Section 7.1b – Basics of Graphing and Slope Intercept Form – Part 2

Slope-Intercept Equation

- Now think about this, a **LINE** is made up of **an INFINTE** number of individual points
- There are **two equations** we are going to talk about this year
- Here is the first one:

$$\boldsymbol{y = mx + b}$$

SLOPE-INTERCEPT FORM

- The variables in this equation are very important

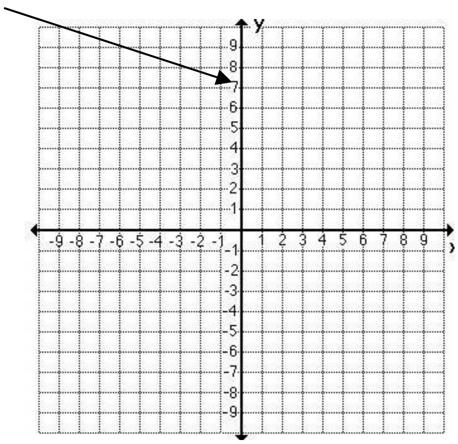
- The $\boldsymbol{m}$: Is the **SLOPE** of the line, represented $\frac{RISE}{RUN}$ also $\frac{CHANGE\ IN\ HEIGHT}{CHANGE\ IN\ LENGTH}$

  The **Slope** is the **same** from any point on the line to another
  The **Slope** stays **constant**

- The $\boldsymbol{b}$: Is the $\boldsymbol{y - intercept}$, **where the line crosses the** $\boldsymbol{y - axis}$

  Why b and not y then?

  $(0, b)$



  No matter where you cross the $y - axis$, what is the $x - value$?

  As mentioned before, is always 0

  So, every $y - intercept$, has the coordinates: $\boldsymbol{(0, b)}$

  The $\boldsymbol{b}$, is wherever **it crosses** the $\boldsymbol{y - axis}$.

No matter where it crosses the $x - value$ is 0

- Lastly, the $x\ and\ y$.

  They represent the $\boldsymbol{(x, y)}$ **coordinates** of **every possible point** on the line

Every line (except 1 type) has a $\boldsymbol{y-intercept}$ and has a $\boldsymbol{slope}$. As an example:

$$y = mx + b \quad \rightarrow \quad y = \frac{2}{3}x + 4$$

- The **Slope** $(\boldsymbol{m})$ is: $\frac{2}{3}$ For **every 2 you go up**, **you go right 3**, both positive

- Remember that the $x\ and\ y$ represent every set of coordinates (x, y)
  So, the $\boldsymbol{y-intercept}$ is when the $\boldsymbol{x-value}$ is 0
  We can **plug 0 in to the equation for $\boldsymbol{x}$** and then **solve for $\boldsymbol{y}$**

$y = \frac{2}{3}x + 4$

$y = \frac{2}{3}(0) + 4$

$y = 0 + 4$

$y = 4$

- $y = mx + b$
- $y = m(0) + b$
- $y = 0 + b$
- $y = b$

So $y = b, when\ x\ is\ 0$

That's why b is the $y - intercept$

Now let's go back to the (x, y), remember that they represent the **coordinates of every possible point on the line**, they also are called **the solution** to the $y = mx + b$ equation.

- What I mean by that is that when I plug the $\boldsymbol{x\ and\ y}$ **values** into the equation of a line, it **stays equal**.

<u>**Example:**</u> $y = \frac{2}{3}x + 4$

i) When $x = 0$

$y = \frac{2}{3}(0) + 4 \quad \rightarrow \quad y = 4$ Coordinates are: $(0, 4)$

ii) When $x = 3$

$y = \frac{2}{3}(3) + 4 \quad \rightarrow \quad y = 2 + 4 = 6$ Coordinates are: $(3, 6)$

iii) When $x = 6$

$y = \frac{2}{3}(6) + 4 \quad \rightarrow \quad y = 4 + 4 = 8$ Coordinates are: $(6, 8)$

- We can continue this infinitely!

So, what do we know so far?

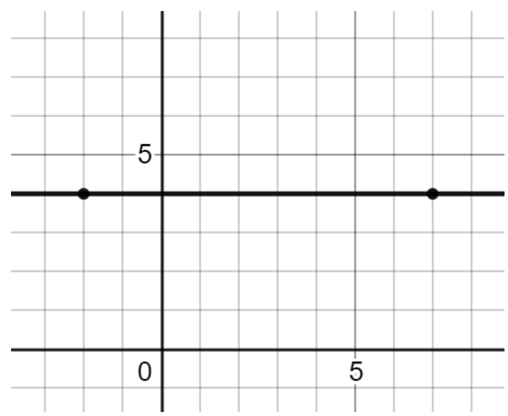
- ✓ Every $\boldsymbol{y-intercept}$ has an $\boldsymbol{x-value}$ **of** $\mathbf{0}$
- ✓ Every $\boldsymbol{x-intercept}$ has a $\boldsymbol{y-value}$ **of** $\mathbf{0}$
- ✓ We can find an **infinite number** of coordinates **(solutions)** for a line

Now for **Slope** we know a few things too.

