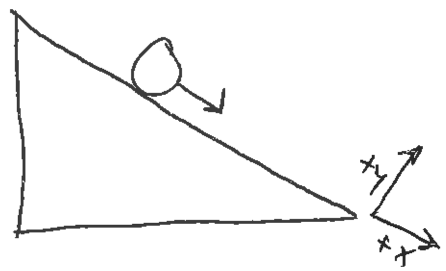
# Worksheet #2 Solutions

① a.




**Known:**

$t = 5$ seconds

$\Delta x = x - x_0 = 50$ meters

$v_0 = 0$ m/s

**Unknown:**

$a$

Ideally, we want to use an equation that has only one unknown variable. Luckily, we have one:

$$x = x_0 + v_0 t + \frac{1}{2} a t^2$$

Solving for a,

$$x - x_0 = \Delta x = v_0 t + \frac{1}{2} a t^2$$

$$\frac{1}{2} a t^2 = \Delta x - v_0 t$$

$$a = \frac{2(\Delta x - v_0 t)}{t^2} = \frac{2(50 - (0)(5))}{25} = \boxed{4 \text{ m/s}^2}$$

b. Now we know $t$, $v_0$, and $a$, but not $\Delta x$. We can use the same equation, because we will still have only 1 unknown variable:

$v_0 = 2.0$ m/s

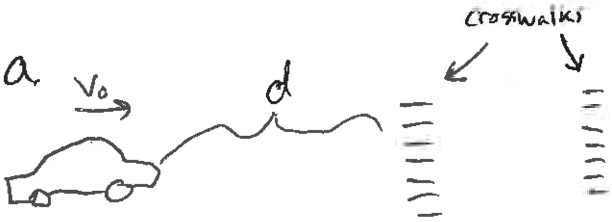
$a = 4$ m/s$^2$

$$\Delta x = v_0 t + \frac{1}{2} a t^2 = (2)(5) + \frac{1}{2}(4)(25) = \boxed{60 \text{ meters}}$$

c. We can do the same thing as part b, but now $v = -2.0$ m/s because it is now uphill, which we have defined as the negative x-direction:

$v_0 = -2.0$ m/s $\quad \Delta x = (-2)(5) + \frac{1}{2}(4)(25) = \boxed{40 \text{ meters}}$

2) a




**Known:**

$V_0 = 20\ m/s$

$d = 50\ m$

$a = -3.8\ m/s^2$

$V_f = 0\ m/s$

**Unknown:**

$\Delta x$, $t$

First, we will determine how long the car takes to stop. Next, we will use this to determine how far the car travels before stopping.

We need an equation for $t$ that does not depend on $\Delta x$. Therefore, we can use $a = \frac{V_f - V_0}{t} \Rightarrow t = \frac{V_f - V_0}{a}$

Now, we plug this into our equation for $\Delta x$:

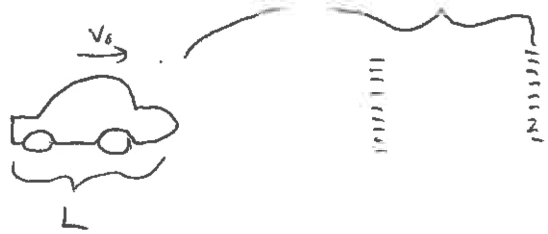
$$\Delta x = V_0 t + \frac{1}{2} a t^2$$

$$= \frac{V_0 (V_f - V_0)}{a} + \frac{1}{2} \frac{a (V_f - V_0)^2}{a^2}$$

$$\Delta x = \frac{20(-20)}{-3.8} + \frac{1}{2} \frac{(-3.8)(-20)^2}{(-3.8)^2} = 52.6 \text{ meters}$$

So the car will not be able to stop before entering the intersection.

② b.




Knowns

$V_0 = 20\ m/s$
$L = 3.5\ m$
$d = 50m + 20m = 70m$
$t = 3\ s$
$a = 2.3\ m/s^2$

We must determine how far the car travels in 3 seconds and compare that to the distance needed to clear the intersection. To do this, we can use

$$\Delta x = V_0 t + \frac{1}{2} a t^2 = (20)(3) + \frac{1}{2}(2.3)(3)^2$$

$$\Delta x = 70.35\ m$$

At first, it seems as if the car has made it. However, the entire car must make it through. The back of the car must travel $d + L = 73.5$ meters to clear the intersection, so the car does not make it here either.