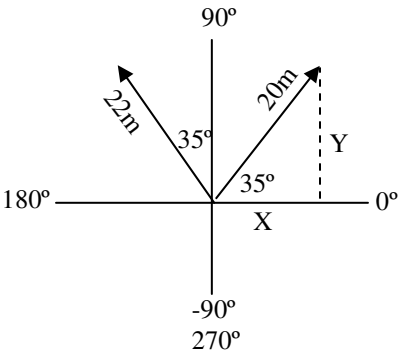
PreAP Linear Motion 13



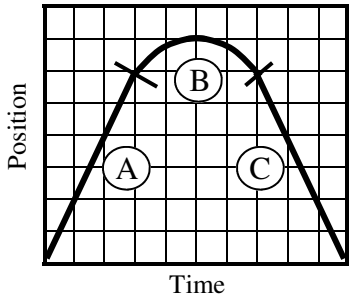
1. * Use the 20m long arrow to answer the following. We start by drawing a vertical line from the tip of the arrow to the x-axis to create a right triangle. Find the x and y components of the 20 m long arrow (*find x and y if 20 m is the hypotenuse*).

2. * A. Remembering that all angles need to be measured counterclockwise from the positive x-axis, what is the correct direction for the 22 m arrow?
   * B. Use the angle from the x-axis to calculate the x and y components, using the same equations that you used in Q1.

3. * A 2 kg rock is tossed straight up into the air. It goes 12 m. How fast was it thrown? (*You have enough info. Your freefall notes can help.)*

4. A 45 kg soapbox car starts at rest and rolls 85 m downhill in 6.4 seconds. What is the soapbox car's acceleration?

Graph I Position vs. Time

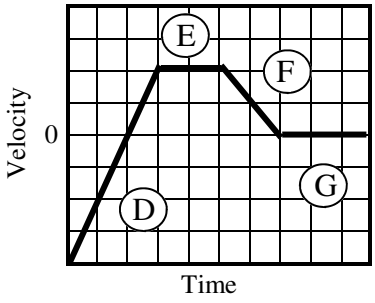


5. Use the two graphs at the left to answer the following. Notice that graph II is a velocity vs time graph. Which segment shows? (*There can be more than one answer.*)

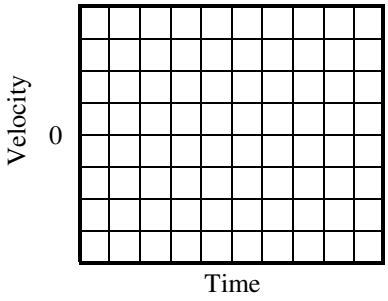
   A) at rest?
   B) + Δv?
   C) − Δx?
   D) + v?
   E) − v?
   F) Δx = 0?
   G) + a?
   H) − a?

