3.2 Graphing Linear Equations

The **solution of an equation** in two variables x and y is an ordered pair (x, y) that **makes the equation true.**

The **graph of an equation** in x and y is the set of all points (x, y) that are **solutions of the equation.**

Determine whether each ordered pair is a solution of $x + 2y = 5$.

1. $(7, -3)$ not a solution

$7 + 2(-3) \stackrel{?}{=} 5$

$7 + -6 = 5$

$1 \neq 5$

2. $(1, 2)$ solution

$1 + 2(2) \stackrel{?}{=} 5$

$1 + 4 = 5$

$5 = 5$ ✓

Determine whether each ordered pair is a solution of $2x + y = 1$.

3. $(\frac{1}{2}, 0)$ solution

$2(\frac{1}{2}) + 0 \stackrel{?}{=} 1$

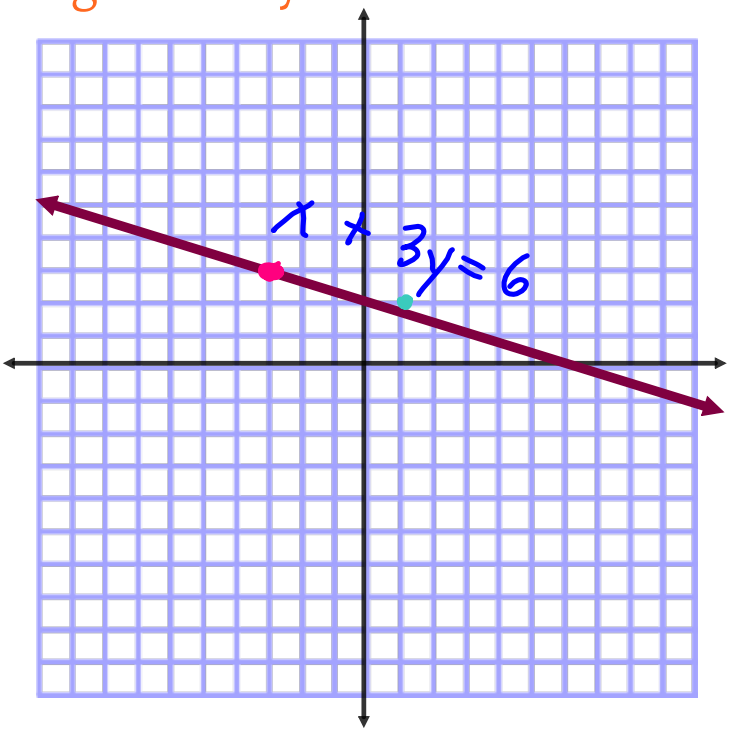
$1 = 1$ ✓

4. $(\frac{5}{2}, -6)$ not a solution

$2(\frac{5}{2}) + -6 \stackrel{?}{=} 1$

$-1 \neq 1$

Use the graph to decide whether the point lies on the graph of $x + 3y = 6$. Justify your answer algebraically.



5. $(1, 2)$ not a sol.

$1 + 3(2) \stackrel{?}{=} 6$

$7 \neq 6$

6. $(-3, 3)$ solution

$-3 + 3(3) \stackrel{?}{=} 6$

$6 = 6\checkmark$

A linear equation is an equation that can be written in the form $Ax + By = C$, called **standard form**, where A, B, & C are numbers, and A and B are not both zero.

A two-variable equation is written in **function form** (solve for y) if one of its variables is isolated on one side of the equation.

$y = 3x + 4$ is in function form

$2x + 3y = 6$ is **not** in function form

Write the equation above in function form.

$+2x + 3y = 6$

$-2x \qquad -2x$

$\frac{3y}{3} = \frac{-2x}{3} + \frac{6}{3}$

$y = -\frac{2}{3}x + 2$ function form

Steps to Graphing a Linear Equation

Step 1: Rewrite the equation in **function form**.
solve for y

Step 2: Choose a few values of *x* and make a table.

Step 3: Plot the points from the table of values. A line through these points is the graph of the equation.

