Graphing Linear Equations in Standard Form

To graph equations in standard form, we will follow a 6-step process:

Step 1: Solve for y to put the equation in slope-intercept form

Step 2: Plot the y-intercept on the y-axis of the graph.

Step 3: Turn the slope into a fraction if it isn't already.

Step 4: Plot additional points using the slope as a $\frac{\Delta y}{\Delta x} = \frac{change\ in\ y}{change\ in\ x}$ from the y-intercept. This means the top number in the fraction tells you amount of vertical change (up or down), and the bottom number in the fraction tells you amount of horizontal change (right or left).

Step 5: Connect our points with a line.

Step 6: Check that our slope is correct based on whether the line should be rising or falling.

Example 1: Graph an Equation in Standard Form

$5x - 3y = 6$

Step 1: Solve for y.

$5x - 3y = 6$

$-5x \qquad -5x$ **We subtract 5x because it is added or subtracted to the y-value.

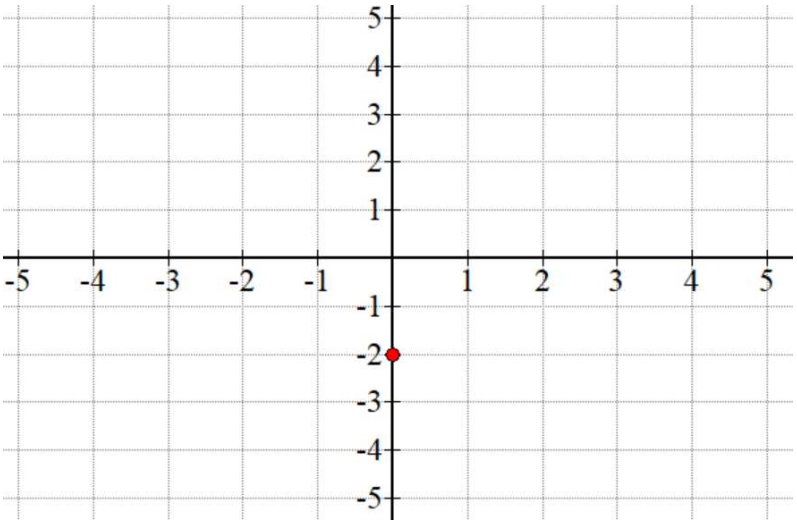
$-3y = -5x + 6$ **We cannot combine the 6 and the -5x. They are not like terms. We want to write the term with an "x" in it before the constant so that it looks right when in slope-intercept form. Remember that the 5x is negative and the 6 is positive.

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

$$y = \frac{5}{3}x - 2$$

Remember that the slope of the line is $\frac{5}{3}$ and the y-intercept is -2.

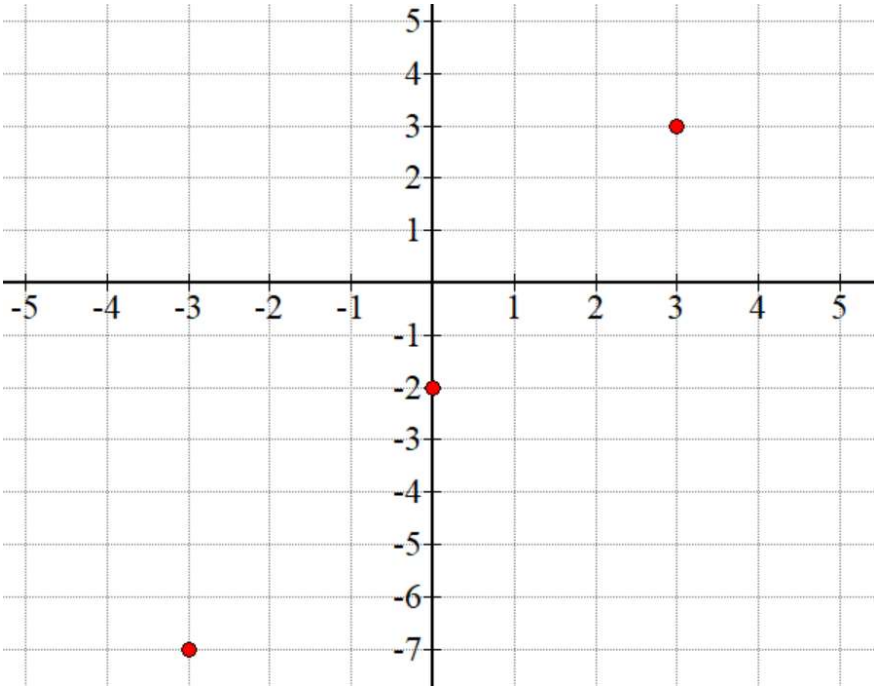
Step 2: Plot the y-intercept (in this case -2) on the y-axis.



