Problem Solving – Smooth Form

-given

- equation to be solved
- solve equation for unknown (with symbols)
- plug in #'s w/ units
- answer w/units

4. An airplane flies at a constant speed of 300. m/s. How long will it take the plane to fly a distance of 1.2 km?

$d = 1200\,m$ – $V_{avg} = d/t$

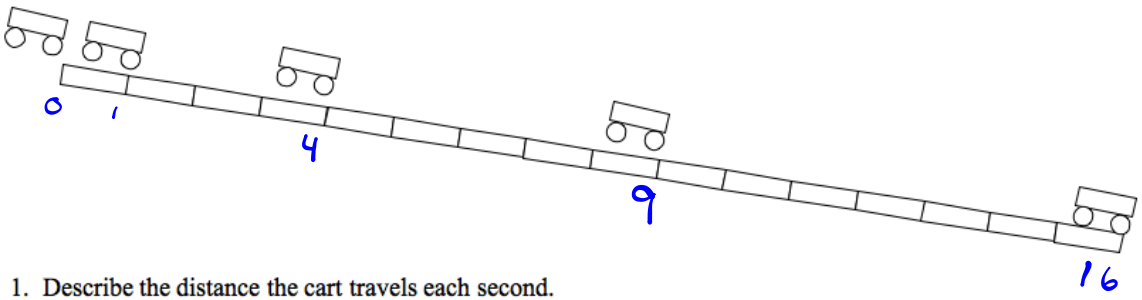
$V = 300.\,m/s$

– $t = d/V_{avg} = 1200\,m / 300.\,m/s = \boxed{4.0\,s}$

5. A car travels at an average speed of 30. m/s. How far will the car go in 3.0 hours? 3.3600s

Acceleration

A cart is allowed to roll freely down a ramp, as shown below. The position of the cart is marked after each second.



1. Describe the distance the cart travels each second.

   increases, quadratically

2. Describe any changes in the speed and velocity of the cart as it rolls downhill.

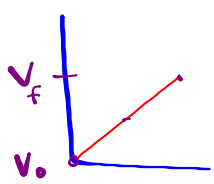
   increases linearly

Time (s)	Position (m)	Average Velocity (m/s)	Instantaneous Velocity (m/s)	Acceleration
0	0	0	0	2
1	1	1	2	2
2	4	2	4	2
3	9	$\vec{V}_{avg} = \frac{\Delta \vec{x}}{t}$ 3	$V_{avg} = \frac{V_0 + V_f}{2}$ 6	$\vec{a} = \frac{V_f - V_0}{t}$ 2
4	16	4	8	2

Instantaneous initial velocity = $\vec{V}_0$

Instantaneous final velocity = $\vec{V}_f$

Average velocity = $\frac{\vec{V}_0 + \vec{V}_f}{2}$



Acceleration: rate of change of velocity

Formula:

$$\vec{a} = \frac{\Delta \vec{V}}{t}$$

$$\vec{a} = \frac{\vec{V}_f - \vec{V}_0}{t}$$

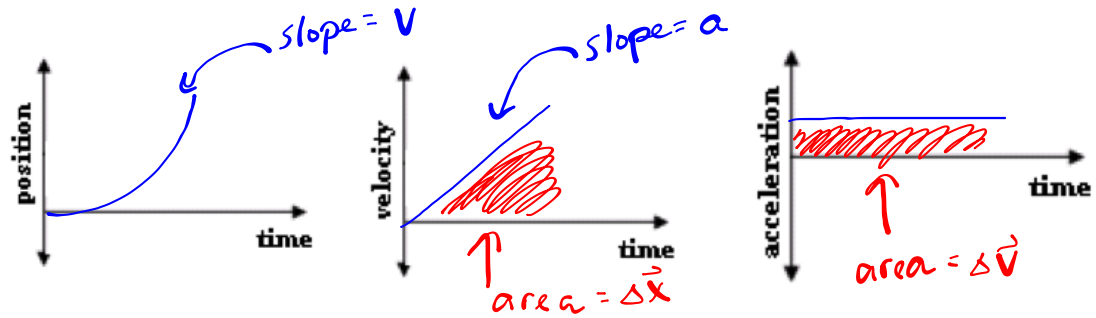
Units:

$$\left[\frac{m/s}{s}\right] = \left[m/s^2\right]$$

Type:

vector

3. Use the chart you just filled in to sketch the following graphs of motion for the cart.



4. What is the relationship between position and time? quadratic

5. What is the relationship between velocity and time? linear

6. What is the relationship between acceleration and time? constant

Uniform acceleration: constant acceleration (or zero accl)

7. What is the meaning of the slope of the velocity-time graph?

accl

8. What is the meaning of the area under the velocity-time graph?

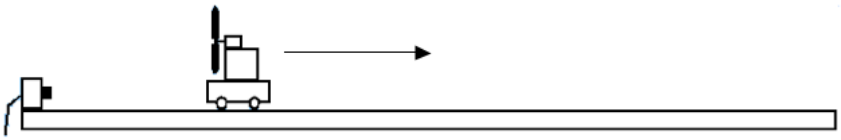
displacement

9. What is the meaning of the slope of the position-time graph?

velocity

Graphs of Accelerated Motion

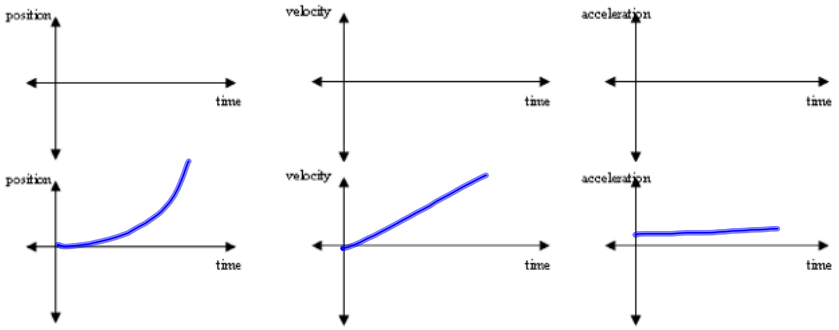
DEMO #1



Sketch below your predictions and the results for the fan-cart moving **away** from the detector and **speeding up** at a steady rate.