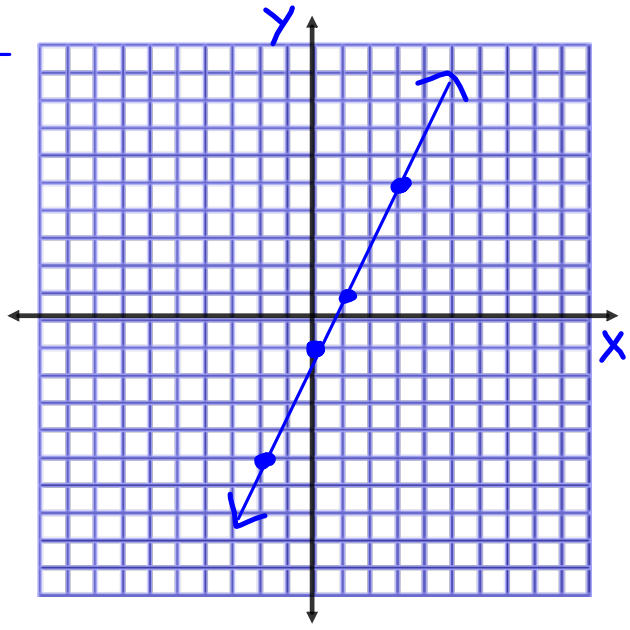
Example 7

already in function form

Draw the graph of $y = 2x - 1$.

x		y
-2	2(-2) - 1	-5
0	2(0) - 1	-1
1	2(1) - 1	1
3	2(3) - 1	5

↑ any 4 #'s

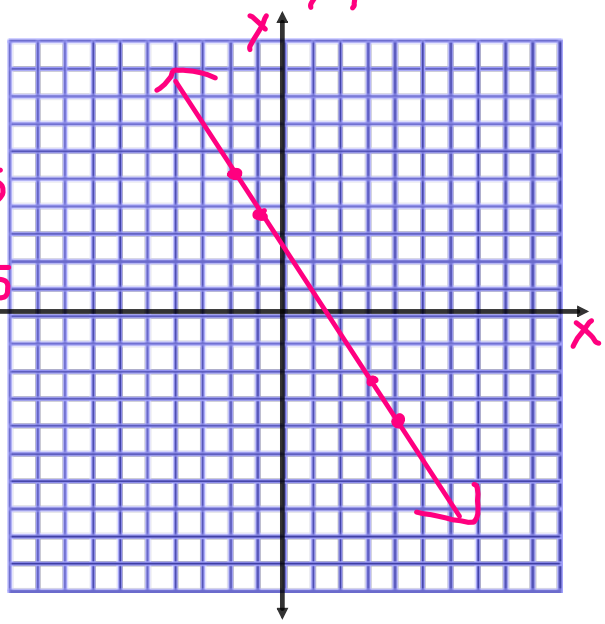


Example 8

Draw the graph of $3x + 2y = 4$.

$+3x + 2y = 4$
$-3x \quad -3x$
$\frac{2y}{2} = \frac{-3x}{2} + \frac{4}{2}$
$y = -1.5x + 2$

x		y
-2	$-1.5(-2) + 2$	5
-1	$-1.5(-1) + 2$	3.5
3	$-1.5(3) + 2$	-2.5
4	$-1.5(4) + 2$	-4

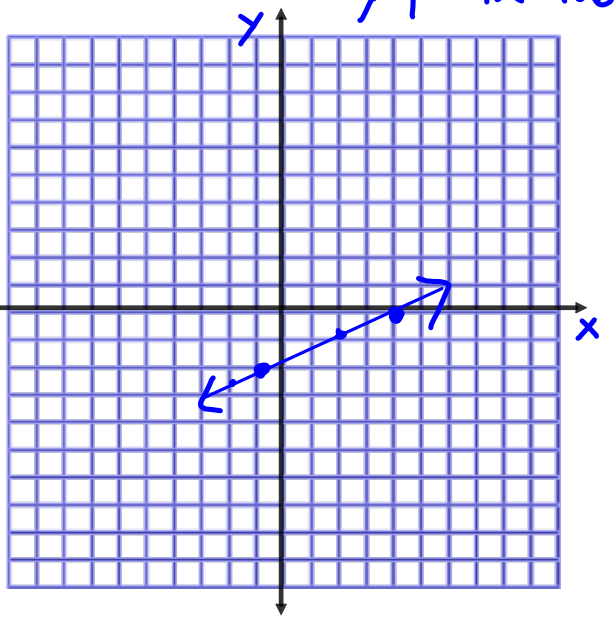


Example 9

Draw the graph of $2x - 5y = 8$.