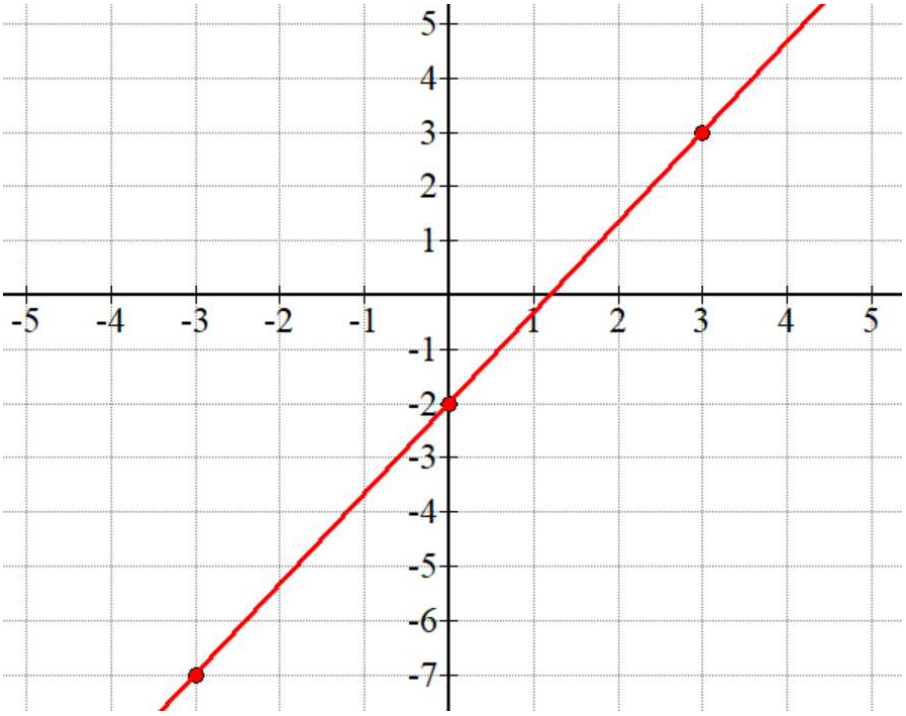
Step 3: Our slope is already in fraction form so we can skip this step.

Step 4: Plot additional points using the slope as a $\frac{\Delta y}{\Delta x} = \frac{chang\ \ in\ y}{chan\ \ \ in\ x}$ from the y-intercept.

Our slope is $\frac{5}{3}$. Because these are both positive, we can choose both numerator and denominator to be positive, or we can choose both values to be negative. Remember that a negative divided by a negative is a positive. I will plot both.



Step 4: Connect our points with a line.



Step 6: Check that our slope is correct based on whether the line should be rising or falling.

Our slope was a positive number, so we expect to see that our line is rising as we read from left to right. Since our line is rising, we know that we have graphed the line with the appropriate sign on the slope.