- ✓ The Slope of a straight line is consistent
- ✓ The Slope can go up or down
- ✓ The Slope is: $\frac{Rise}{Run} = \frac{Change\ of\ Height}{Change\ in\ Length} = \frac{Change\ in\ y}{Change\ in\ x} = \frac{y_2 - y_1}{x_2 - x_1}$

Slope of a Horizontal Line

- ❖ What is the Slope?



Pick any two points on the line and use the Slope Equation

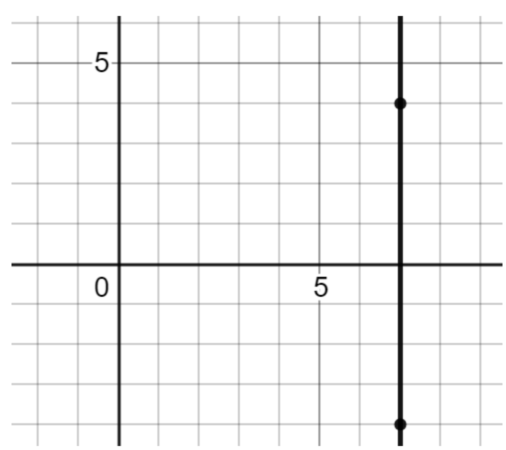
$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{4-4}{7-(-2)} = \frac{0}{9} = 0$$

Since there is **NO CHANGE IN HEIGHT,** every **Horizontal Line** has a:

Slope of: $\mathbf{0}$

Slope of a Vertical Line

- ❖ What is the Slope?



Pick any two points on the line and use the Slope Equation

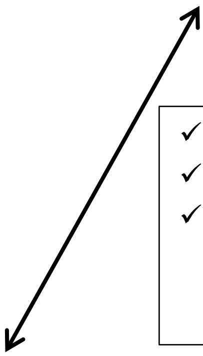
$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{4-(-4)}{7-7} = \frac{8}{0} = Undefined$$

Since there is **NO CHANGE IN LENGHT,** every **Vertical Line** has a:

Slope of: $\boldsymbol{Undefined}$ **(we cannot divide by** $\mathbf{0}$)

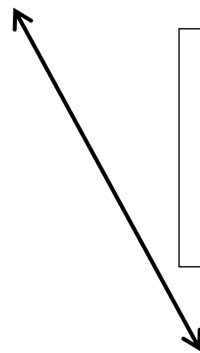
We have seen **4 different types of lines**. Their characteristics will result in **4 types of Slope**.

Look at them from **Left to Right**.



- ✓ The Rise is Positive
- ✓ The Run is Positive
- ✓ So that means the Slope will be:

$$\frac{Positive}{Positive} = Positive$$



- ✓ The Rise is Negative
- ✓ The Run is Positive
- ✓ So that means the Slope will be:

$$\frac{Negative}{Positive} = Negative$$

Horizontal and Vertical Lines. These are Special!

- ✓ The Rise is 0
- ✓ The Run is Finite
- ✓ So that means the Slope will be:

$$\frac{0}{Anything} = 0$$

- ✓ Anything divided by 0 is 0

- ✓ The Rise is Finite
- ✓ The Run is 0
- ✓ So that means the Slope will be:

$$\frac{Anything}{0} = Undefined$$

- ✓ Can't divide by zero

<u>**Solutions to a Line**</u>

- Next is **figuring out if a point is on a line**. That is the same as saying: Is the **following point a solution** to the **equation of the line**.

  - ✓ If the **point is a solution**, then when you plug the (x, y) into the given equation, it will **stay equal**, and the **point is on the line**

  - ✓ If the **point is not a solution**, then when you plug the (x, y) into the given equation, it will **not stay equal**, and the **point is not** on the line

Example 4: Does the line $y = 2x + 5$ go through the point $(1,8)$?

Solution 4:

- Since $\boldsymbol{x}$ **is 1**, we **plug 1** in **for** $\boldsymbol{x}$ and since $\boldsymbol{y}$ **is 8**, we plug **8 in for** $\boldsymbol{y}$.
- Work through the equation and see if it stays equal.
- If **it does**, it's **a solution** (A point on the line)
- If **it doesn't**, it's **not a solution** (Not a point on the line)

$$y = 2x + 5$$

$$8 = 2(1) + 5$$

$$8 = 2 + 5$$

$$8 = 7$$

- 8 DOES NOT EQUAL 7

So that means that $(1, 8)$ is **NOT a solution** to $y = 2x + 5$

In other words, the point at $(1, 8)$ is **not on the line** with the equation $y = 2x + 5$

Example 5:

- Does the line $y = -\frac{2}{5}x + 6$ go through the point $(10, 2)$?

Solution 5:

Plug 2 in for y

Plug 10 in for x

$$y = -\frac{2}{5}(10) + 6 \quad \rightarrow \quad 2 = -\frac{2}{5}(10) + 6$$

$$2 = -\frac{20}{5} + 6 \quad \rightarrow \quad 2 = -4 + 6$$

$$\mathbf{2 = 2}$$

So that means, the point $(10, 2)$ **is a point** on the line.

