

LINEAR EQUATIONS IN TWO VARIABLES 8.2

Vocab:

- $2x - y = 5$ is an example of an equation in two variables
- The Solution of an equation in x and y is an ordered pair (x, y) that produces a true statement when the values of x and y are substituted into the equation.

Example 1: Checking Solutions -- You can check to see if an ordered pair is a Solution by substituting in the x and y value into the equation. Check to see if it makes a true statement.

1. Tell whether the ordered pair is a solution of $2x - y = 5$

a. $(1, -3)$

$$\begin{aligned} 2(1) - (-3) &= 5 \\ 2 + 3 &= 5 \end{aligned} \quad \checkmark$$

b. $(4, 7)$

$$\begin{aligned} 2(4) - (7) &= 5 \\ 8 - 7 &= 1 \end{aligned} \quad \times$$

Example 2: Graphing a Linear Equation -- If you graph solutions of the equation in two variables and the graph forms a line, then the equation is called a **linear equation**.

1. Graph $y = 2x - 1$

Step 1: Make a table of solutions:

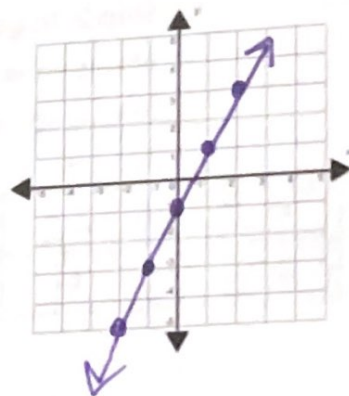
| | | | | | |
|---|----|----|----|---|---|
| x | -2 | -1 | 0 | 1 | 2 |
| y | -5 | -3 | -1 | 1 | 3 |

Step 2: Choose 2 negative numbers, zero, and 2 positive numbers for x .

Step 3: Substitute your values for x in the equation to find each y value.

Step 4: List the solutions as ordered pairs: $(-2, -5)$ $(-1, -3)$ $(0, -1)$ $(1, 1)$ $(2, 3)$

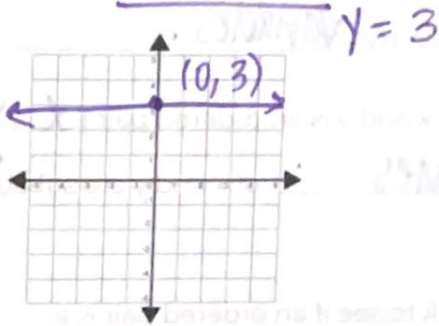
Step 5: Graph the ordered pairs. Connect the points. This line is the graph of $y = 2x - 1$



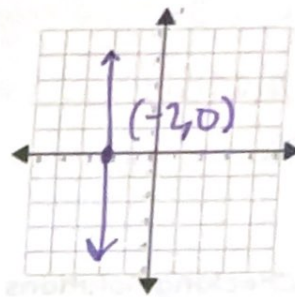
Example 3: Graphing Horizontal and Vertical Lines

1. Graph $y = 3$ and $x = -2$

- a. The graph of the equation $y = 3$ is a horizontal line through $(0, 3)$. It means that no matter what value x equals, y will always be 3.



- b. The graph of the equation $x = -2$ is a vertical line through $(-2, 0)$. It means that no matter what value y equals, x will always be -2.



Example 4: Writing an Equation in Function Form – Function form is when an equation is solved for y . It is helpful to put an equation in function form before graphing it. In general, a linear equation is a function **unless** its graph is a vertical line. (Ex. 3, b.)

1. Write $x + 2y = 6$ in function form. Then graph the equation.

- a. Step 1: Solve for y

$$x + 2y = 6$$

$$-x \quad -x$$

$$2y = 6 - x$$

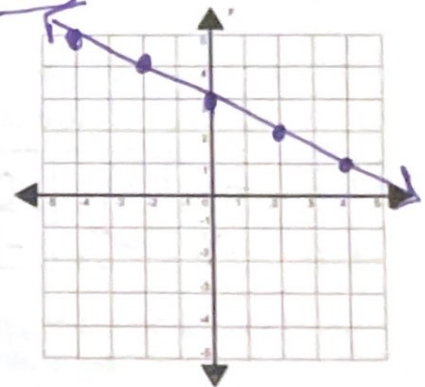
$$\frac{2y}{2} = \frac{6-x}{2}$$

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

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

- b. Step 2: To graph, use its function form to make a table of solutions. Then graph the points from the table and draw a line through the points.

| | | | | | |
|---|----|----|---|---|---|
| x | -4 | -2 | 0 | 2 | 4 |
| y | 5 | 4 | 3 | 2 | 1 |



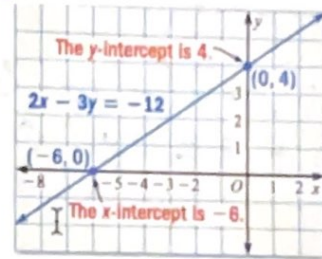
start
down
1 over 2
↘ -1/2 ↙

USING INTERCEPTS 8.3

Vocab:

1. x-intercept: the x-coordinate of a point where the graph crosses the x-axis
2. y-intercept: the y-coordinate of a point where the graph crosses the y-axis

* In the graph, $2x - 3y = -12$ is graphed. Where it crosses the x-axis is the x-intercept -6 and where it crosses the y-axis is the y-intercept 4.