<u>Example 2: Graph an Equation in Standard Form</u>

$2x + y = 5$

Step 1: Solve for y.

$2x + y = 5$

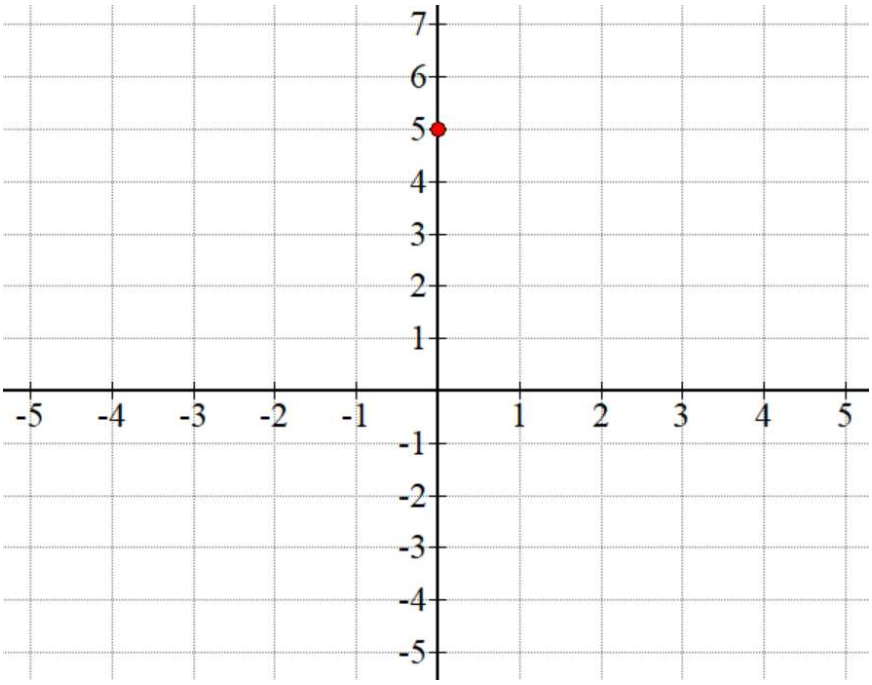
$-2x \quad -2x$ **We subtract 2x because it is added or subtracted to the y-value.

$y = -2x + 5$ **We cannot combine the 5 and the -2x. They are not like terms. We want to write the term with an "x" in it before the constant so that it looks right when in slope-intercept form. Remember that the 2x is negative and the 5 is positive.

$y = -2x + 5$

The slope of the line is -2 and the y-intercept is 5.

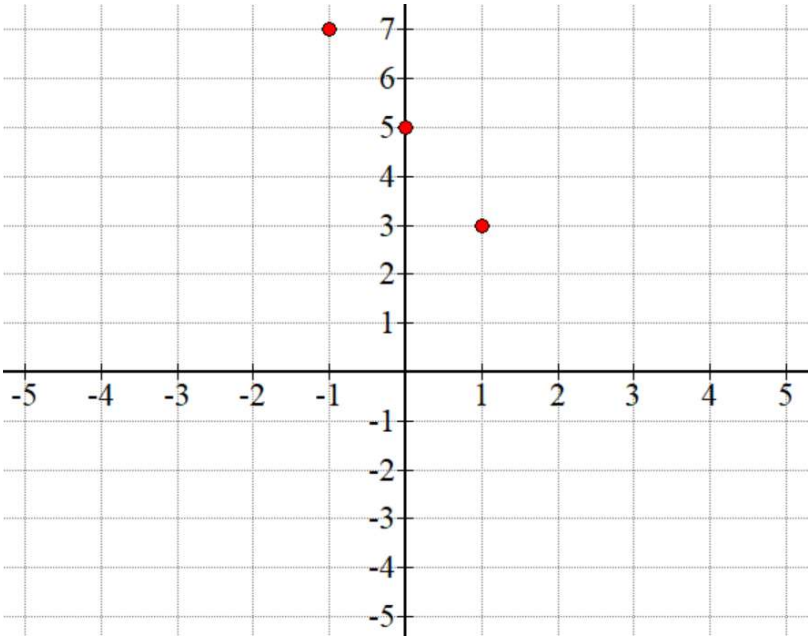
Step 2: Plot the y-intercept (in this case 5) on the y-axis.



