EXAMPLES:

FOR EACH OF THE FOLLOWING EXAMPLES ASSUME

+ MEANS RIGHT ; – MEANS LEFT.

1. A skater changes her velocity from -2.0 m/s to -14.0 m/s in 3.0 seconds. What is the skater's acceleration?

Looking for Acceleration of the skater	**Solution** $\vec{a} = \frac{\vec{v} - \vec{v}_o}{\Delta t} = \frac{-14.0\,m/s - (-2.0\,m/s)}{3\,s}$ $= \frac{-12.0\,m/s}{3\,s}$ $= -4\,m/s^2$
Given Beginning (initial) velocity = -2.0 m/s Final velocity = -14.0 m/s Change in time = 3 seconds	
Relationship $\vec{a} = \frac{\Delta\vec{v}}{\Delta t} = \frac{\vec{v} - \vec{v}_o}{t - t_o}$	

Follow up questions:

a. What direction is the initial velocity? left

b. Is the skater speeding up or slowing down? speeding up

c. Is the acceleration positive or negative? negative

d. What direction is the acceleration? left.

2. A car brakes from +16m/s to 1.0m/s in 2.0s. What is the car's acceleration?

Looking for Car's acceleration	**Solution** $\vec{a} = \frac{\vec{v} - \vec{v}_o}{\Delta t} = \frac{1.0\,m/s - 16\,m/s}{2.0\,s}$ $= \frac{-15\,m/s}{2.0\,s}$ $= -7.5\,m/s^2$
Given Initial velocity = +16 m/s Final velocity = +1.0 m/s Time 2.0s	
Relationship $\vec{a} = \frac{\vec{v} - \vec{v}_o}{\Delta t}$	

Follow up questions:

a. What direction is the initial velocity? right

b. Is the car speeding up or slowing down? slowing down

c. Is the acceleration positive or negative? negative

d. What direction is the acceleration? left.

3. A can of sardines in olive oil accelerates from -80.0m/s to -20.0m/s in 30s, what is the can of sardines in olive oil's acceleration?

Looking for Acceleration of the can of sardines in olive oil	**Solution** $\vec{a} = \frac{\vec{v} - \vec{v}_o}{\Delta t} = \frac{-20.0\,m/s - (-80.0\,m/s)}{30\,s}$ $\vec{a} = \frac{60.0\,m/s}{30\,s} = 2\,m/s^2$
Given Beginning (initial) velocity = -80.0 m/s Final velocity = -20.0 m/s Change in time = 30 seconds	
Relationship $\vec{a} = \frac{\vec{v} - \vec{v}_o}{\Delta t}$	

Follow up questions:

a. What direction is the initial velocity? left

b. Is the can of sardines in olive oil speeding up or slowing down? slowing down

c. Is the acceleration positive or negative? positive

d. What direction is the acceleration? right

4. A leather glove filled with sriracha sauce changes its velocity from 3m/s to 23m/s 5.0 seconds. What is the leather glove filled with sriracha sauce's acceleration?

Looking for Acceleration of the leather glove filled with sriracha sauce	**Solution** $\vec{a} = \frac{\vec{v} - \vec{v}_o}{t} = \frac{23\,m/s - 3\,m/s}{5.0\,s}$ $\vec{a} = 4.0\,m/s^2$
Given Beginning (initial) velocity = 3 m/s Final velocity = 23 m/s Change in time = 5.0 seconds	
Relationship $\vec{a} = \frac{\vec{v} - \vec{v}_o}{t}$	

Follow up questions:

a. What direction is the initial velocity? right

b. Is the leather glove filled with sriracha sauce speeding up or slowing down? speeding up

c. Is the acceleration positive or negative? positive

d. What direction is the acceleration? right

Like all mathematical formulas, the acceleration formula can be rearranged in order to solve for any of the variable quantities.

We can write the formula in the following ways:

$$\Delta\vec{v} = \vec{a}\Delta t$$

$$\vec{v} = \vec{v}_o + \vec{a}\Delta t$$

$$t = \frac{\Delta\vec{v}}{\vec{a}} = \frac{\vec{v} - \vec{v}_o}{\vec{a}}$$

EXAMPLES:

5. A man's wallet with assorted deli meat where the bills should be accelerates at -4.0m/s^2 for 2.0s. What is the change in its velocity?

Looking for Change in velocity of the man's wallet with assorted deli meat where the bills should be	**Solution** $\Delta\vec{v} = \vec{a}t = -4.0\,m/s^2 \times (2.0\,s)$ $= -8.0\,m/s$
Given Acceleration = -4.0m/s^2 Change in time = 2.0s	
Relationship $\Delta\vec{v} = \vec{a}\Delta t$	

Follow up questions:

a. From the given information can you determine the direction of initial velocity? NO

b. Can you determine if the man's wallet with assorted deli meat where the bills should be speeding up or slowing down? NO

c. Is the acceleration positive or negative? negative

d. What direction is the acceleration? left

6. How much time is required for a truck to speed up from -7.0m/s to -19m/s if the acceleration is 8.0m/s^2 to the left?

Looking for Time for the truck's velocity to change	**Solution** $t = \frac{\vec{v} - \vec{v}_o}{\vec{a}} = \frac{-19\,m/s - (-7.0\,m/s)}{-8.0\,m/s^2} = \frac{-12\,m/s}{-8.0\,m/s^2} = 1.5\,s$
Given Initial velocity = -7.0m/s Final velocity = -19m/s Acceleration = -8.0m/s^2	
Relationship $t = \frac{\vec{v} - \vec{v}_o}{\vec{a}}$	

Follow up questions:

a. What direction is the initial velocity? left

b. Is the truck speeding up or slowing down? speeding up

c. Is the acceleration positive or negative? negative

d. What direction is the acceleration? left

7. A tube sock that has lost its elasticity so now it always slouches down around your ankle has an initial velocity of 6.0m/s to the left. The tube sock that has lost its elasticity so now it always slouches down around your ankle then accelerates to the right at 7.0m/s^2 for 4.0s. What is the final velocity of the tube sock that has lost its elasticity so now it always slouches down around your ankle?