**** Finding Intercepts ****

| | |
|--------------------------|---|
| To find the x-intercept: | Substitute <u>0</u> in for y in the equation and solve for <u>x</u> |
| To find the y-intercept: | Substitute <u>0</u> in for x in the equation and solve for <u>y</u> |

Example 1: Finding Intercepts of a Graph

1. Find the intercepts of the graph of $3x - 2y = 6$

a. To find the x-intercept, let $y = 0$ and solve for x

Step 1: Write the equation $3x - 2y = 6$

Step 2: Substitute 0 for y $3x - 2(0) = 6$

Step 3: Solve for x $\frac{3x}{3} = \frac{6}{3}$

Step 4: The x-intercept is 2

b. To find the y-intercept, let $x = 0$ and solve for y

Step 1: Write the equation $3x - 2y = 6$

Step 2: Substitute 0 for x $3(0) - 2y = 6$

Step 3: Solve for y $-2y = \frac{6}{-2}$

Step 4: The y-intercept is -3

Practice:

1. Tell whether the ordered pair is a solution of $3x + 2y = -8$

$$\begin{array}{r} 19 \\ \times 2 \\ \hline 38 \end{array}$$

a. $(0, 4)$

b. $(-2, -1)$

c. $(10, -19)$

$$3(0) + 2(4) = -8$$

$$0 + 8 = -8 \quad (\text{X})$$

$$(3)(-2) + 2(-1) = -8$$

$$-6 + -2 = -8 \quad (\checkmark)$$

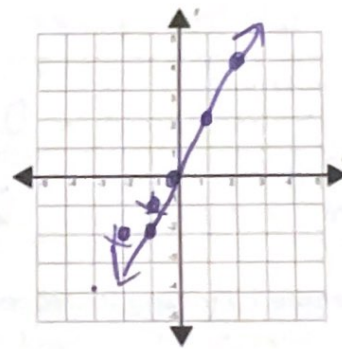
$$3(10) + 2(-19) = -8$$

$$30 + -38 = -8 \quad (\checkmark)$$

2. Graph the equations:

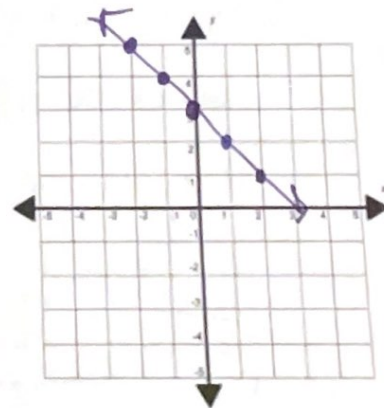
a. $y = 2x$

| | | | | | |
|---|----|----|---|---|---|
| x | -4 | -2 | 0 | 2 | 4 |
| y | -2 | -1 | 0 | 1 | 2 |



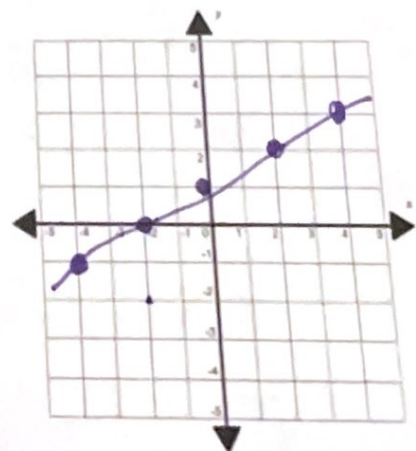
b. $y = -x + 3$

| | | | | | |
|---|----|----|---|---|---|
| x | -2 | -1 | 0 | 1 | 2 |
| y | 5 | 4 | 3 | 2 | 1 |



c. $y = \frac{1}{2}x + 1$

| | | | | | |
|---|----|----|---|---|---|
| x | -4 | -2 | 0 | 2 | 4 |
| y | -1 | 0 | 1 | 2 | 3 |



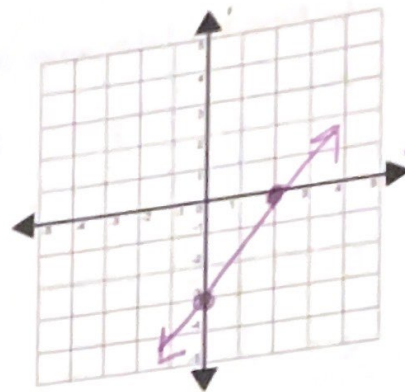
Example 2: Using Intercepts to Graph a Linear Equation

1. Graph the equation $3x - 2y = 6$ from Example 1.

The x-intercept is 2, so plot the point (2, 0)

The y-intercept is -3, so plot the point (0, -3)

Draw a line through the points.



