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

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

$1 + 0 = 1$

$1 = 1$ ✓

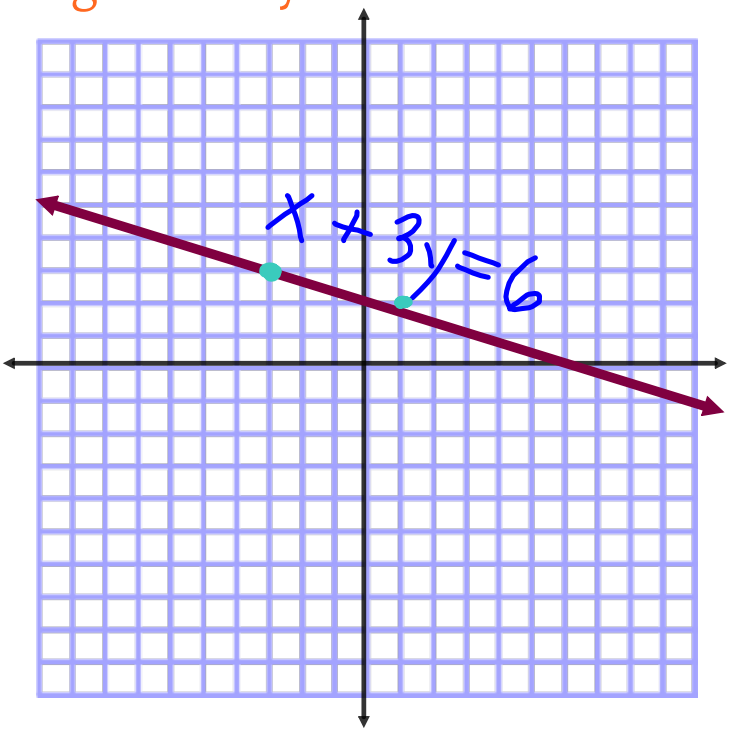
4. $(\frac{5}{2}, -6)$ not a solution

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

$5 + -6 = 1$

$-1 \neq 1$

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.

x y

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

$1 + 6 = 6$

$7 \neq 6$

6. (-3, 3) solution

x y

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

$-3 + 9 = 6$

$6 = 6\checkmark$

A linear equation is an equation that can be written in the form $Ax + By = C$, (x & y → on same side)
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** if one of its variables is isolated on one side of the equation.

Solve for y →

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

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

Write the equation above in function form.

$2x + 3y = 6$

$-2x \quad -2x$

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

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

Steps to Graphing a Linear Equation

Step 1: Rewrite the equation in **function form**.
get y by itself ←

Step 2: Choose a few values of *x* and make a table.
at least 4

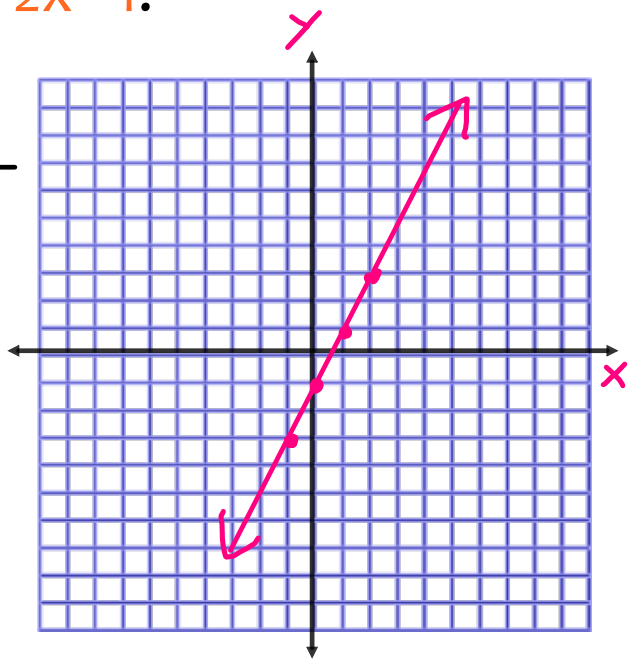
Step 3: Plot the points from the table of values. A line through these points is the graph of the equation.