$(10, 2)$ is a solution to the equation $y = -\frac{2}{5}x + 6$

Writing Equations of Lines

Step 1: Identify the $\boldsymbol{y - intercept}$

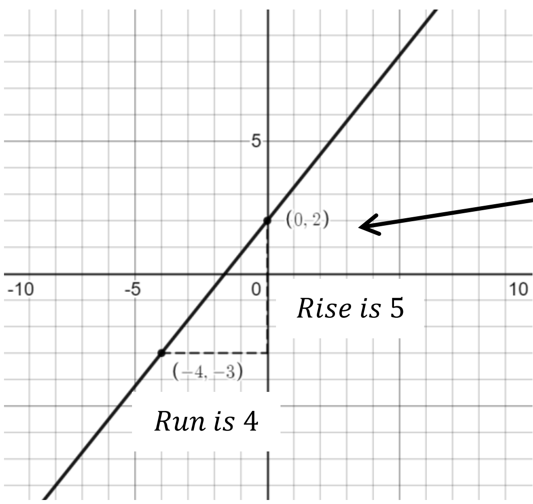
Step 2: Identify **two points** on the grid where the line crosses an **intersection of $\boldsymbol{x\ and\ y}$** gridlines perfectly

Step 3: Count your SLOPE Rise and Run

Step 4: Fill in the equation: $y = \bigcirc x \bigcirc$

$y - intercept$ with sign goes here

Slope goes here

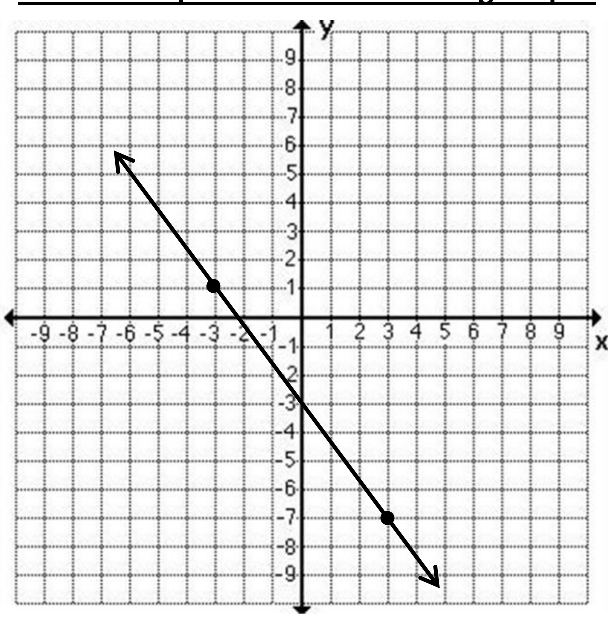


$y - intercept\ is + 2$

So, the equation can be filled in to be:

$$\boldsymbol{y = \frac{5}{4}x + 2}$$

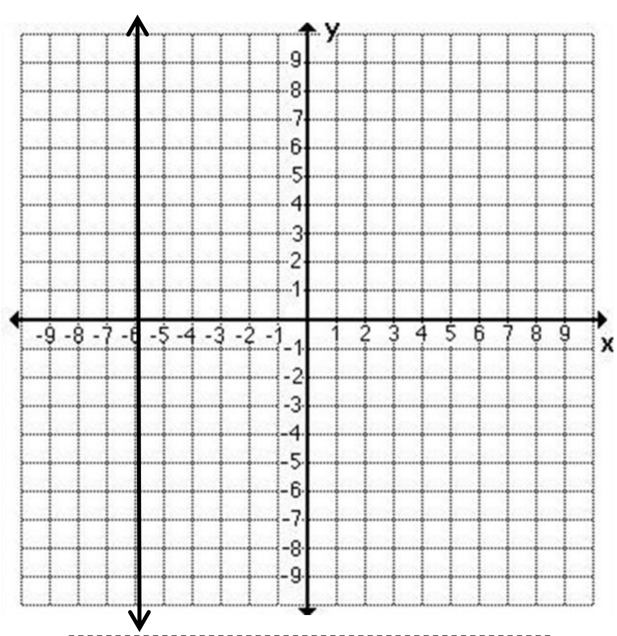
Write the Equation of the Following Graphs



$Slope$ is: $-\frac{8}{6} = -\frac{4}{3}$

$y - intercept$ is: $(0, -3)$

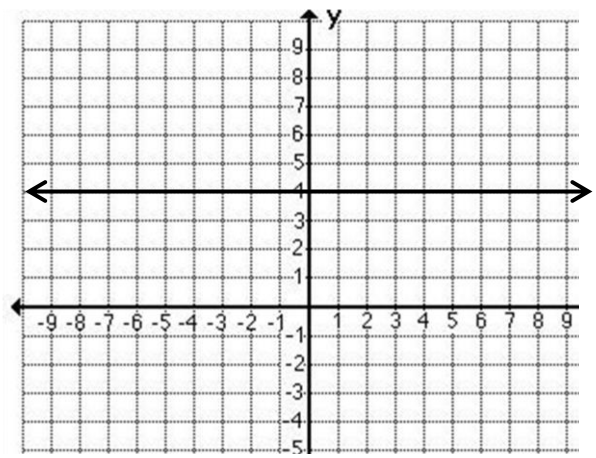
So: $\boldsymbol{y = -\frac{4}{3}x - 3}$