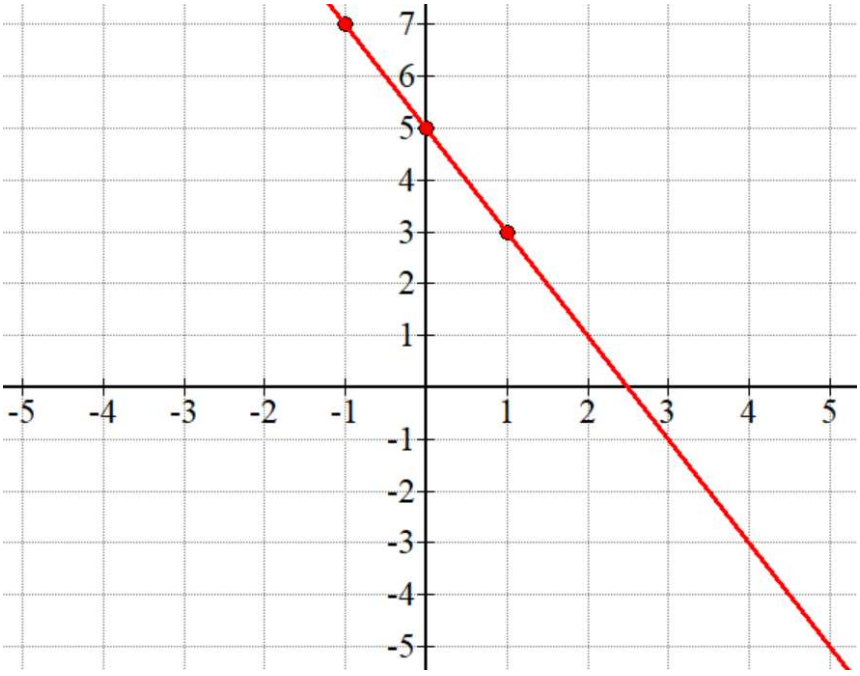
Step 3: In order to put our slope in fraction form, we just need to put the whole number over one. The slope in fraction form is $-\frac{2}{1}$.

Step 4: Plot additional points using the slope as a $\frac{\Delta y}{\Delta x} = \frac{cha \quad in\ y}{chang \quad in\ x}$ from the y-intercept.

Our slope is $-\frac{2}{1}$. Because there is a negative, we have to choose whether the negative goes with the numerator of the fraction or the denominator of the fraction. It does not matter which one we choose. I will plot both points.



Step 5: Connect our points with a line.



Step 6: Check that our slope is correct based on whether the line should be rising or falling.

Our slope was a negative number, so we expect to see that our line is falling as we read from left to right. Since our line is falling, we know that we have graphed the line with the appropriate sign on the slope.

Example 3: Graph an Equation in Standard Form

$x + 2y = -6$

Step 1: Solve for y.

$x + 2y = -6$

$-x \quad -x$ **We subtract x because it is added or subtracted to the y-value.