Example 7

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

$y = 2x - 1$

x		y
-1	$2(-1) - 1$ $-2 \; -1$	-3
0	$2(0) - 1$ $0 \; -1$	-1
1	$2(1) - 1$ $2 \; -1$	1
2	$2(2) - 1$ $4 \; -1$	3



Example 8

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

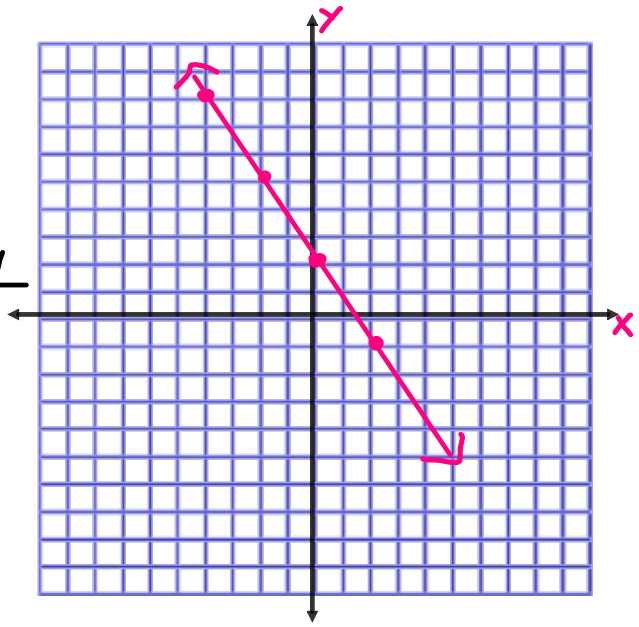
$3x + 2y = 4$

$-3x \quad -3x$

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

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

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



Example 9

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

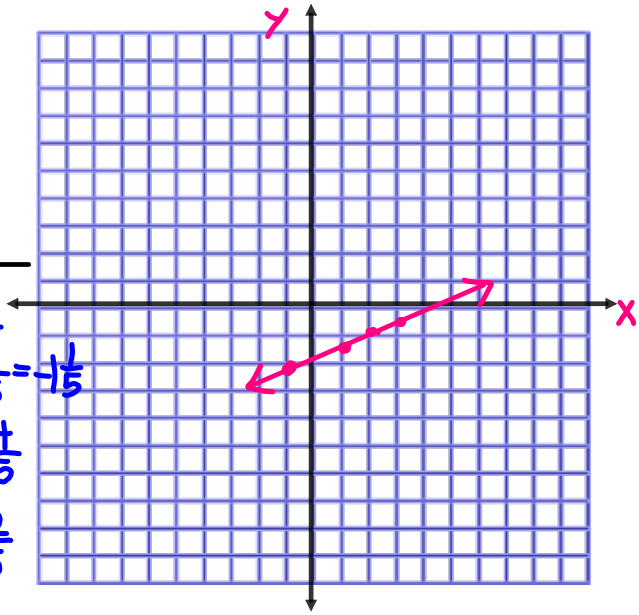
$2x - 5y = 8$

$-2x \quad -2x$

$\frac{-5y}{-5} = \frac{-2x}{-5} + \frac{8}{-5}$

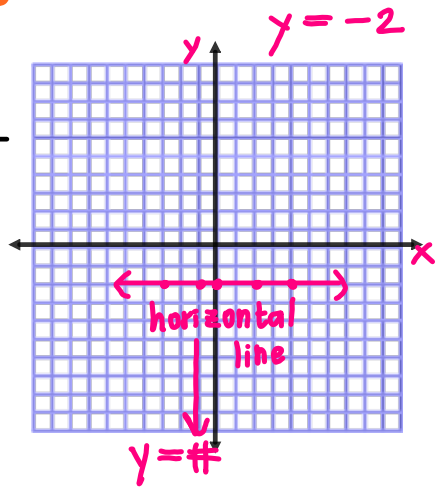
$y = \frac{-2x + 8}{-5}$

x		y
-1	$\frac{-2(-1) + 8}{-5} = \frac{2+8}{-5} = \frac{10}{-5}$	-2
1	$\frac{-2(1) + 8}{-5} = \frac{-2+8}{-5} = \frac{6}{-5}$	$-\frac{6}{5} = -1\frac{1}{5}$
2	$\frac{-2(2) + 8}{-5} = \frac{-4+8}{-5} = \frac{4}{-5}$	$-\frac{4}{5}$
3	$\frac{-2(3) + 8}{-5} = \frac{-6+8}{-5} = \frac{2}{-5}$	$-\frac{2}{5}$

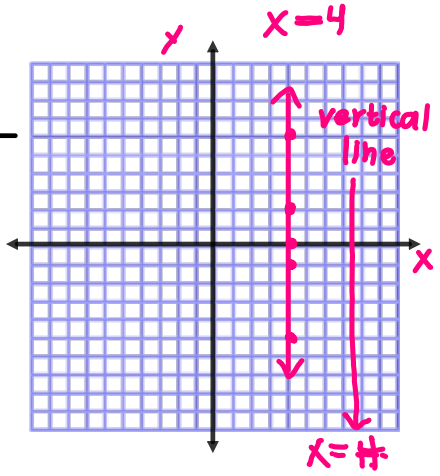


What would your graph look like if your table of values looked like these?

