position-time graph reveals information about the object's velocity. By *detecting* the slope, one can infer about an object's velocity. "As the slope goes, so goes the velocity."

### Review:

1. Categorize the following motions as being either examples of + or - acceleration.

a. Moving in the + direction and speeding up (getting faster) \_\_\_\_\_

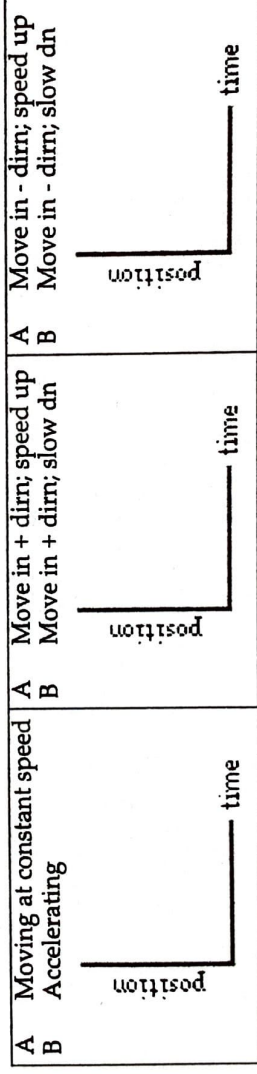
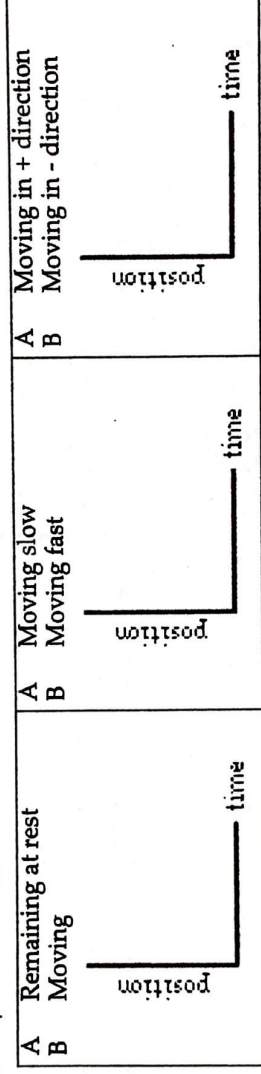
b. Moving in the + direction and slowing down (getting slower) \_\_\_\_\_

c. Moving in the - direction and speeding up (getting faster) \_\_\_\_\_

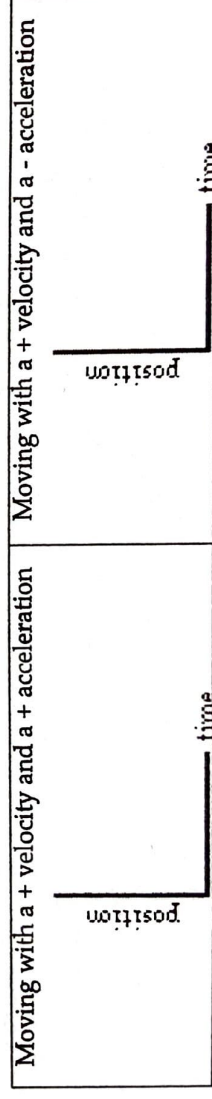
d. Moving in the - direction and slowing down (getting slower) \_\_\_\_\_

### Interpreting Position-Graphs

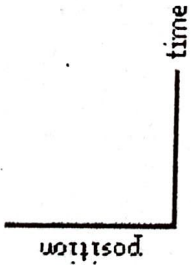
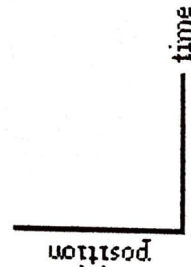
2. On the graphs below, draw two lines/curves to represent the given verbal descriptions; label the lines/curves as A or B.



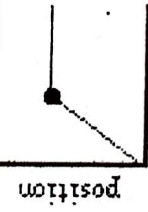


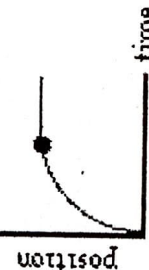
3. For each type of accelerated motion, construct the appropriate shape of a position-time graph.



