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.

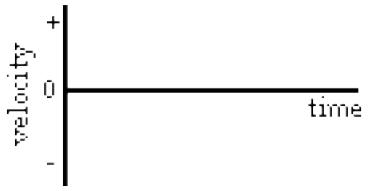
Review:

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) _____

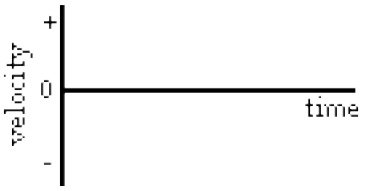
Interpreting Velocity-Graphs

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

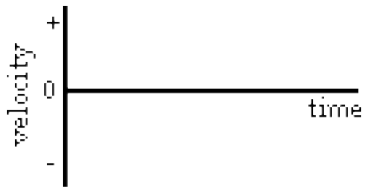
A Moving at constant speed in - direction
B Moving at constant speed in + direction



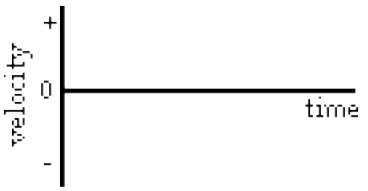
A Moving in + direction and speeding up
B Moving in - direction and speeding up



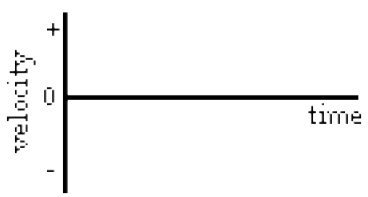
A Moving in + direction and slowing down
B Moving in - direction and slowing down



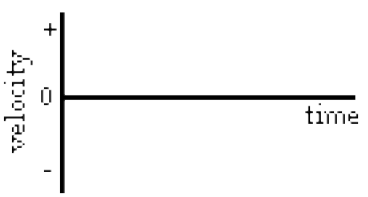
A Moving with + velocity and - accel'n
B Moving with + velocity and + accel'n



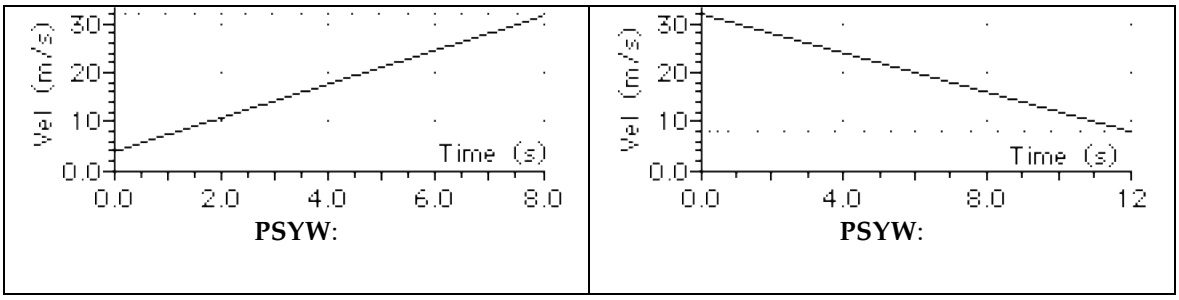
A Moving with - velocity and - accel'n
B Moving with - velocity and + accel'n



A Moving in + dir'n, first fast, then slow
B Moving in - dir'n, first fast, then slow



3. Use the velocity-time graphs below to determine the acceleration. **PSYW**



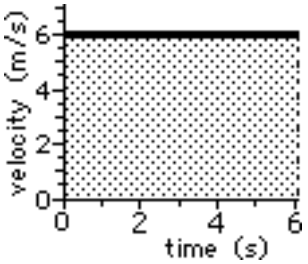
PSYW: **PSYW**:

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

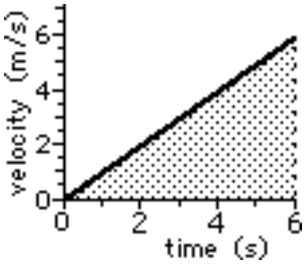
area = base*height



A = (6 m/s)*(6 s) = **36 m**

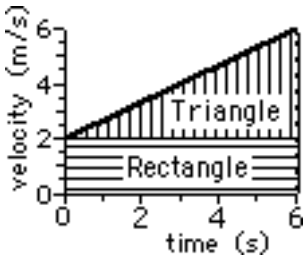
... **triangle**, then use

area = 0.5 * base*height



A = 0.5 * (6 m/s)*(6 s) = **18 m**

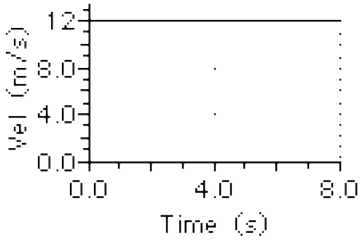
... **trapezoid**, then make it into a rectangle + triangle and add the two areas.



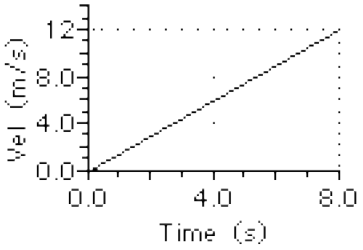
$A_{total} = A_{rectangle} + A_{triangle}$

A_{total} = (2m/s)*(6 s) + 0.5 * (4 m/s) * (6 s) = **24 m**

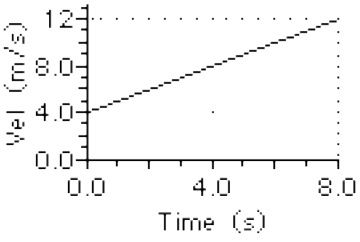
Find the displacement of the objects represented by the following velocity-time graphs.



PSYW:



PSYW:



PSYW:

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