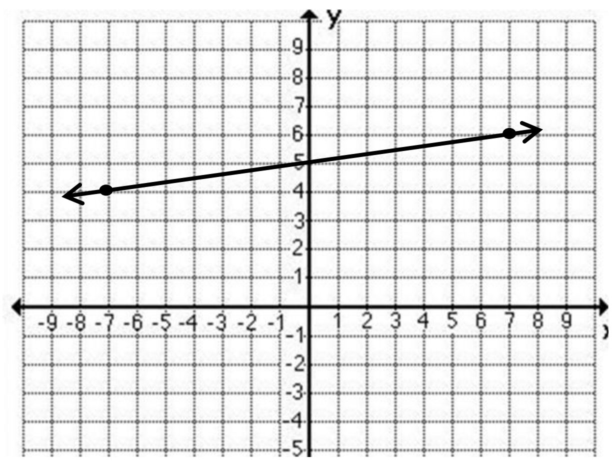
$Slope$ is: $Undefined$

$y - intercept$ is: No $y - int$

Vertical Line, so: $\boldsymbol{x = -6}$



$Slope$ is:	0
$y - intercept$ is:	$(0, 4)$
Horizontal Line, so:	$\boldsymbol{y = 4}$

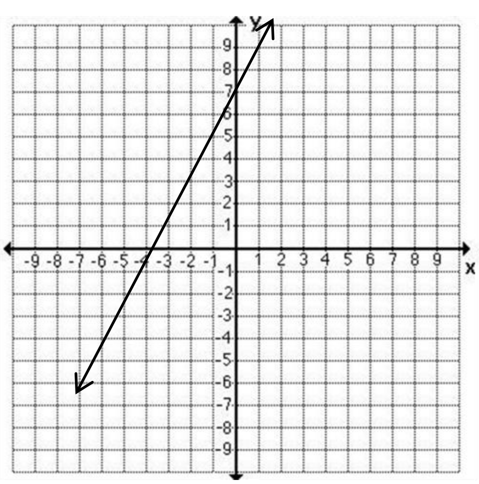


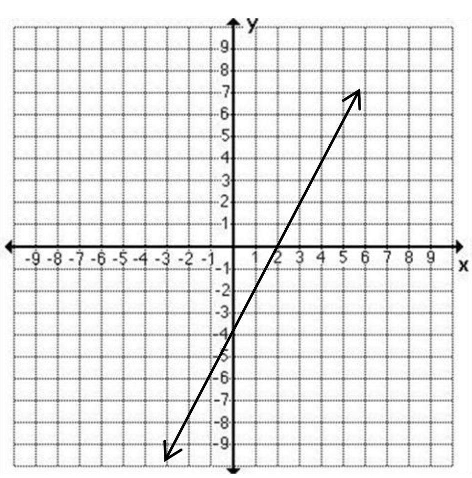
$Slope$ is:	$\frac{2}{14} = \frac{1}{7}$
$y - intercept$ is:	$(0, 5)$
So:	$\boldsymbol{y = \frac{1}{7}x + 5}$

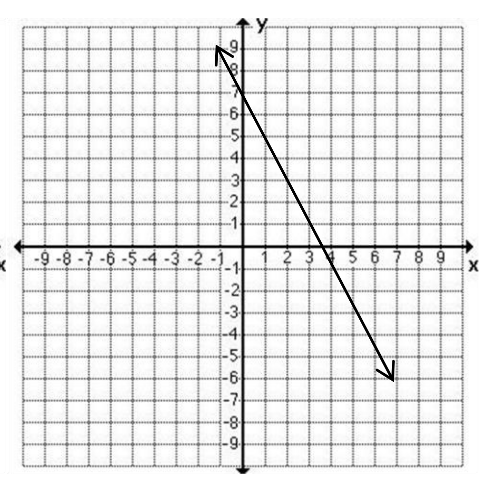
<u>Matching Equations to Graphs</u>

- The last concept we will look at in this section is **matching graphs** to **equations** and vice versa
- The trick is to take the **information we have** and use it to our advantage
- If the equation is in **<u>Slope-Intercept Form</u>**
  - Just **Identify** the **SLOPE** $\boldsymbol{and\ y - intercept}$ and use the process of elimination