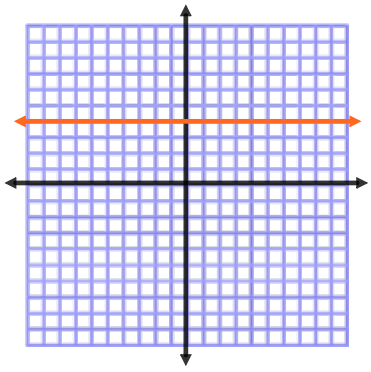
x	y
-3	-2
-1	-2
0	-2
2	-2
4	-2



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

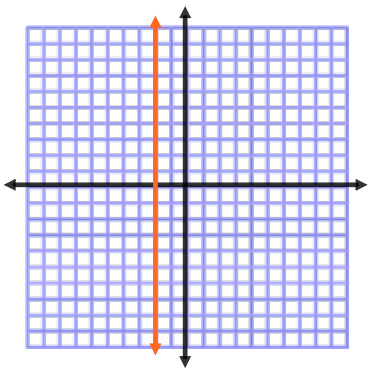


Horizontal Lines



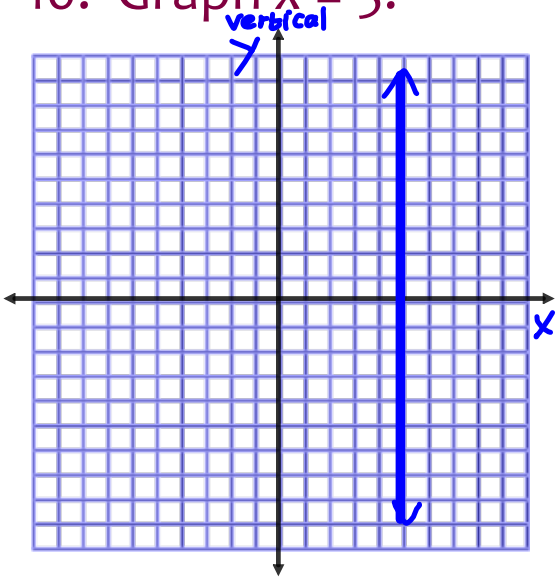
In the coordinate plane, the graph of $y = b$ is a ***horizontal line***.

Vertical Lines

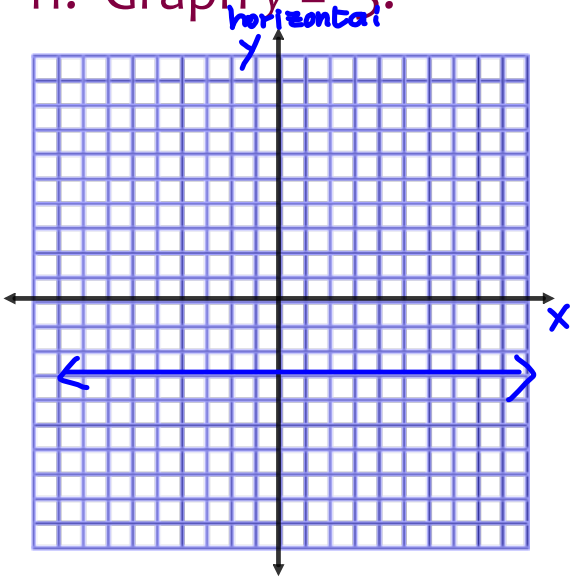


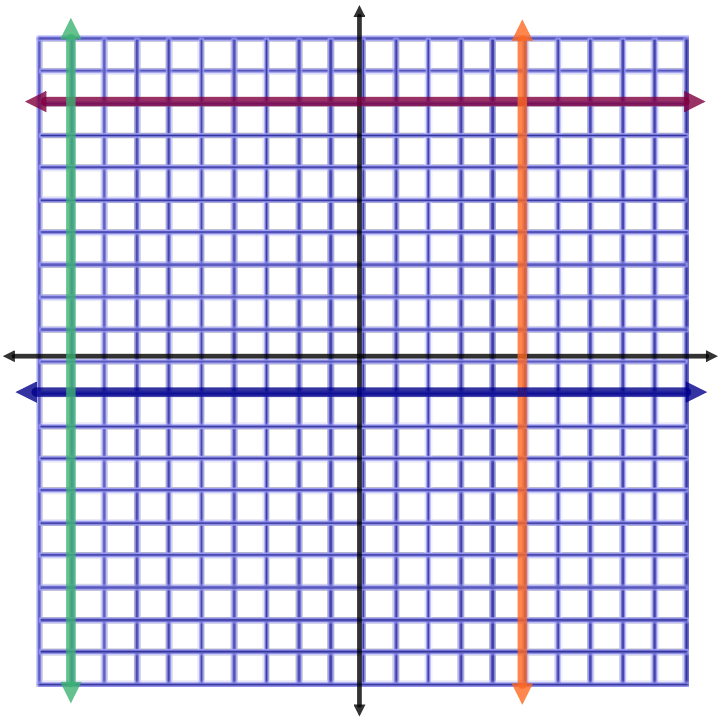
In the coordinate plane, the graph of $x = a$ is a ***vertical line***.