Looking for Final velocity of the tube sock that has lost its elasticity so now it always slouches down around your ankle	**Solution** $\vec{v} = \vec{v}_o + \vec{a}t = -6.0\,m/s + 7.0\,m/s^2(4.0\,s)$ $\vec{v} = -6.0\,m/s + 28\,m/s$ $\vec{v} = 22\,m/s$
Given Initial velocity = -6.0m/s Acceleration = 7.0m/s^2 Time = 4.0s	
Relationship $\vec{v} = \vec{v}_o + \vec{a}\Delta t$	

Follow up questions:

a. What direction is the initial velocity? left

b. Is the tube sock that has lost its elasticity so now it always slouches down around your ankle speeding up or slowing down? BOTH! (slows from -6.0m/s to 0m/s, then speeds up from 0m/s to 22m/s)

c. Is the acceleration positive or negative? positive

d. What direction is the acceleration? right

Questions.

1. $\vec{v}_i = 24\ m/s$, $\vec{v} = 15\ m/s$, $t = 12\ s$

$$\vec{a} = \frac{\Delta\vec{v}}{t} = \frac{\vec{v} - \vec{v}_i}{t} = \frac{15\ m/s - 24\ m/s}{12\ s} = \frac{-9\ m/s}{12\ s} = -0.75\ m/s^2 \Rightarrow -0.8\ m/s^2$$

(acceptable) (correct)

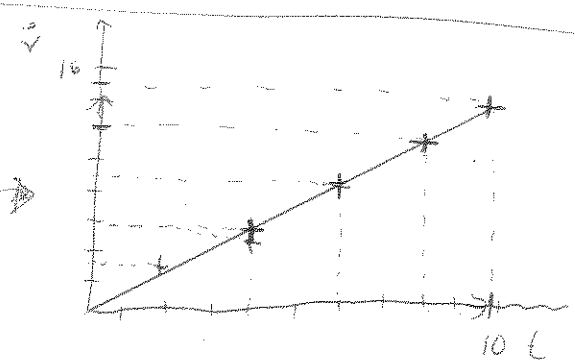
$\Rightarrow 0.8\ m/s^2\ [S]$

2. $\vec{v}_i = -85\ m/s$, $\vec{v} = -15\ m/s$, $t = 4.5\ s$

$$\vec{a} = \frac{\Delta\vec{v}}{t} = \frac{-15\ m/s - (-85\ m/s)}{4.5\ s} = 15.\overline{5}\ m/s^2 = 16\ m/s^2 \text{ right}$$

3.

t (s)	$\vec{v}$ (m/s)
0	0
2	3
4	6
6	9
8	12
10	15



$\vec{a} = \frac{\Delta\vec{v}}{t}$ = SLOPE

$$\vec{a} = \frac{15\ m/s - 0\ m/s}{10\ s - 0\ s} = 1.5\ m/s^2$$

4. $$t = \frac{\Delta\vec{v}}{\vec{a}} = \frac{\vec{v} - \vec{v}_i}{\vec{a}} = \frac{0 - (30.0\ m/s)}{-4.0\ m/s^2} = 7.5\ s$$

5. $$\vec{v} = \vec{v}_i + \vec{a}t = 2.0\ m/s + (4.0\ m/s^2)(5.0\ s) = 22\ m/s$$ (* I chose down the ramp as +)

$= 22\ m/s$ down the ramp

6. $\vec{v}_i = +4.0\ m/s$, $\vec{a} = -4.0\ m/s^2$, $t = 3.0\ s$

$\vec{v} = \vec{v}_i + \vec{a}t$

$\vec{v} = 4.0\ m/s + (-4.0\ m/s^2)(3.0\ s)$

$\vec{v} = -8.0\ m/s$

$\vec{v} = 8.0\ m/s$ down the ramp

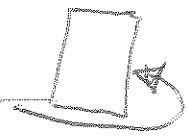
$v = 8.0\ m/s$

7. $$t = \frac{\Delta\vec{v}}{a} = \frac{-10\ m/s - 20\ m/s}{-10\ m/s^2} = 3\ s$$

8. $\vec{v}_i = -60.0\ km/h = \frac{60.0\ km}{h} \times \frac{1000\ m}{km} \times \frac{1\ h}{3600\ s} = -16.\overline{6}\ m/s$, $\vec{v} = 0$, $t = 2.2\ s$

$$\vec{a} = \frac{\Delta\vec{v}}{t} = \frac{0 - (-16.\overline{6}\ m/s)}{2.2\ s} = 7.6\ m/s^2$$

$= 7.6\ m/s^2\ [E]$



9. Increase.