

### Describing Motion with Velocity-Time Graphs

Read from **Lesson 4** of the 1-D Kinematics chapter at **The Physics Classroom**:

- <http://www.physicsclassroom.com/Class/1DKin/U1L4a.html>
- <http://www.physicsclassroom.com/Class/1DKin/U1L4b.html>
- <http://www.physicsclassroom.com/Class/1DKin/U1L4c.html>
- <http://www.physicsclassroom.com/Class/1DKin/U1L4d.html>

**MOP Connection:** Kinematic Graphing: sublevels 5-8 (and some of sublevels 9-11)

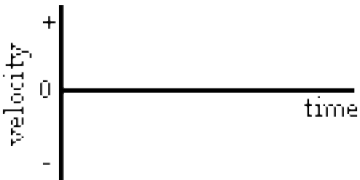
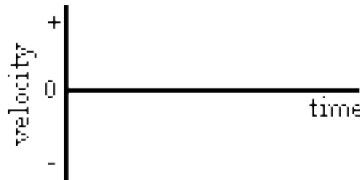
Motion can be described using words, diagrams, numerical information, equations, and graphs. Describing motion with graphs involves representing how a quantity such as the object's velocity = changes with respect to the time. The key to using velocity-time graphs is knowing that the slope of a velocity-time graph represents the object's acceleration and the area represents the displacement.

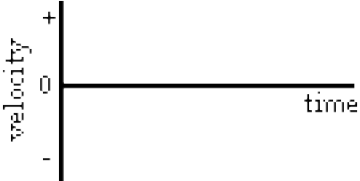
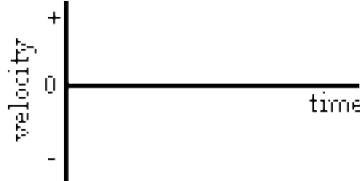
**Review:**

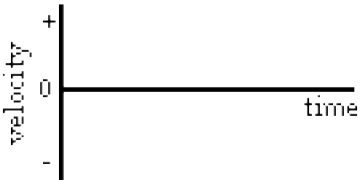
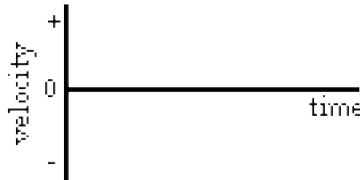
1. Categorize the following motions as being either examples of + or - acceleration.
  - a. Moving in the + direction and speeding up (getting faster) \_\_\_\_\_
  - b. Moving in the + direction and slowing down (getting slower) \_\_\_\_\_
  - c. Moving in the - direction and speeding up (getting faster) \_\_\_\_\_
  - d. Moving in the - direction and slowing down (getting slower) \_\_\_\_\_

**Interpreting Velocity-Graphs**

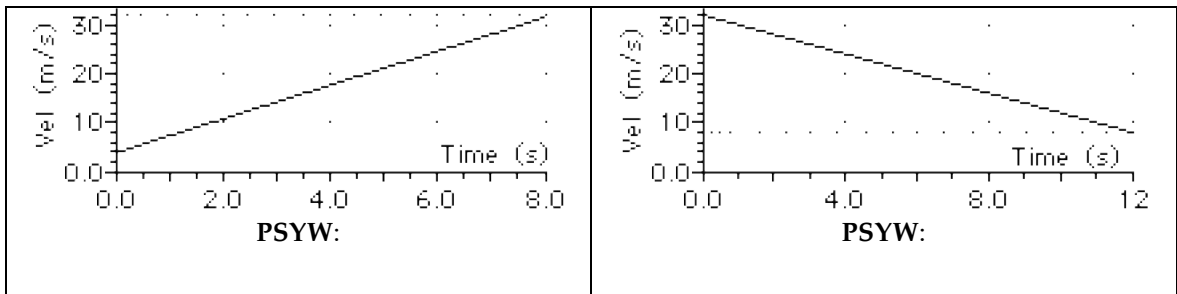
2. On the graphs below, draw two lines/curves to represent the given verbal descriptions; label the lines/curves as A or B.

A Moving at constant speed in - direction B Moving at constant speed in + direction 	A Moving in + direction and speeding up B Moving in - direction and speeding up 
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A Moving in + direction and slowing down B Moving in - direction and slowing down 	A Moving with + velocity and - accel'n B Moving with + velocity and + accel'n 
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A Moving with - velocity and - accel'n B Moving with - velocity and + accel'n 	A Moving in + dir'n, first fast, then slow B Moving in - dir'n, first fast, then slow 
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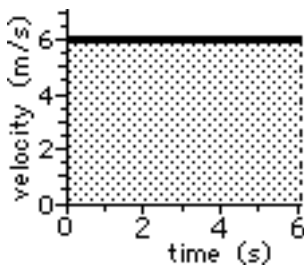
3. Use the velocity-time graphs below to determine the acceleration. **PSYW**



4. The area under the line of a velocity-time graph can be calculated using simple rectangle and triangle equations. The graphs below are examples:

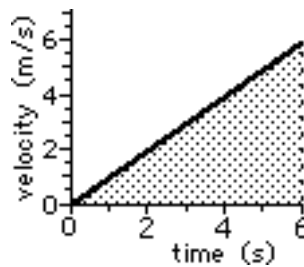
If the area under the line forms a ...

... **rectangle**, then use  
area = base\*height



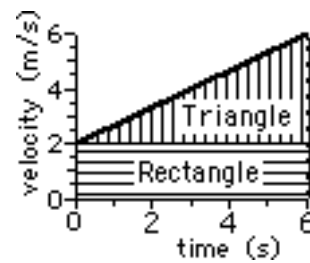
$$A = (6 \text{ m/s}) \cdot (6 \text{ s}) = 36 \text{ m}$$

... **triangle**, then use  
area =  $0.5 \cdot \text{base} \cdot \text{height}$



$$A = 0.5 \cdot (6 \text{ m/s}) \cdot (6 \text{ s}) = 18 \text{ m}$$

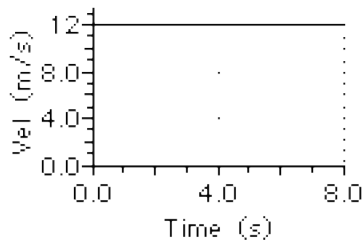
... **trapezoid**, then make it into  
a rectangle + triangle  
and add the two areas.



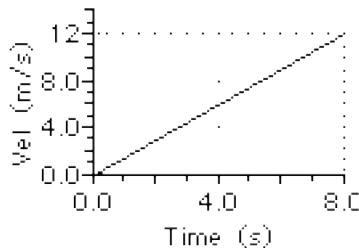
$$A_{\text{total}} = A_{\text{rectangle}} + A_{\text{triangle}}$$

$$A_{\text{total}} = (2 \text{ m/s}) \cdot (6 \text{ s}) + 0.5 \cdot (4 \text{ m/s}) \cdot (6 \text{ s}) = 24 \text{ m}$$

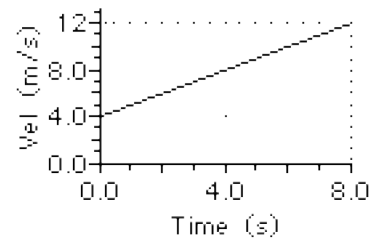
Find the displacement of the objects represented by the following velocity-time graphs.



PSYW:



PSYW:



PSYW:

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