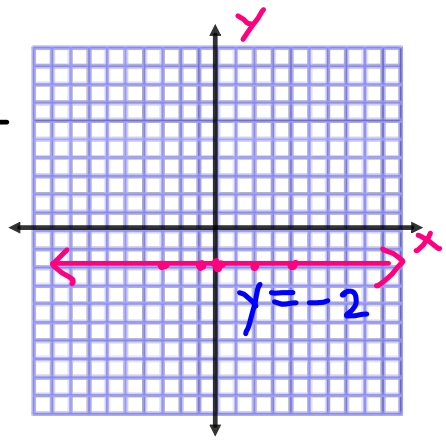
$+2x - 5y = 8$
$-2x \quad -2x$
$\frac{-5y}{-5} = \frac{-2x}{-5} + \frac{8}{-5}$
$y = .4x - 1.6$

x		y
-1	$.4(-1) - 1.6$	-2
-2	$.4(-2) - 1.6$	-2.4
2	$.4(2) - 1.6$	-.8
4	$.4(4) - 1.6$	0



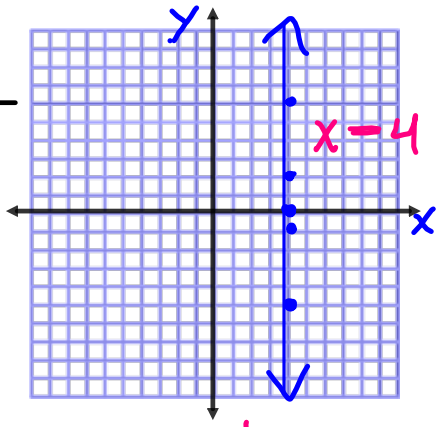
What would your graph look like if your table of values looked like these?

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



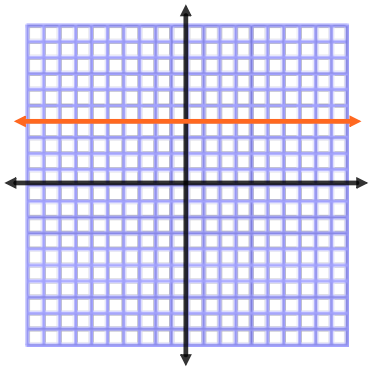
horizontal line

x	y
4	-5
4	-1
4	0
4	2
4	6



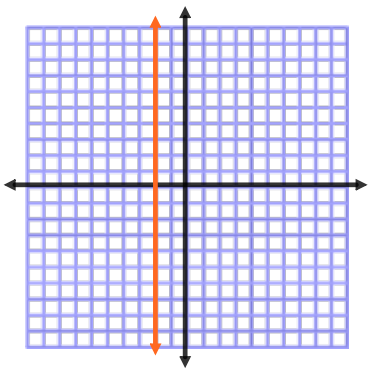
vertical line

Horizontal Lines



In the coordinate plane, the graph of $y = b$ is a ***horizontal line***.

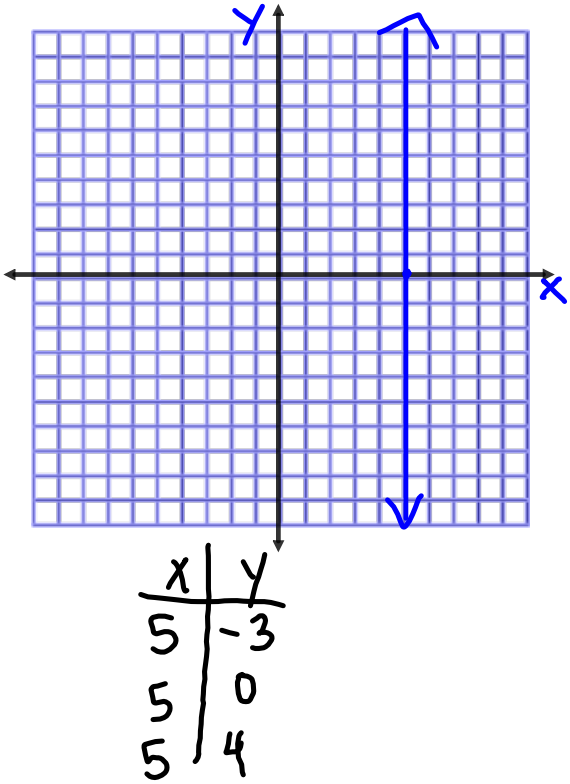
Vertical Lines



In the coordinate plane, the graph of $x = a$ is a ***vertical line***.