Example 3: Writing and Graphing an Equation -- You are canoeing along a 12 mile stretch of river. You travel 4 miles per hour when paddling and 2 miles per hour when drifting. Write and graph an equation describing your possible paddling and drifting times for the trip. Give 3 possible combinations of paddling and drifting times.

1. To write an equation, let x be the paddling time and y be the drifting time. Let's see it written verbally:

| | | | | | | | | |
|--------------------------|---|--------------------------|---|---------------|----------------|---------------|---|----------------------------------|
| <u>Paddling distance</u> | | <u>Drifting distance</u> | | = | total distance | | | |
| paddling rate | • | paddling time | + | drifting rate | • | drifting time | = | total distance |
| <u>4</u> | | <u>x</u> | | | | <u>2</u> | | <u>12 mi.</u> |
| | | | | | | | | |
| | | | | | | | | <u>$4x + 2y = 12$</u> |

Now write an equation from this:

2. To graph the equation, find and use the intercepts:

Find the x-intercept:

$$4x + 2y = 12$$

$$4x + 2(0) = 12$$

$$4x = 12$$

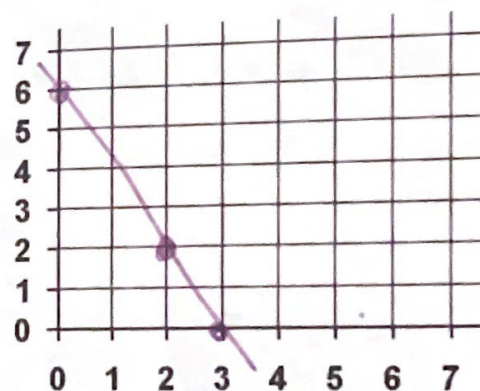
$$x = 3$$

Find the y-intercept:

$$4x + 2y = 12$$

$$4(0) + \frac{2y}{2} = \frac{12}{2}$$

$$y = 6$$



3. Three points on the graph are

(0, 6) -- not paddle at all and drift for 6 hours

(2, 2) -- paddle for 2 hours and drift for 2 hours

(3, 0) -- paddle for 3 hours and not drift at all

Practice:

1. Find the intercepts of the equations graph. Then graph the equation.

a. $x - 2y = -2$

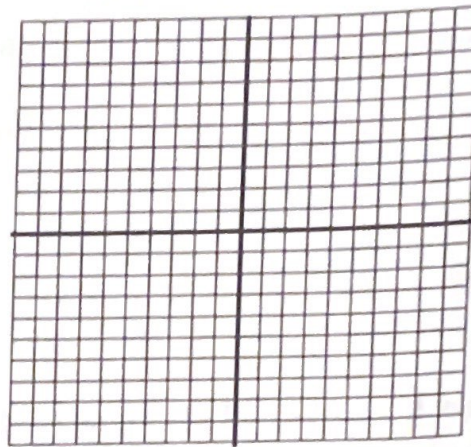
x

$$x - 2(0) = -2$$

$$x = -2$$

y

$$0 - 2y = -2$$
$$y = 1$$



b. $4x + 3y = 12$

x

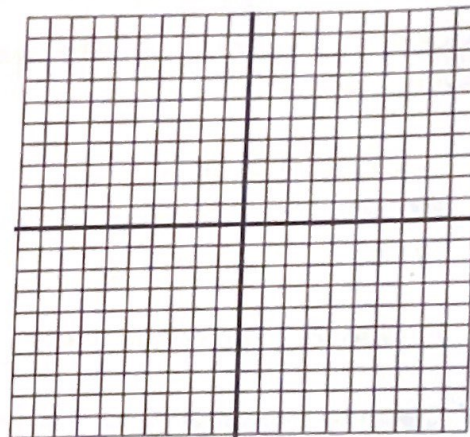
$$4x + 3(0) = 12$$

$$x = 3$$

y

$$4(0) + 3y = 12$$

$$y = 4$$



c. $y = -2x - 8$

x

$$-2x - 8 = 0$$
$$+8 \quad +8$$
$$\quad \quad -2$$

$$x = -4$$

y

$$y = -2x - 8$$
$$(0)$$

$$y = -8$$