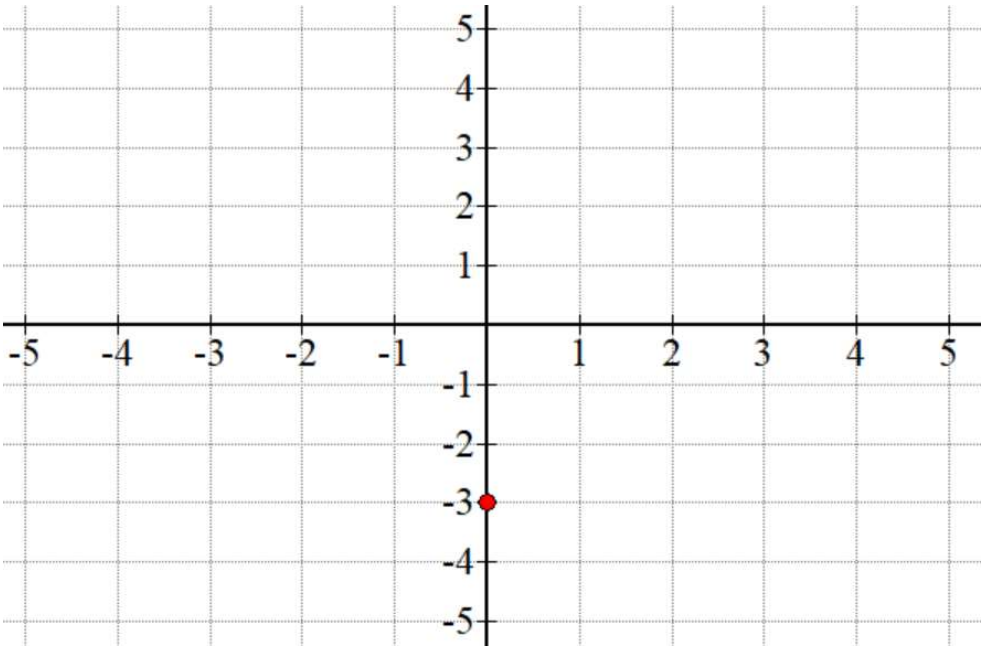
$2y = -x - 6$ **We cannot combine the -6 and the -x. They are not like terms. We want to write the term with an "x" in it before the constant so that it looks right when in slope-intercept form.

$$\frac{2y}{2} = \frac{-x}{2} + \frac{-6}{2}$$

$$y = -\frac{1}{2}x - 3$$

Remember that the slope of the line is $-\frac{1}{2}$ (there is a one in front of the x) and the y-intercept is -3.

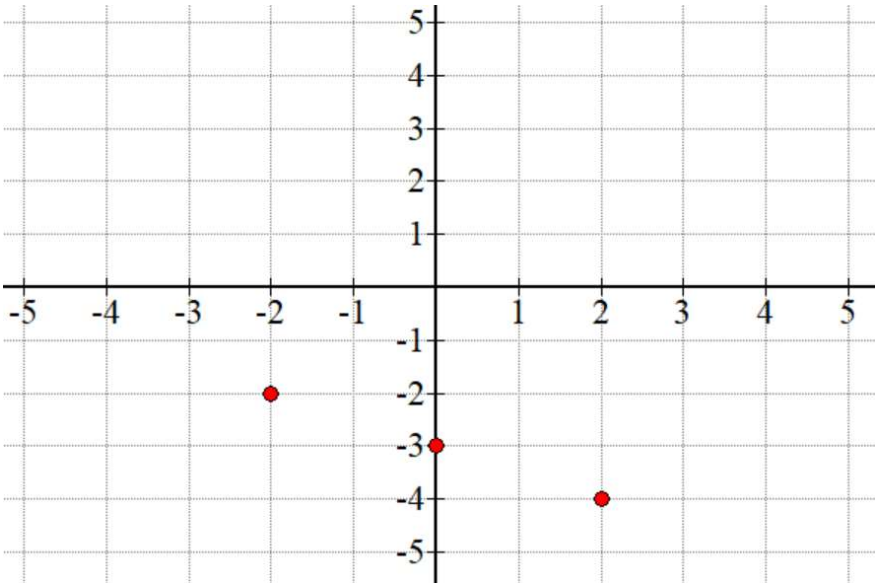
Step 2: Plot the y-intercept (in this case -3) on the y-axis.