Vertical

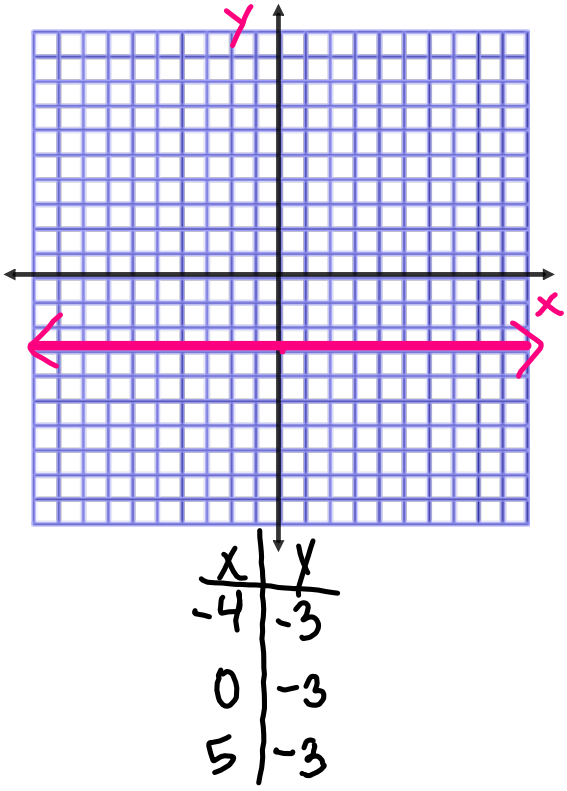
10. Graph $x = 5$.



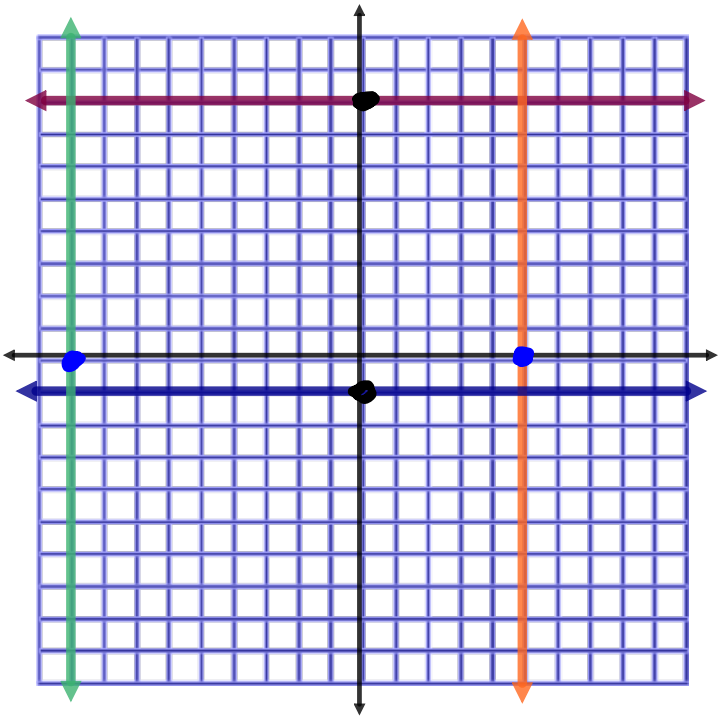
x	y
5	-3
5	0
5	4

Horizontal

11. Graph $y = -3$.



x	y
-4	-3
0	-3
5	-3



Write the equation of the...

12. maroon line

$y = 8$

13. orange line

$x = 5$

14. green line

$x = -9$

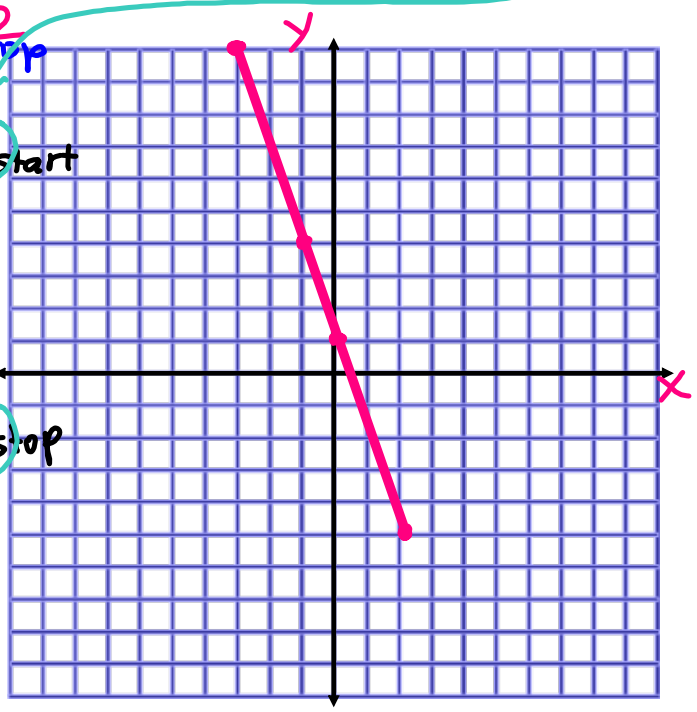
15. blue line

$y = -1$

16. **Graph** the function $y = -3x + 1$ with domain ~~$x \leq 0$~~ $-3 \leq x \leq 2$. Then **identify the range**. y-values

start stop

x		y
-3	$-3(-3) + 1$	10 start
-1	$-3(-1) + 1$	4
0	$-3(0) + 1$	1
2	$-3(2) + 1$	-5 stop

