Rules to remember when graphing motion with PT, VT, and AT graphs

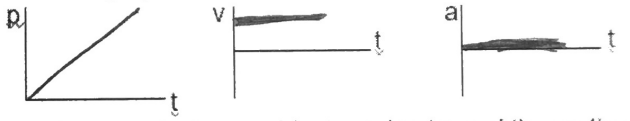
1. **The position time graph: "Where is the object?"**
   A. **The origin of the position time graph is the location of the motion sensor.**
2. **The velocity time graph: "How fast is the object moving?"**
3. **The acceleration time graph: "Is the object changing its velocity?"**
4. **Only dealing with constant acceleration**
   A. **Therefore only straight horizontal lines on the acceleration time graph**
5. **Only straight diagonal or straight horizontal lines on the velocity time graph**
6. **Straight diagonal lines, horizontal lines, or curved lines on the position time graph**
   A. **Curved lines on the position time graph means the object is accelerating.**
   B. **Straight lines on the position time graph means the object is not accelerating. (moving at constant velocity or at rest)**

A. Moving away from the motion sensor = positive quadrant on the velocity time graph (direction of motion).

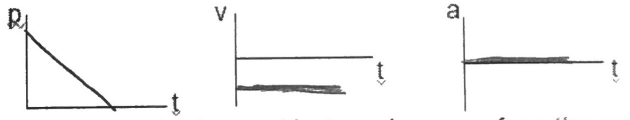
B. Moving toward the motion sensor = negative quadrant on the velocity time graph (direction of motion).

Other Motion Graphs

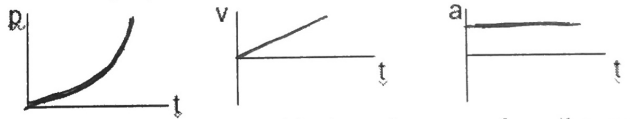
1. Draw the position time, velocity time, and acceleration time graphs for an object moving away from the motion sensor at a constant velocity.



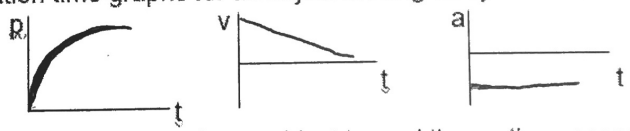
2. Draw the position time, velocity time, and acceleration time graphs for an object moving toward the motion sensor at a constant velocity.



3. Draw the position time, velocity time, and acceleration time graphs for an object moving away from the motion sensor while speeding up.

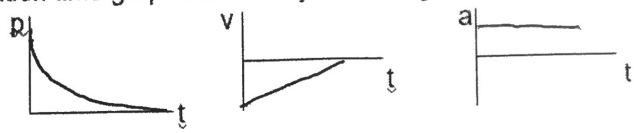


4. Draw the position time, velocity time, and acceleration time graphs for an object moving away from the motion sensor while slowing down.



5. Draw the position time, velocity time, and acceleration time graphs for an object toward the motion sensor while speeding up.

6. Draw the position time, velocity time, and acceleration time graphs for an object moving toward the motion sensor while slowing down.



Acceleration Practice Problems

1. A ball rolls for 15 seconds (t). If the initial velocity of the ball was 0.8 m/s (v_i) and the final velocity was 7 m/s (v_f), what was the acceleration of the ball ?

Formula:	Plug in numbers:	Answer:
$a = \frac{v_f - v_i}{t}$	$a = \frac{(7\ m/s - 0.8\ m/s)}{15\ s}$	$.46\ m/s^2$

2. A meteoroid changed velocity from 1.0 km/s (v_i) to 1.8 km/s (v_f) in 0.03 seconds (t). What is the acceleration of the meteoroid?

Formula:	Plug in numbers:	Answer:
$a = \frac{v_f - v_i}{t}$	$a = \frac{(1.8 km/s - 1.0\ km/s)}{.03s}$	$26.67\ km/s^2$

3. A car going 50mph (v_i) accelerates to pass a truck. Five seconds (t) later the car is going 80mph (v_f). Calculate the acceleration of the car in m/s^2. careful! hours need to be changed to seconds to make units match.

Formula:	Plug in numbers:	Answer:
$a = \frac{v_f - v_i}{t}$	$\frac{50\ mi}{hr} \mid \frac{1609m}{1\ mi} \mid \frac{1hr}{3600s} = 22.35\ m/s$ $\frac{80\ mi}{hr} \mid \frac{1609m}{1\ mi} \mid \frac{1hr}{3600s} = 35.76\ m/s$ $a = \frac{(35.76\ m/s - 22.35\ m/s)}{5s}$	$2.68\ m/s^2$

4. The space shuttle releases a space telescope into orbit around the earth. The telescope goes from being stationary (v_i) to traveling at a speed of 1700 m/s (v_f) in 25 seconds (t). What is the acceleration of the satellite?

Formula:	Plug in numbers:	Answer:
$a = \frac{v_f - v_i}{t}$	$a = \frac{(1700\ m/s - 0\ m/s)}{25\ s}$	$68\ m/s^2$

5. A ball is rolled at a velocity of 12 m/sec (v_i). After 36 seconds (t), it comes to a stop (v_f). What is the acceleration of the ball?

Formula:	Plug in numbers:	Answer:
$a = \frac{v_f - v_i}{t}$	$a = \frac{(0\ m/s - 12\ m/s)}{36s}$	$-.33\ m/s^2$