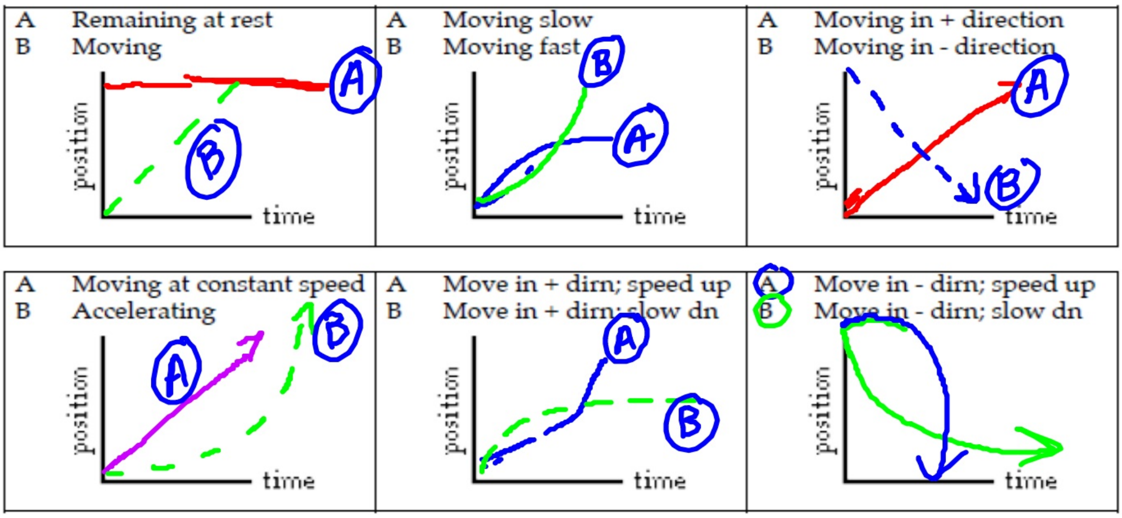
## Review:

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) ___+___

| Direction | Speeding ↑ or ↓ | Acceleration |
|---|---|---|
| + | ↑ (+) | + |
| + | ↓ (−) | − |
| − | ↑ (+) | − |
| − | ↓ (−) | + |

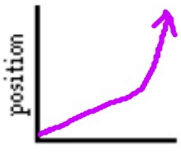
## Interpreting Position-Graphs

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

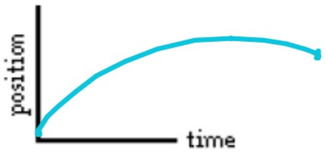


3. For each type of accelerated motion, construct the appropriate shape of a position-time graph.

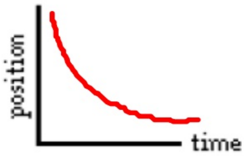
**Moving with a + velocity and a + acceleration**



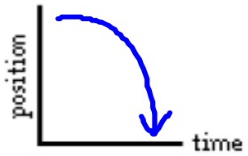

**Moving with a + velocity and a - acceleration**




**Moving with a - velocity and a + acceleration**



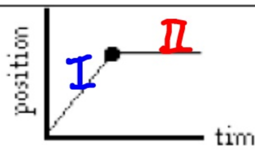

**Moving with a - velocity and a - acceleration**



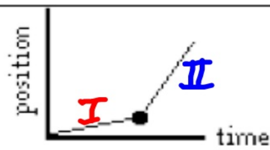

- vel ⇒ - direction
- slowing down
+ accel

- vel ⇒ - direction
+ speeding ↑
- accel

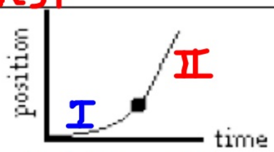
4. Use your understanding of the meaning of slope and shape of position-time graphs to describe the motion depicted by each of the following graphs.