<u>Example 1:</u> Identify the graph that matches the equation $y = 2x + 7$





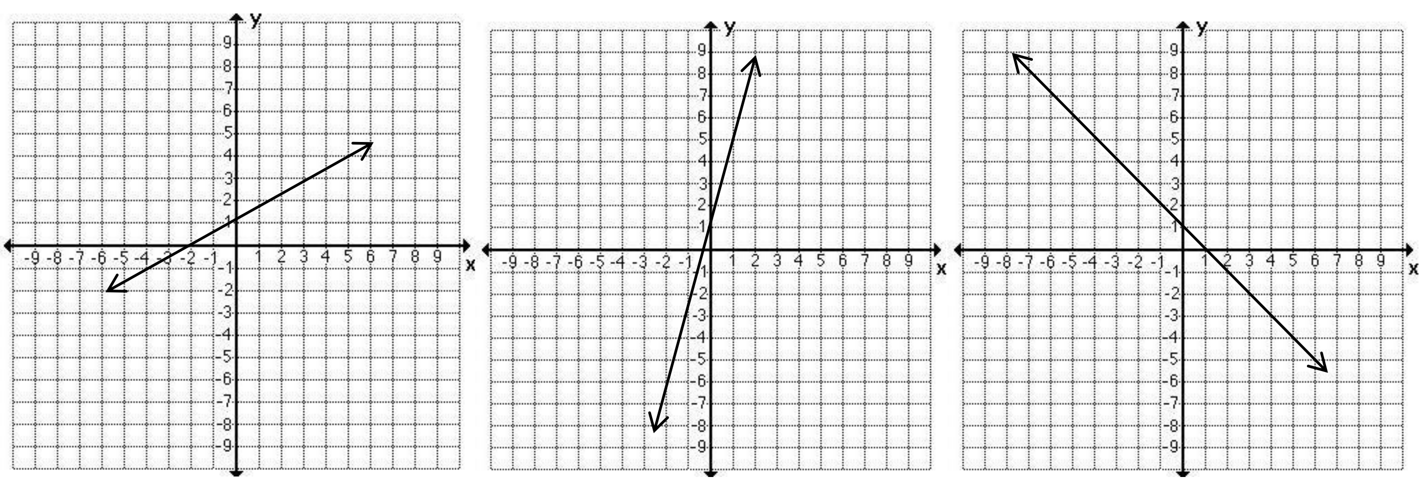


- Right Away I know what?
- My $\boldsymbol{y - intercept}$ is $+7$
  - That immediately **excludes the 2nd graph**
  - It goes through -7
- My **Slope** is POSITIVE 2
  - That **removes the 3rd graph**
  - It has a negative Slope
- **It has to be the 1st graph**

Sometimes it's even easier

Example 2:

Which graph matches the equation: $y = -x + 1$

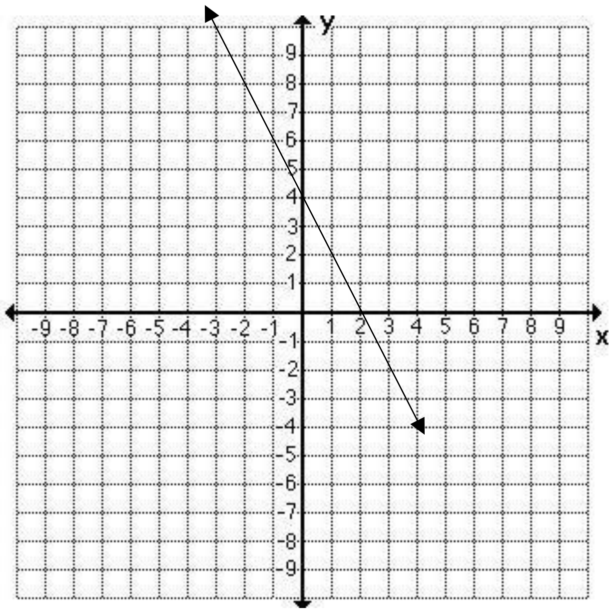


- Why is this so easy?
- Look at the **Slope** of the equation?
  - It's **NEGATIVE**
- Which graph has a negative slope?
  - **Only the third one**!

What about **1 graph** and **multiple equations**?

- Use elimination and the information you have to narrow down the equations that fit

Example 5: What equation matches the following graph?