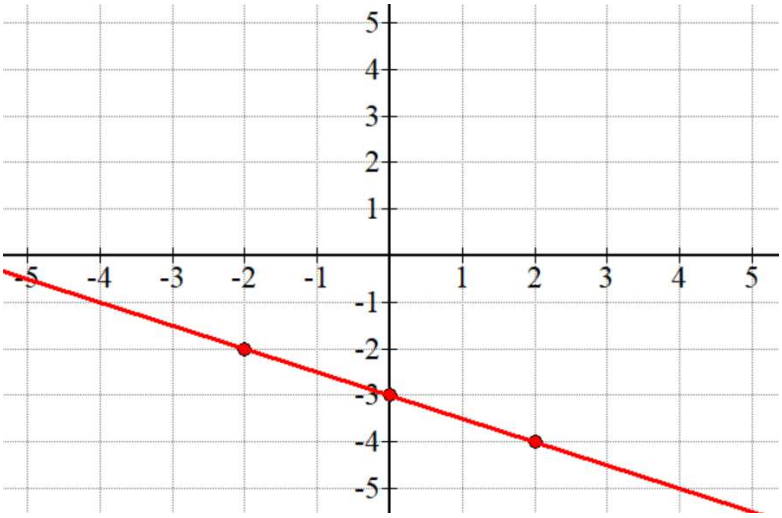
Step 3: The slope is already in fraction form, so we can skip this step.

Step 4: Plot additional points using the slope as a $\frac{\Delta y}{\Delta x} = \frac{cha \quad in\, y}{chang \quad in\, x}$ from the y-intercept.

Our slope is $-\frac{1}{2}$. Because there is a negative, we have to choose whether the negative goes with the numerator of the fraction or the denominator of the fraction. It does not matter which one we choose.



Step 5: Connect our points with a line.



Step 6: Check that our slope is correct based on whether the line should be rising or falling.

Our slope was a negative number, so we expect to see that our line is falling as we read from left to right. Since our line is falling, we know that we have graphed the line with the appropriate sign on the slope.

Example 4: Graph an Equation in Standard Form

$2x - y = -4$

Step 1: Solve for y.

$2x - y = -4$

$-2x \qquad -2x$

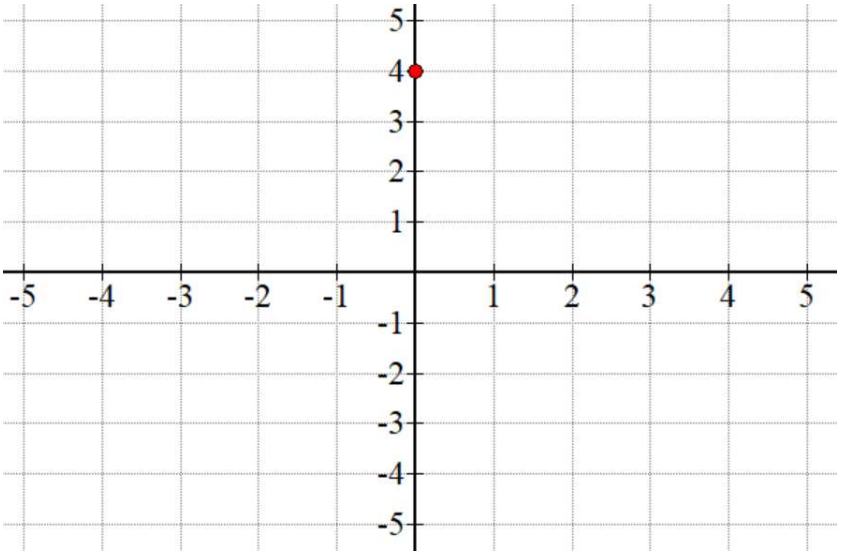
$-y = -2x - 4$ **We cannot combine the -4 and the -2x. They are not like terms. We want to write the term with an "x" in it before the constant so that it looks right when in slope-intercept form.

$$\frac{-y}{-1} = \frac{-2x}{-1} + \frac{-4}{-1}$$

$y = 2x + 4$

Remember that the slope of the line is 2 and the y-intercept is 4.