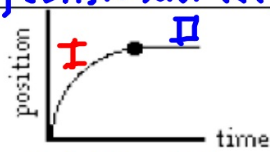

Verbal Description:
I: +dir, const. vel., no accel.
II: at rest




Verbal Description:
I: +dir; const. slow vel; no accel
II: " "; const. fast vel; " "

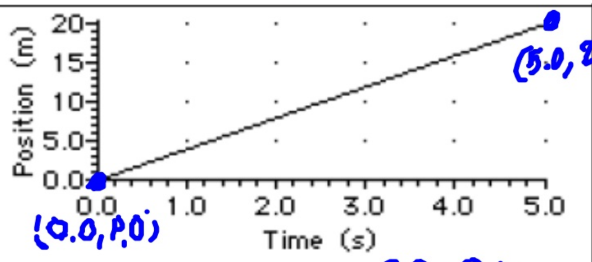



Verbal Description:
I: +dir; speeding up; + accel
II: +dir.; const. vel; no accel.

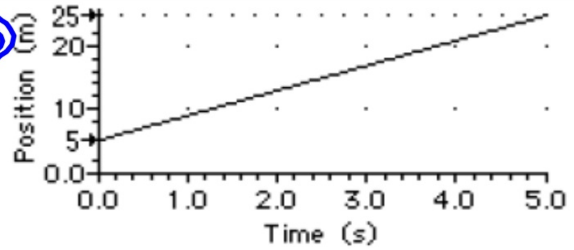



Verbal Description:
I: +dir; slowing down; - accel
II: at rest

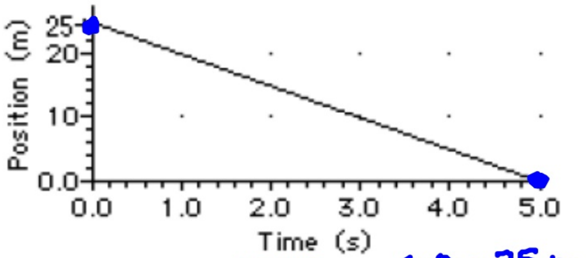
5. Use the position-time graphs below to determine the velocity. **PSYW**



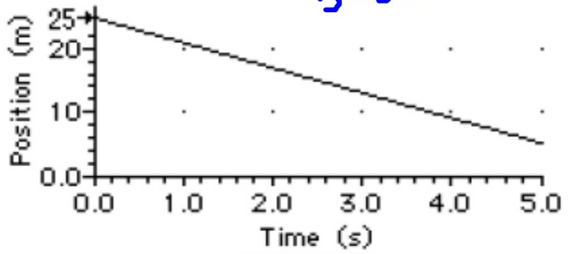

PSYW: $4.0 \text{ m/s} = \frac{20-0 \text{ m}}{5-0 \text{ s}}$




PSYW: $4.0 \frac{m}{s} = \frac{25-5 \text{ m}}{5-0 \text{ s}}$




PSYW: $-5.0 \text{ m/s} = \frac{0.0-25 \text{ m}}{5.0-0.0 \text{ s}}$

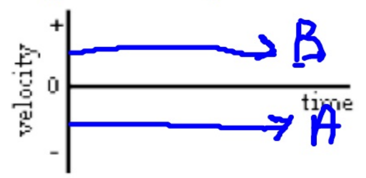



PSYW: $-4.0 \frac{m}{s} = \frac{5-25 \text{ m}}{5-0 \text{ s}}$

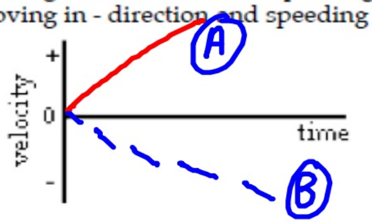
## Interpreting Velocity-Graphs

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

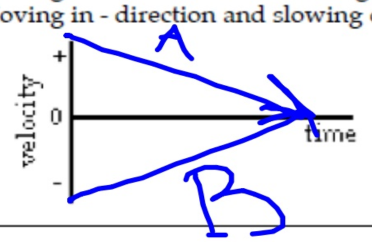
A Moving at constant speed in - direction
B Moving at constant speed in + direction



