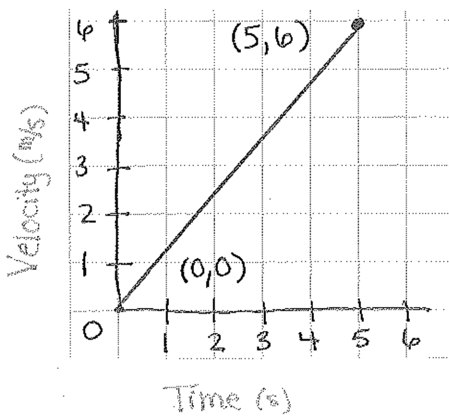
MOTION PRACTICE #2 ANSWER KEY

1. You ride your bike towards the north, starting from rest and constantly increasing your velocity to 6 $^{m}/_{s}$ in 5 seconds.
   a. Sketch a **quantitative** *v-t* graph of your motion



   b. Calculate the **slope** of this graph

$$\text{slope} = m = \frac{v_2 - v_1}{t_2 - t_1} = \frac{(6-0)\,m/s}{(5-0)\,s}$$

$$\boxed{m = 1.2\ m/s^2}$$ ← acceleration units!!

   c. Write the **linear equation** for this graph

$y = mx + b$; $y \to v$, $m \to 1.2$, $x \to t$, $b \to 0$

$$\boxed{v = (1.2\ m/s^2)\,t}$$

   d. Calculate what your **final velocity** would be if you continued this motion for a total time of 8 seconds.

$a = \frac{v_2 - v_1}{t}$ → $v_2 = v_1 + at$ ($v_1 = 0$)

$v_2 = ?$
$v_1 = 0\ m/s$
$a = 1.2\ m/s^2$
$t = 8\ s$

$= 0\ m/s + (1.2\ m/s^2)(8\ s)$

$$\boxed{v_2 = 9.6\ m/s}$$

   e. Use the equation $\boldsymbol{d_2 = \frac{1}{2}at^2 + v_1 t + d_1}$ to calculate your *displacement* after 8 seconds, assuming you started at the flagpole (origin).

$d_2 = ?$
$a = 1.2\ m/s^2$
$t = 8\ s$
$d_1 = 0\ m$
$v_1 = 0\ m/s$

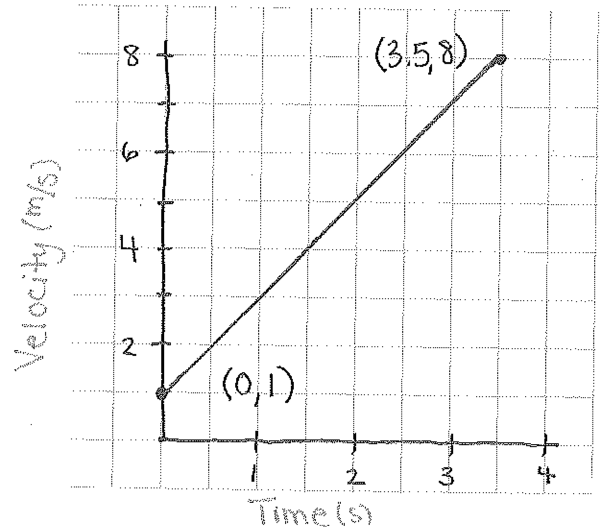
$d_2 = \frac{1}{2}at^2 + v_1 t + d_1$ ($v_1 = 0$, $d_1 = 0$)

$= \frac{1}{2}(1.2\ m/s^2)(8\ s)^2$

$\boxed{d_2 = 38\ m \quad \text{North of the pole}}$

2. You ride your bike to the north, increasing your velocity from 1 m/s to 8 m/s in 3.5 seconds:

   a. Sketch a **quantitative** *v-t* graph of your motion



   b. Calculate the **slope** of this graph

$$m = \frac{V_2 - V_1}{t_2 - t_1} = \frac{8\ m/s - 1\ m/s}{3.5s - 0s}$$

$$\boxed{m = 2.0\ m/s^2}$$

   c. Write the **linear equation** for this graph

$y = mx + b$
↑ ↑ ↑ ↑
v 2 t 1

$$\boxed{V = (2.0 m/s^2)t + (1.0 m/s)}$$

   d. Calculate what your **final velocity** would be if you continued this motion for a total time of 6 seconds.

↙ from 2c

$t = 6s$ $V_2 = (2 m/s^2)t + 1 m/s$
$= (2 m/s^2)(6s) + 1 m/s$

$$\boxed{V_2 = 13\ m/s^2}$$

   e. Use the equation given in #1e to calculate your **final *displacement*** after 9 seconds, assuming you started 5m south of the flagpole *(Hint: $d_1 = -5m$)*. Where are you standing in relation to the flagpole?

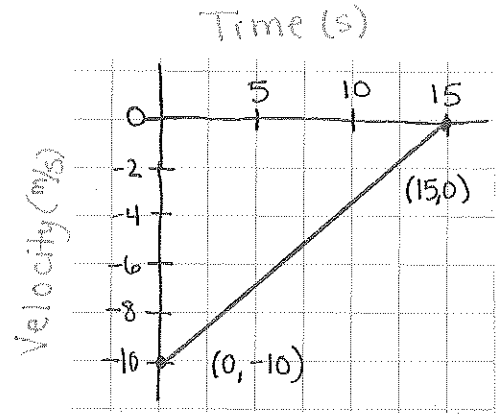
$d_2 = ?$
$a = 2 m/s^2$
$t = 9s$
$d_1 = -5m$
$V_1 = 1 m/s$

$d_2 = \frac{1}{2}at^2 + V_1t + d_1$
$= \frac{1}{2}(2 m/s^2)(9s)^2 + (1 m/s)(9s) + (-5m)$

$\boxed{d_2 = 85\ m \text{ NORTH of the pole}}$

positive!

3. You ride your bike to the south with and initial velocity of 10 $^{m}/_{s}$ and decrease your speed constantly until you come to a stop after 15 seconds:
   a. Sketch a **quantitative** *v-t* graph of your motion



   b. Calculate the **slope** of this graph

$m = \frac{V_2 - V_1}{t_2 - t_1} = \frac{0 \, ^{m}/_{s} - -10 \, ^{m}/_{s}}{15s - 0s}$ ← South!

$m = 0.67 \, ^{m}/_{s^2}$

   c. Use the equation given in #1e to calculate your **final *displacement*** once you've come to a stop, assuming you started 50m north of the flagpole. Where are you standing in relation to the flagpole?

$d_2 = ?$

$d_1 = 50m$

$V_1 = -10 \, ^{m}/_{s}$

$t = 15s$

$a = 0.67 \, ^{m}/_{s^2}$

$d_2 = \frac{1}{2}at^2 + V_1 t + d_1$

$= \frac{1}{2}(0.67 \, ^{m}/_{s^2})(15s)^2 + (-10 \, ^{m}/_{s})(15s) + (50m)$

$= 75.4m - 150m + 50m$

$d_2 = -25m$ → 25 m SOUTH of the pole