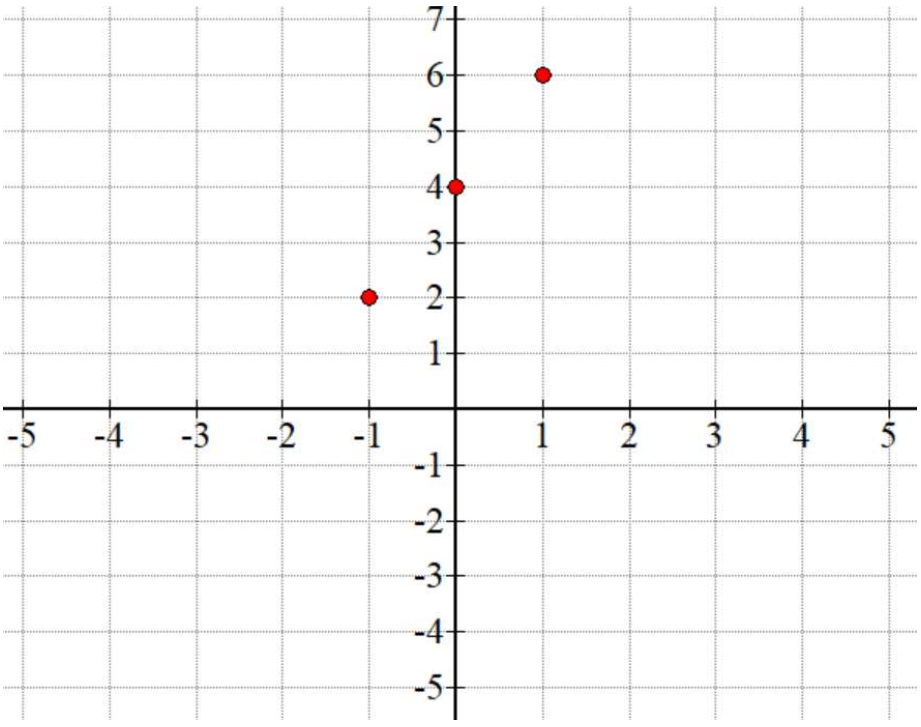
Step 2: Plot the y-intercept (in this case 4) on the y-axis.



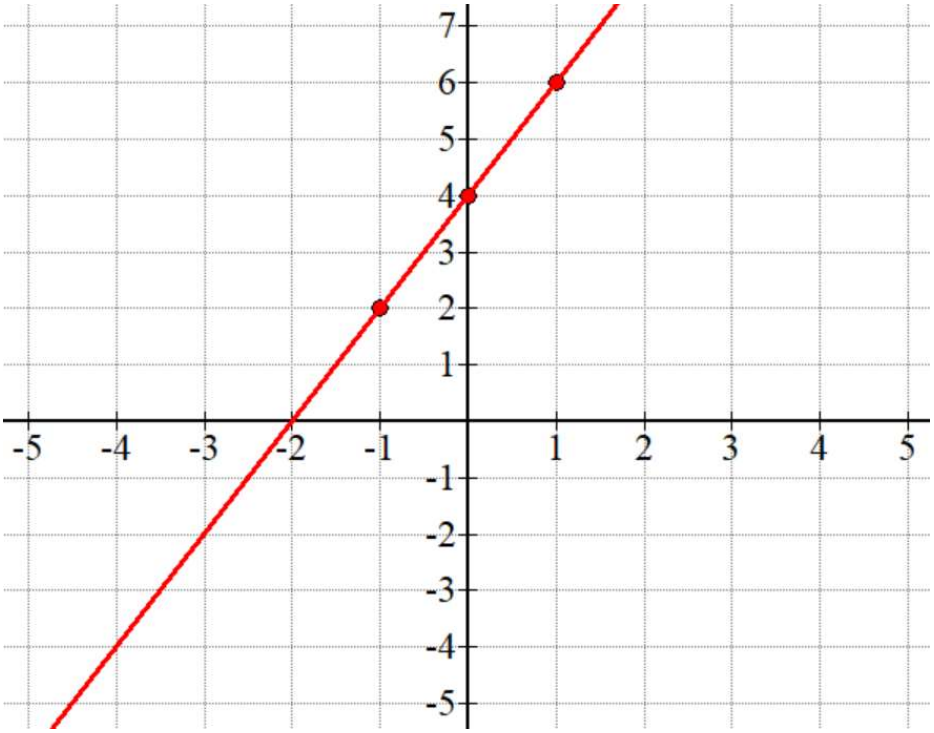
Step 3: In order to put our slope in fraction form, we just need to put the whole number over one. The slope in fraction form $\frac{2}{1}$.