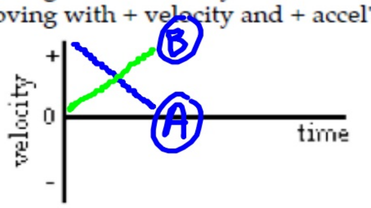

A Moving in + direction and speeding up
B Moving in - direction and speeding up



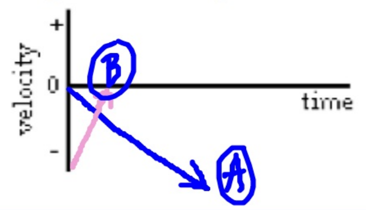

A Moving in + direction and slowing down
B Moving in - direction and slowing down



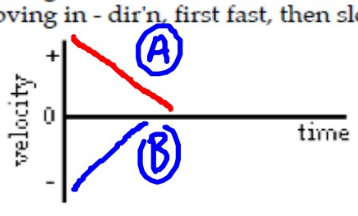

A Moving with + velocity and - accel'n
B Moving with + velocity and + accel'n



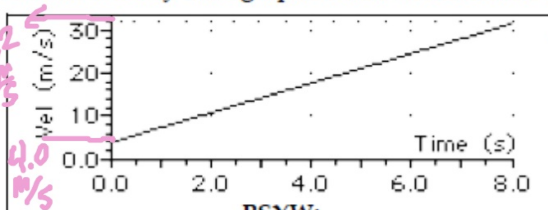

A Moving with - velocity and - accel'n
B Moving with - velocity and + accel'n



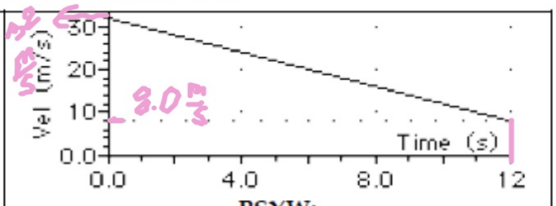

A Moving in + dir'n, first fast, then slow
B Moving in - dir'n, first fast, then slow



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




**PSYW:**




**PSYW:**

$$a = \frac{\Delta V}{\Delta t} = \frac{V_f - V_i}{t_f - t_i}$$

$$= \frac{32 - 4.0 \frac{m}{s}}{8.0 - 0.0 s}$$

$$= \frac{28 \frac{m}{s}}{8.0 s}$$

$$= 3.5 \, m/s^2$$

$$a = \frac{V_f - V_i}{t_f - t_i}$$

$$= \frac{8.0 - 32 \frac{m}{s}}{12 - 0.0 s}$$

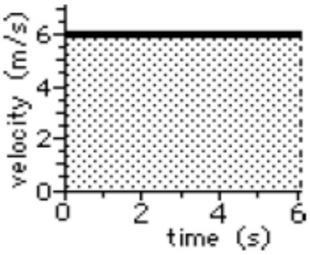
$$= \frac{-24 \frac{m}{s}}{12 s} = -2.0 \frac{m}{s^2}$$

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**

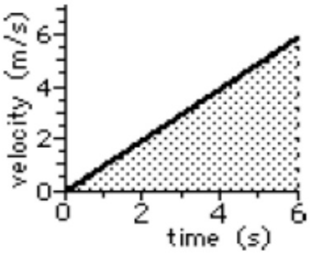
$$= (\Delta V)(\Delta t) = \Delta x$$

$$\frac{m}{s} * s = m$$

$$V = \frac{\Delta X}{\Delta t}$$

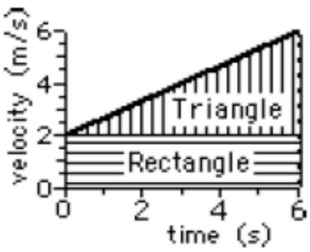
... **triangle**, then use

area = 0.5 * base*height




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

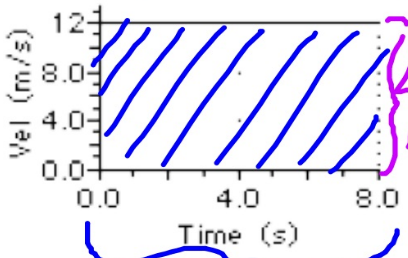
... **trapezoid**, then make it into a rectangle + triangle and add the two areas.