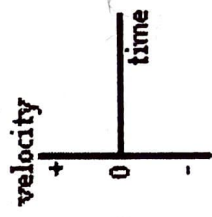
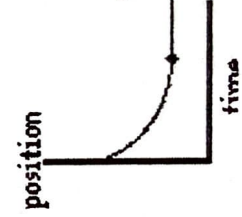
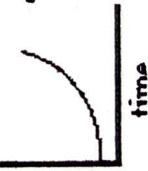
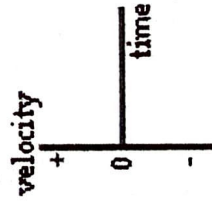
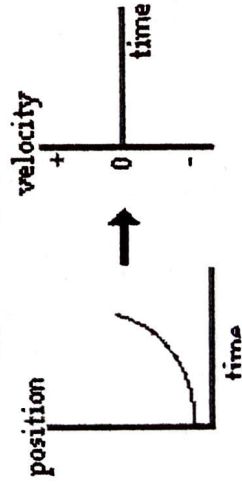
### 1-D Kinematics

<p>Moving with a - velocity and a + acceleration</p> 	<p>Moving with a - velocity and a - acceleration</p> 
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4. Use your understanding of the meaning of slope and shape of position-time graphs to describe the motion depicted by each of the following graphs.

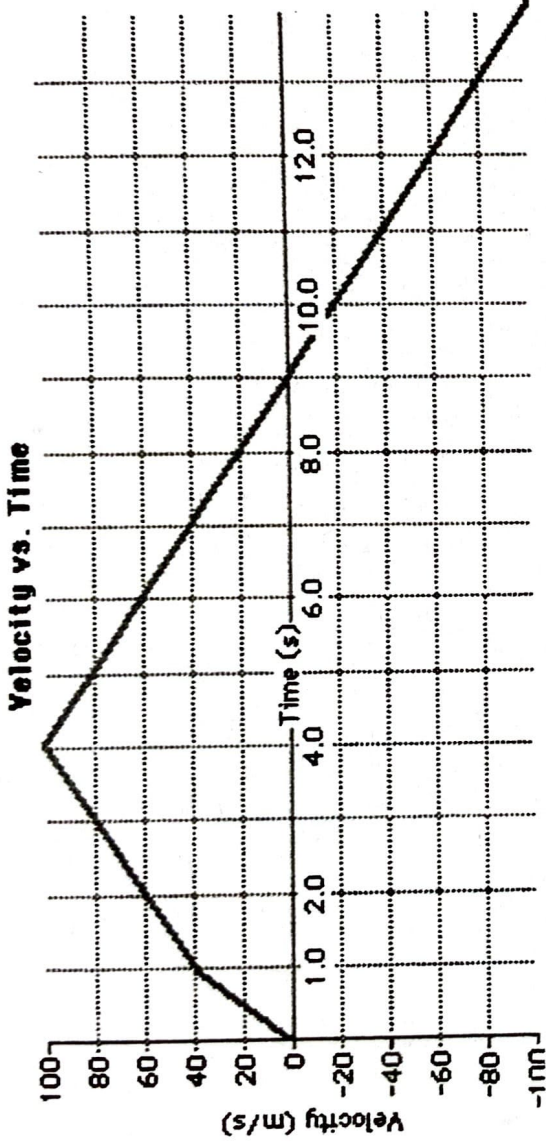
 <p>Verbal Description:</p>	 <p>Verbal Description:</p>
 <p>Verbal Description:</p>	 <p>Verbal Description:</p>

5. For the following pos-time graphs, determine the corresponding shape of the vel-time graph.



### Interpreting Velocity-Time Graphs

The motion of a two-stage rocket is portrayed by the following velocity-time graph.



Several students analyze the graph and make the following statements. Indicate whether the statements are correct or incorrect. Justify your answers by referring to specific features about the graph.

**Correct?  
Yes or No**

#### Student Statement

- After 4 seconds, the rocket is moving in the negative direction (i.e., down).

Justification: \_\_\_\_\_

- The rocket is traveling with a greater speed during the time interval from 0 to 1 second than the time interval from 1 to 4 seconds.