Step 4: Plot additional points using the slope as a $\frac{\Delta y}{\Delta x} = \frac{chan \quad in\, y}{chang \quad in\, x}$ from the y-intercept.

Our slope is $\frac{2}{1}$. Because these are both positive, we can choose both numerator and denominator to be positive, or we can choose both values to be negative. Remember that a negative divided by a negative is a positive.



Step 5: Connect our points with a line.



Step 6: Check that our slope is correct based on whether the line should be rising or falling.

Our slope was a positive number, so we expect to see that our line is rising as we read from left to right. Since our line is rising, we know that we have graphed the line with the appropriate sign on the slope.

Example 5: Special Case – Horizontal Line

$y + 2 = -2$

Step 1: Solve for y.

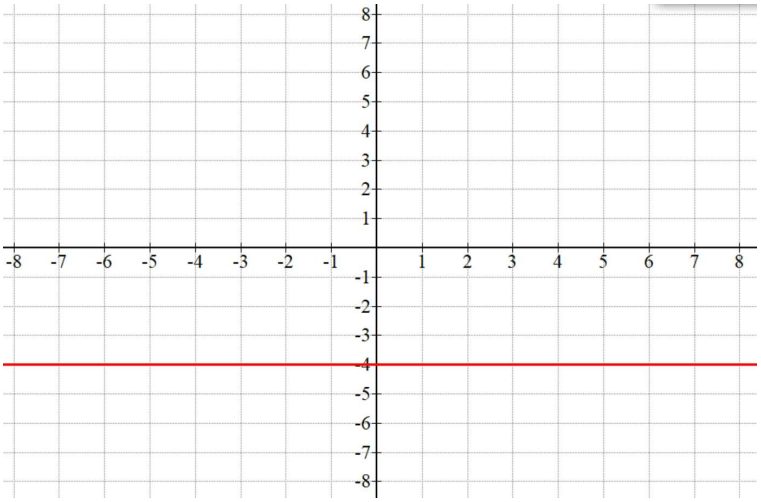
$y + 2 = -2$

$-2 \quad -2$

$y = -4$ **We can combine the -2 and the -2. They are like terms.

$y = -4$

Because there is only a y variable and there is no x, we know that this is a horizontal line. So, we draw a horizontal line through -4 on the y-axis (on the y-axis because it is $y = \#$)



Example 6: Special Case – Vertical Line

$x + 2 = 0$

Because there is no y, we solve for the only variable we have, x.

Step 1: Solve for x.

$x + 2 = 0$

$-2 \quad -2$

$x = -2$ **We can combine the 0 and the -2. They are like terms.

$x = -2$

Because there is only an x variable and there is no y, we know that this is a vertical line. So, we draw a vertical line through -2 on the x-axis (on the x-axis because it is $x = \#$)