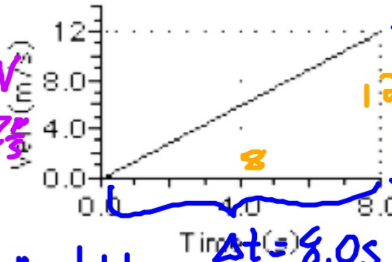

$A_{total} = A_{rectangle} + A_{triangle}$

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

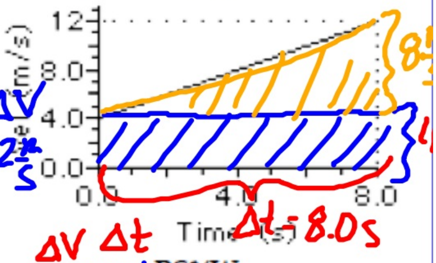
Find the displacement of the objects represented by the following velocity-time graphs.




PSYW:




PSYW:




PSYW:

$\Delta t = 8.0s$

$(\Delta x = v \Delta t$

$A = (12 m/s)(8.0s)$

$96m$

$A = \frac{1}{2}bh$

$\frac{1}{2}(12 \cdot 8) = 48m$

$\Delta x$

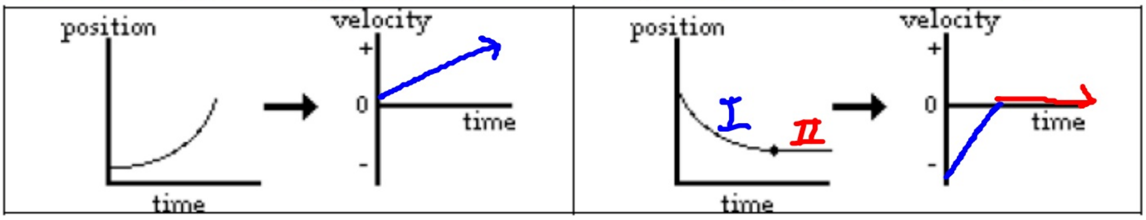
$\Delta v \; \Delta t$

$(4)(8) = 32$

$0.5(8)(8) = 32$

$64m$

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



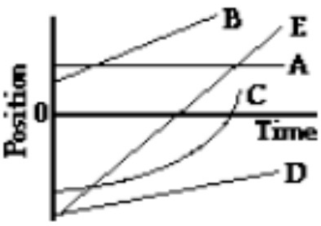

+dir
speeding up
+accel

I: -dir
slowing down
+ accel

II: at rest
accel=0
vel=0

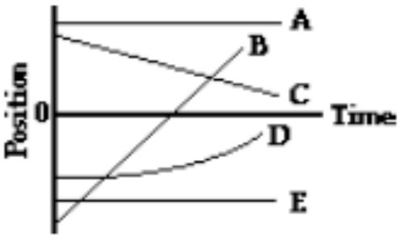
1. The slope of the line on a position vs. time graph reveals information about an object's velocity. The magnitude (numerical value) of the slope is equal to the object's speed and the direction of the slope (upward/+ or downward/-) is the same as the direction of the velocity vector. Apply this understanding to answer the following questions.

a. A horizontal line means at rest.
b. A straight diagonal line means const. velocity.
c. A curved line means accelerating.
d. A gradually sloped line means slow const. vel..
e. A steeply sloped line means fast const. vel..



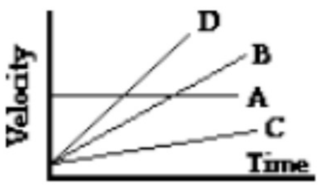

2. The motion of several objects is depicted on the position vs. time graph. Answer the following questions. Each question may have less than one, one, or more than one answer.

A,E a. Which object(s) is(are) at rest?
D b. Which object(s) is(are) accelerating?
A,E c. Which object(s) is(are) not moving?
none ~~B~~ d. Which object(s) change(s) its direction?
B ~~C~~ e. Which object is traveling fastest?
C ~~E~~ f. Which moving object is traveling slowest?
D g. Which object(s) is(are) moving in the same direction as object B?