Justification: \_\_\_\_\_

- The rocket changes its direction after the fourth second.

Justification: \_\_\_\_\_

- During the time interval from 4 to 9 seconds, the rocket is moving in the positive direction (up) and slowing down.

Justification: \_\_\_\_\_

- At nine seconds, the rocket has returned to its initial starting position.

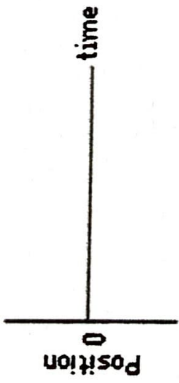
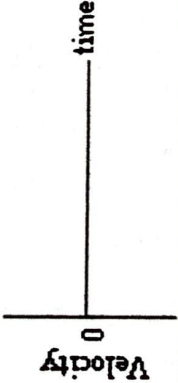
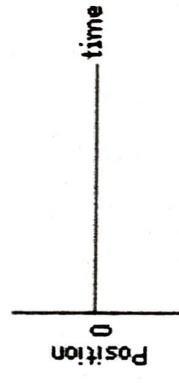
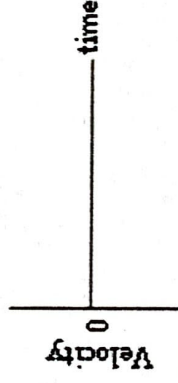
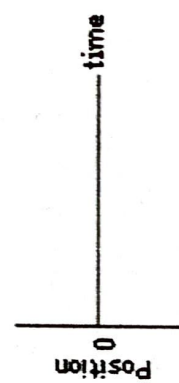
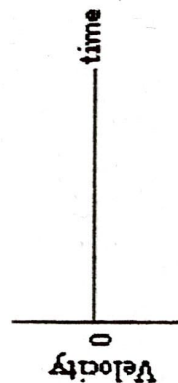
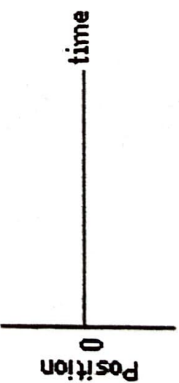
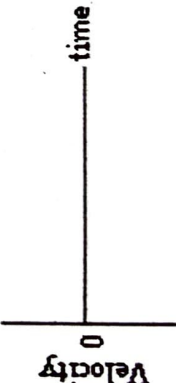
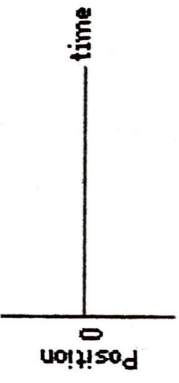
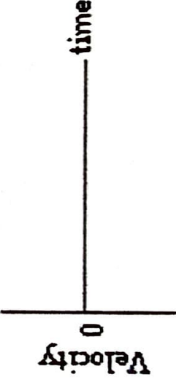
Justification: \_\_\_\_\_

## Graphing Summary

Study Lessons 3 and 4 of the 1-D Kinematics chapter at The Physics Classroom:

<http://www.physicsclassroom.com/Class/1DKin/1KinTOC.html>

**MOP Connection:** Kinematic Graphing: sublevels 1-11 (emphasis on sublevels 9-11)

<p><b>Constant Velocity</b> Object moves in + Direction</p> <p>Velocity Dir'n: + or -</p>  	<p><b>Constant Velocity</b> Object moves in - Direction</p> <p>Velocity Dir'n: + or -</p>  	<p><b>Constant + Acceleration</b> Object moves in + Direction</p> <p>Velocity Dir'n: + or - Speeding up or Slowing Down?</p>  
<p><b>Constant + Acceleration</b> Object moves in - Direction</p> <p>Velocity Dir'n: + or - Speeding up or Slowing Down?</p>  	<p><b>Constant - Acceleration</b> Object moves in - Direction</p> <p>Velocity Dir'n: + or - Speeding up or Slowing Down?</p>  	<p><b>Constant - Acceleration</b> Object moves in + Direction</p> <p>Velocity Dir'n: + or - Speeding up or Slowing Down?</p> 