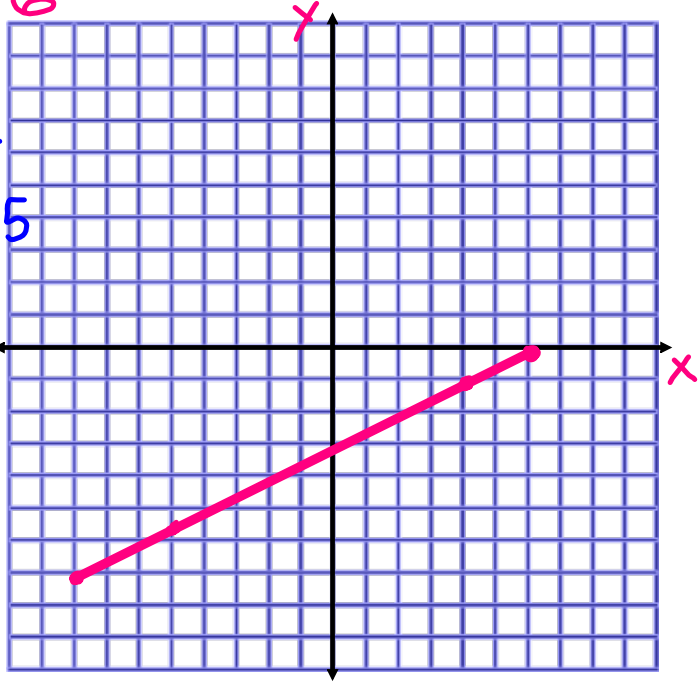


Range $-5 \leq y \leq 10$

least to greatest

17. **Graph** the function $y = \frac{1}{2}x - 3$ with domain ~~$x \geq 2$~~ $-8 \leq x \leq 6$. Then **identify the range**. y-values

x		y
-8	$\frac{1}{2}(-8) - 3$	-7
-5	$\frac{1}{2}(-5) - 3$	-5.5
4	$\frac{1}{2}(4) - 3$	-1
6	$\frac{1}{2}(6) - 3$	0

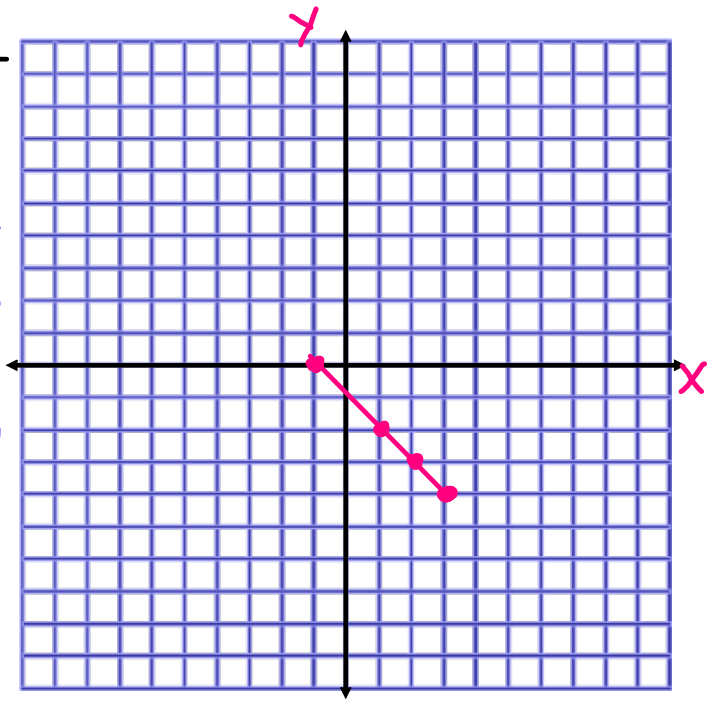


Range $-7 \leq y \leq 0$

18. **Graph** the function y = -x - 1 with domain -1 ≤ x ≤ 3. Then **identify the range**. y-values

x		y
-1	-(-1) - 1	0
1	-(1) - 1	-2
2	-(2) - 1	-3
3	-(3) - 1	-4

Range $-4 \le y \le 0$



Example 19

Savannah averages 40 miles per hour when she drives from Los Angeles to San Francisco. What equation relates the distance traveled to the number of hours traveled?

Graph the relation by letting the horizontal axis represent the time and the vertical axis represent the distance.