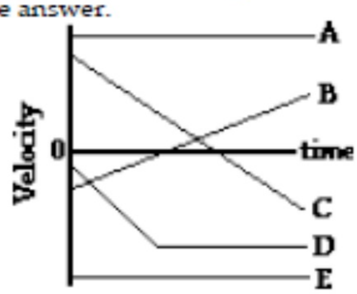

3. The slope of the line on a velocity vs. time graph reveals information about an object's acceleration. Furthermore, the area under the line is equal to the object's displacement. Apply this understanding to answer the following questions.

a. A horizontal line means constant speed.
b. A straight diagonal line means constant acceleration.
c. A gradually sloped line means speeding up at a slow pace.
d. A steeply sloped line means speeding up at a fast rate.

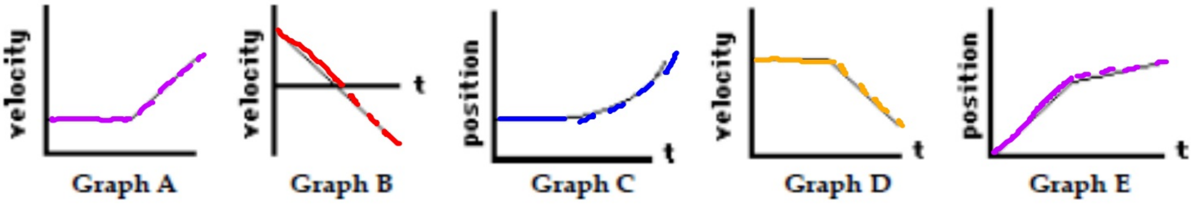



4. The motion of several objects is depicted by a velocity vs. time graph. Answer the following questions. Each question may have less than one, one, or more than one answer.

~~Ø~~ a. Which object(s) is(are) at rest?
B,C b. Which object(s) is(are) accelerating?
~~Ø~~ c. Which object(s) is(are) not moving?
C,B d. Which object(s) change(s) its direction?
B e. Which accelerating object has the smallest acceleration?
C ~~or D~~ f. Which object has the greatest acceleration?
D g. Which object(s) is(are) moving in the same direction as object E?



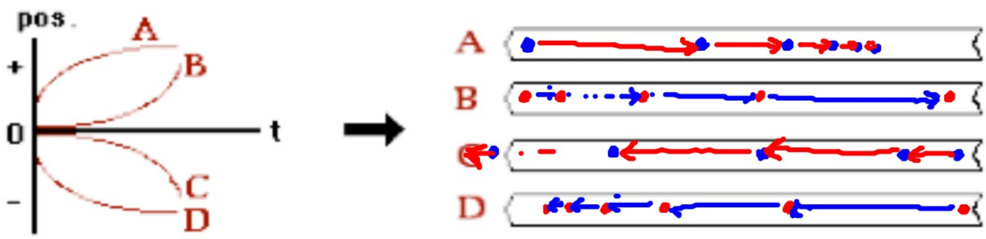
5. The graphs below depict the motion of several different objects. Note that the graphs include both position vs. time and velocity vs. time graphs.




The motion of these objects could also be described using words. Analyze the graphs and match them with the verbal descriptions given below by filling in the blanks.

| Verbal Description | Graph |
|---|---|
| a. The object is moving fast with a constant velocity and then moves slow with a constant velocity. | E |
| b. The object is moving in one direction with a constant rate of acceleration (slowing down), changes directions, and continues in the opposite direction with a constant rate of acceleration (speeding up). | B |
| c. The object moves with a constant velocity and then slows down. | D |
| d. The object moves with a constant velocity and then speeds up. | A |
| e. The object maintains a rest position for several seconds and then accelerates. | C |

6. Consider the position-time graphs for objects A, B, C and D. On the *ticker tapes* to the right of the graphs, construct a dot diagram for each object. Since the objects could be moving right or left, put an arrow on each *ticker tape* to indicate the direction of motion.




7. Consider the velocity-time graphs for objects A, B, C and D. On the *ticker tapes* to the right of the graphs, construct a dot diagram for each object. Since the objects could be moving right or left, put an arrow on each *ticker tape* to indicate the direction of motion.