i) $y = 2x + 4$

Can't be this one, it has a positive slope

ii) $\boldsymbol{y = -2x + 4}$

iii) $y = 2x - 4$

Can't be this one, it has the wrong $y - intercept$

Section 7.1b – Practice Questions

1. Are the following points solutions to the given equations? Are they POINTS on the given LINE?

a) $(1, -3)$ $y = 3x - 5$

b) $(0,\ 5)$ $y = \frac{2}{3}x + 5$

c) $(-2,\ 7)$ $y = \frac{3}{2}x + 4$

d) $(8, -1)$ $y = -\frac{1}{8}x$

e) $(3, 3)$ $y = \frac{2}{3}x + 1$

2. Find 3 different coordinates that exist on the given lines. Remember there are an infinite amount of them.

a) $y = 3x - 5$

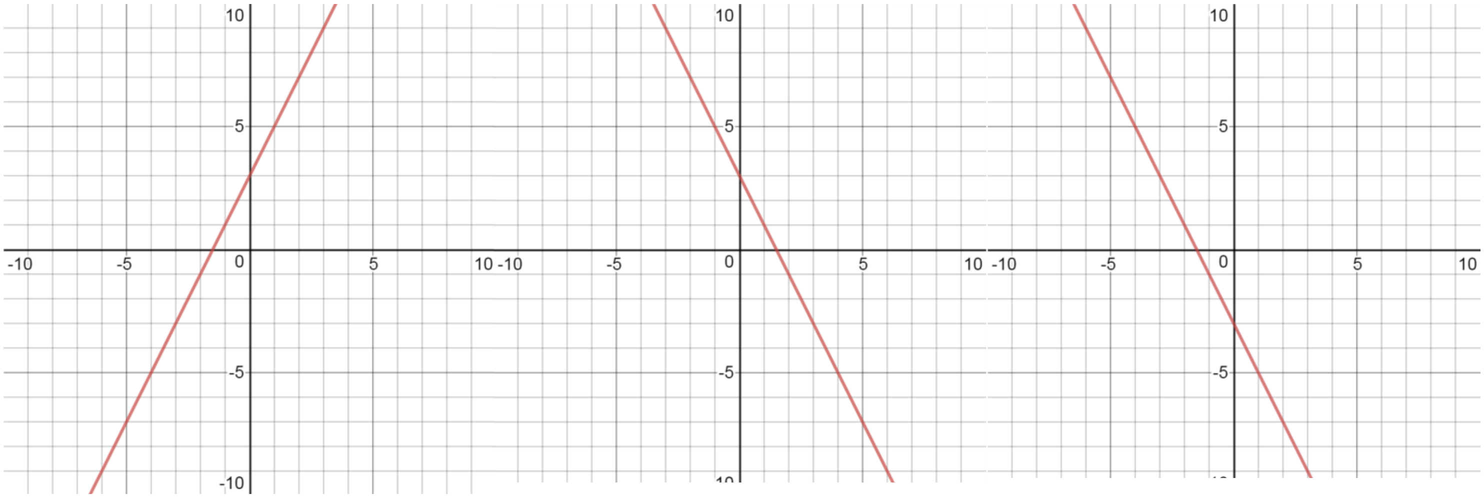
---

b) $y = -\frac{6}{7}x + 8$