6. Translate **Graph I** to the velocity and acceleration graphs below.

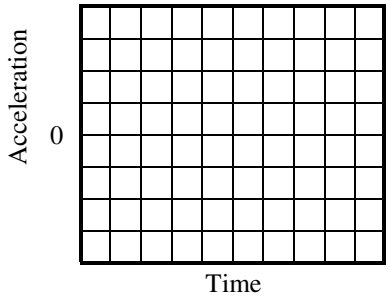
Graph II Velocity vs. Time

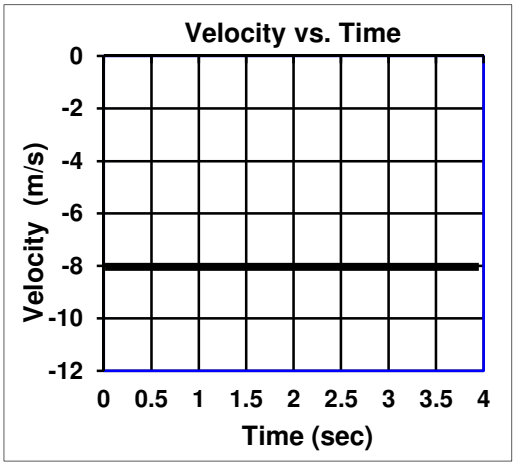


Velocity vs. Time



Acceleration vs. Time



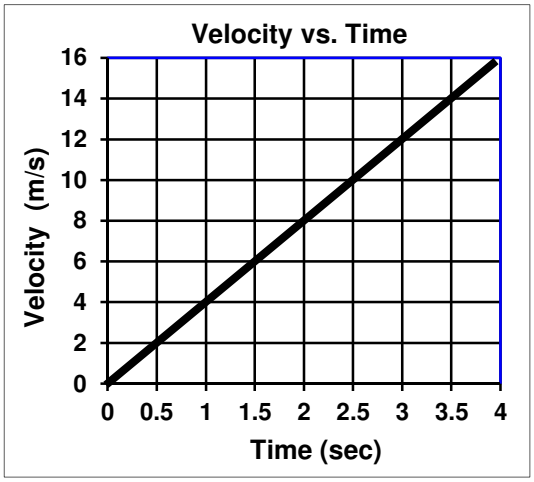


7. An object is travelling 8 m/s to the left for 4 seconds.
   A. Remembering that left is negative, what is was the object's displacement?

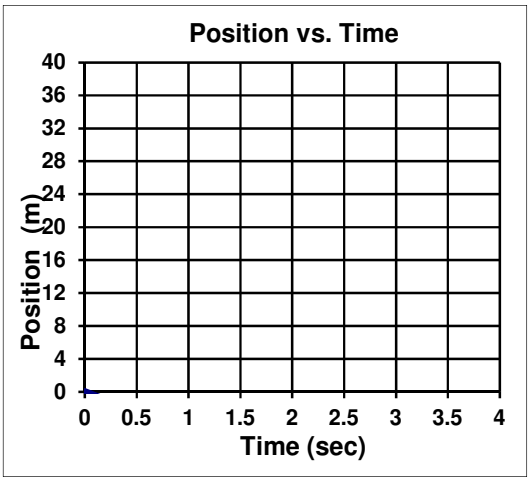
   You should have gotten −32 m.
   B. Now calculate the area of the graph at the right. Notice that the line is BELOW the x-axis.

   So, once again, area equals displacement and AREA CAN BE NEGATIVE! (If below the x-axis.)

8. But what if the shape is not a straight line? Let's use the velocity vs time graph at the left to find out.



time	position
0	0
1	
2	
3	
4	



A. At 0 seconds the object is moving ____ m/s.
After 1 second it is moving ____ m/s.
After 2 seconds it is moving ____ m/s.
After 3 seconds it is moving ____ m/s.

B. So, obviously, it is gaining ____ m/s of velocity every second
OR its acceleration is:

You should have found that the acceleration is 4 m/s^2 (also the slope of the line). Also, notice that the sloped line makes a triangle with the x-axis.

C. With a kinematic equation, calculate the displacement of the object from 0 to 1 seconds.

You should have that it moved 2 m. Record it in the table.

D. Draw a straight line from 1 second up to the line, making a small triangle. Remembering that the area of a triangle = ½(Base)(Height), calculate the area of the triangle.

Hmmmm. So the area of the triangle equaled the displacement of the object. [What about units? (Base)Height = sec(m/sec) = meters or displacement]

E. With a kinematic equation, calculate the displacement of the object from 0 to 2 seconds.

F. Calculate the area of the triangle drawn straight up from 2 seconds.

And once again it works. Record it in the table.

G. Calculate the displacement of the object at 3 seconds and 4 seconds. Use the areas of the triangles. *Record them in the table.*

H. Draw these positions on the Position vs Time graph. For ease, let's assume the object started at 0 m. Just draw dots. The shape will be obvious after.

1A) y = 20sin35° = 11.5 m find x on your own.
2A) θ is greater than 90°, so θ = 90° + 35° = 125°
2B) y = 22sin125° = 18 m, find x.
3) Did you see that Vf = 0 m/s (at the top)? Use the $V_f^2 = V_i^2$ … formula to get Vi = 15.3 m/s
4) a = 4.15 m/s^2