PREDICTION

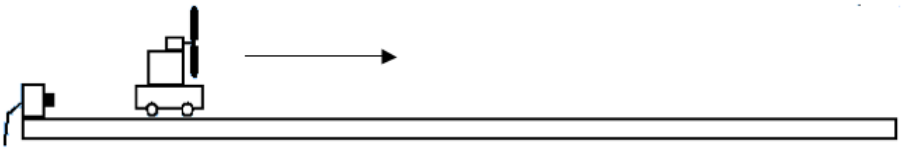
RESULTS



1. What is the significance of the slope of the velocity-time graph?

accl

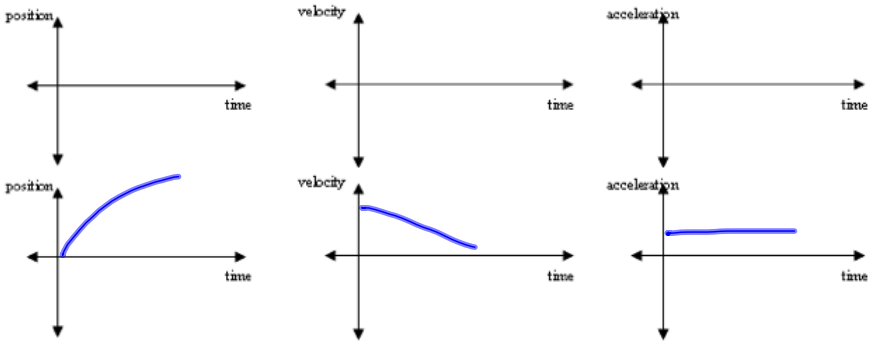
DEMO #2



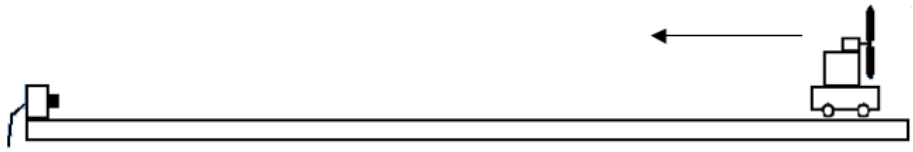
Sketch below your predictions and the results for the fan-cart moving **away** from the detector and **slowing down** at a steady rate.

PREDICTION

RESULTS

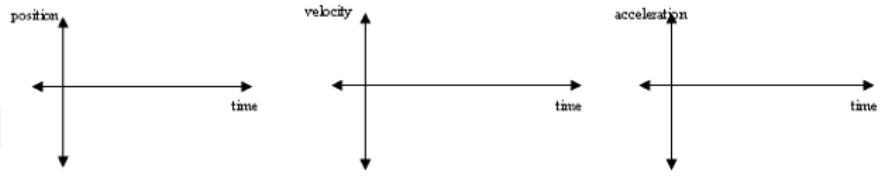


DEMO #3

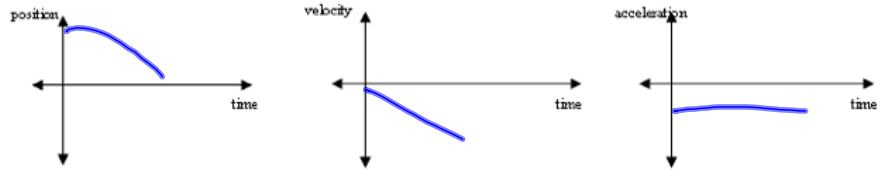


Sketch below your predictions and the results for the fan-cart moving **towards** the detector and **speeding up** at a steady rate.

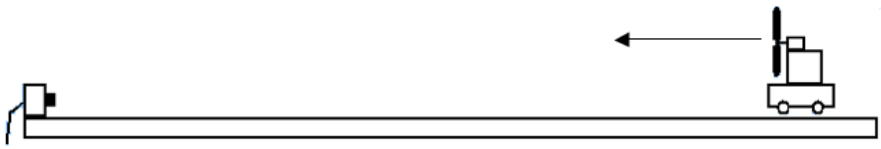
PREDICTION



RESULTS

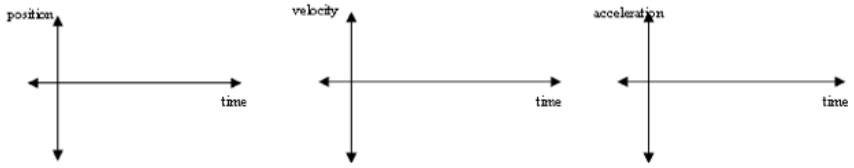
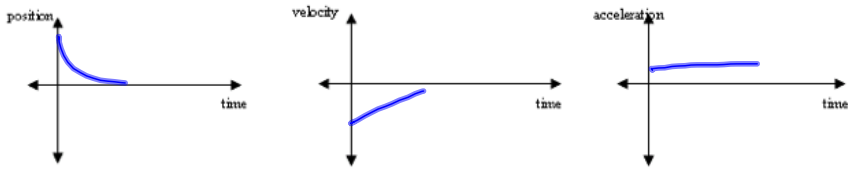


DEMO #4



Sketch below your predictions and the results for the fan-cart moving **towards** the detector and **slowing down** at a steady rate.

PREDICTION



RESULTS