---

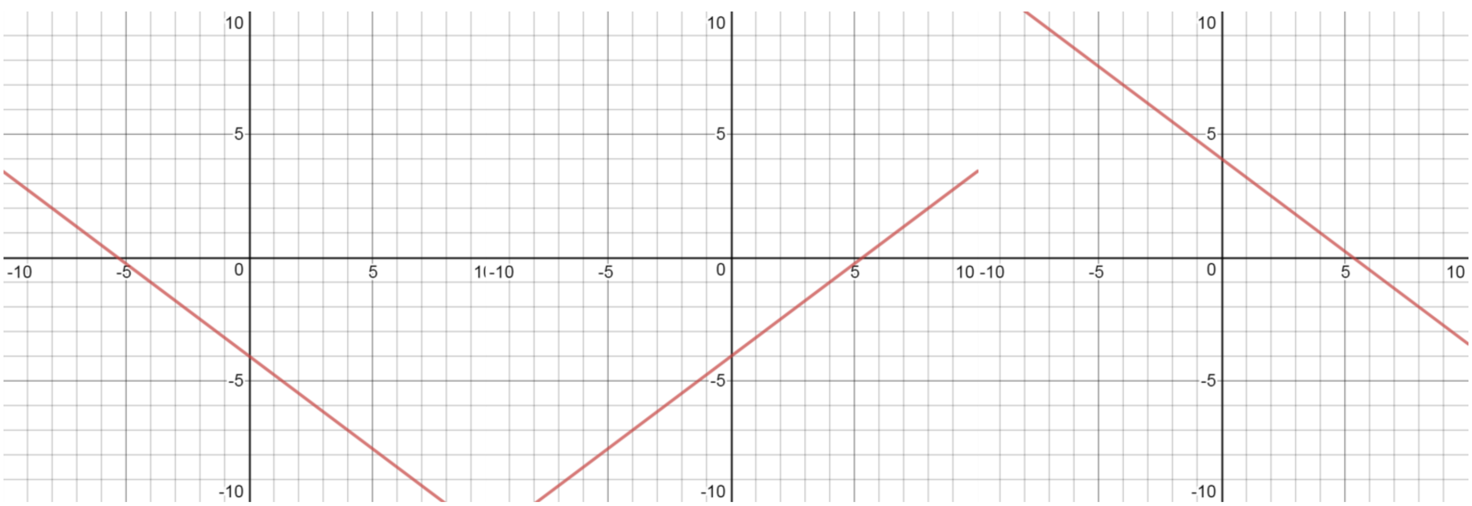
c) $y = \frac{3}{5}x - 6$

3. Which graph represents $y = -2x + 3$ How do you know?



Explanation Goes Here

4. Which graph represents $y = \frac{3}{4}x - 4$ How do you know?



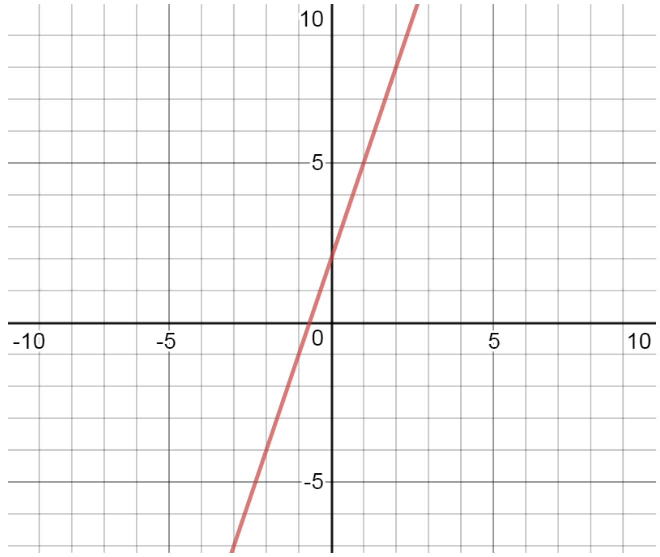
Explanation Goes Here

5. Which equation matches the graph below:

$y = 3x + 2$

$y = -3x + 2$

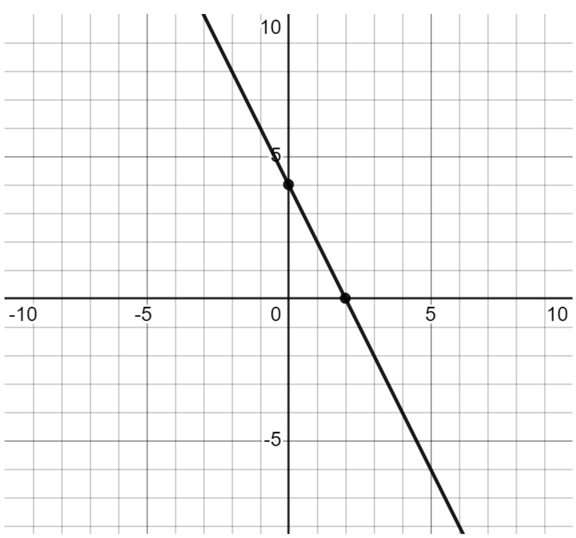
$y = 3x - 2$



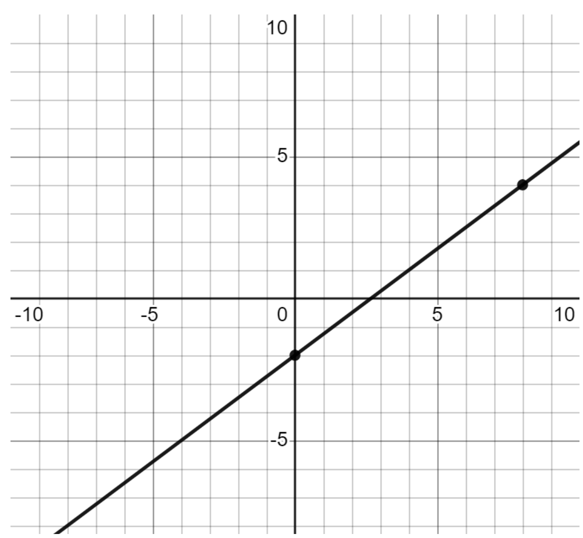
Explanation Goes Here

6. Use the given y-intercept and determine the slope of the following lines to write their equations in Slope-Intercept Form

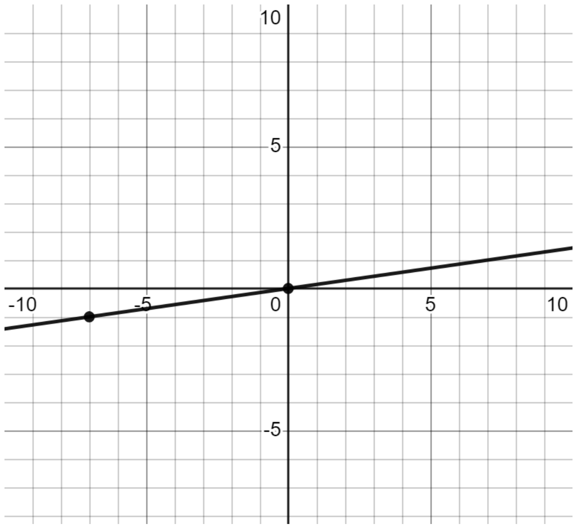
a) Equation:



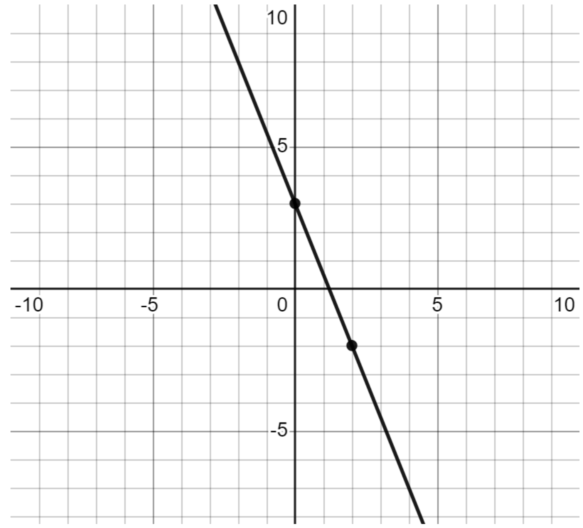
b) Equation:



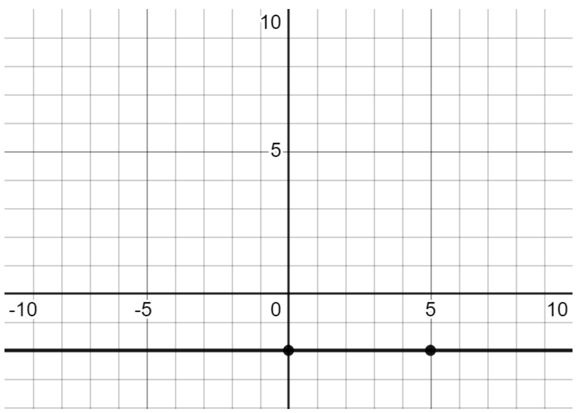
c) Equation:



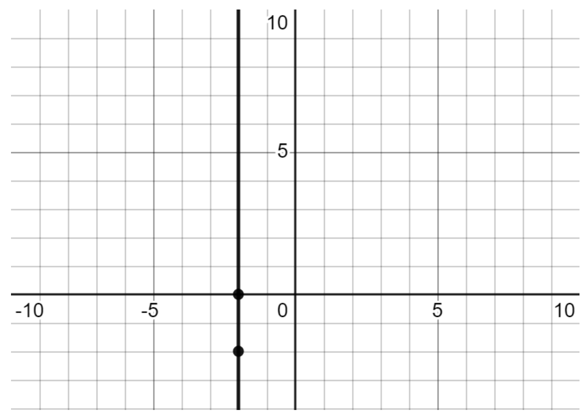
d) Equation:



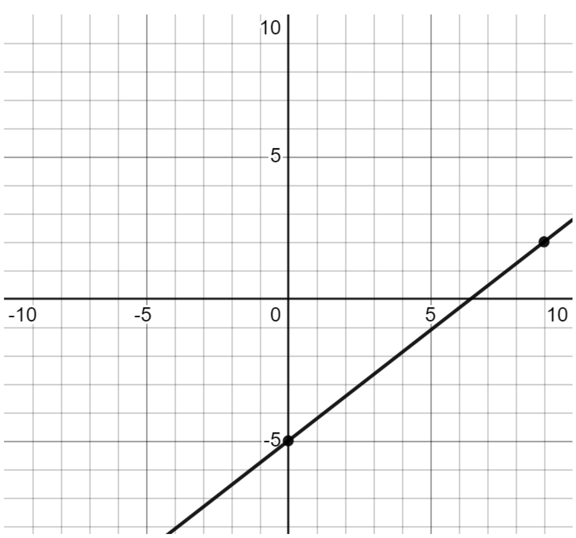
e) Equation:



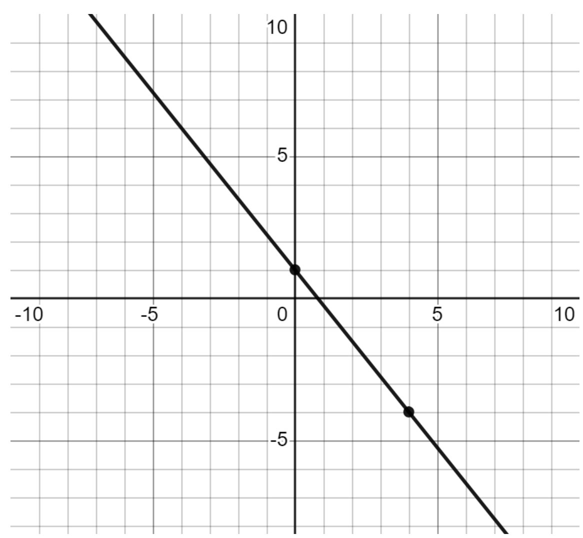
f) Equation:



g) Equation:



h) Equation:



Section 7.1b – Answer Key

1. Need Explanations a) No b) Yes c) No d) Yes e) Yes
2. Infinite Solutions Pick an x and solve for y Check with Herlaar
3. Second Graph Correct Slope and y-int (explain with more detail in your solution)
4. Second Graph Only graph with positive slope
5. First Equation Positive slope, positive y-int
6. a) $y = -2x + 4$ b) $y = \frac{3}{4}x - 2$ c) $y = \frac{1}{7}x$ d) $y = -\frac{5}{2}x + 3$ e) $y = -2$ f) $x = -2$ g) $y = \frac{7}{9}x - 5$ h) $y = -\frac{5}{4}x + 1$

Extra Work Space