10. Graph $x = 5$.



11. Graph $y = -3$.





Write the equation of the...

12. maroon line

$y = 8$

13. orange line

$x = 5$

14. green line

$x = -9$

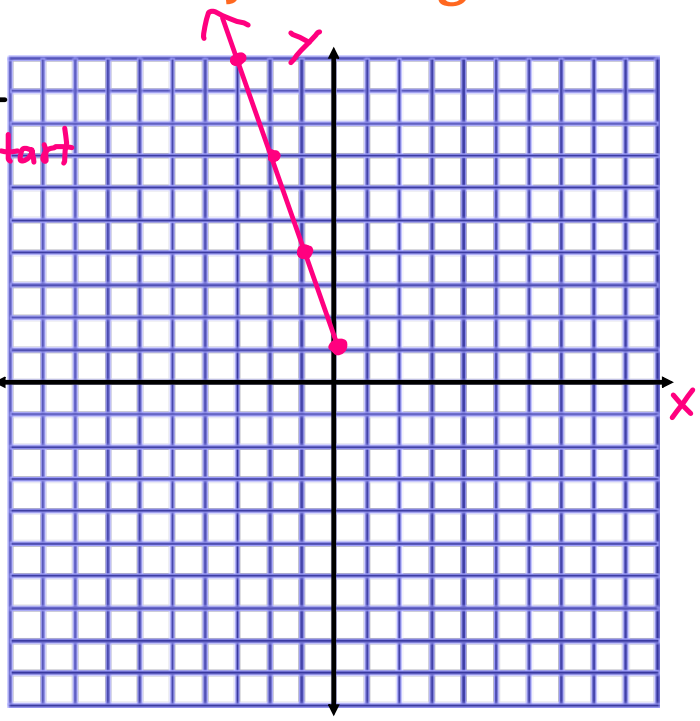
15. blue line

$y = -1$

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

x		y
start 0	$-3(0) + 1$	1 start
-1	$-3(-1) + 1$	4
-2	$-3(-2) + 1$	7
-3	$-3(-3) + 1$	10
arrow		⋮

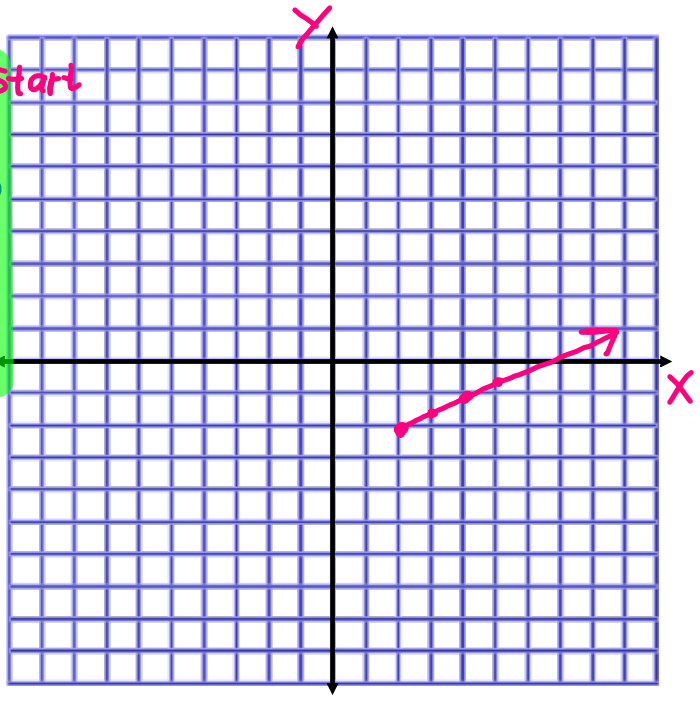
range
$y \geq 1$



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

x		y
start 2	$\frac{1}{2}(2) - 3$	-2 start
3	$\frac{1}{2}(3) - 3$	-1.5
4	$\frac{1}{2}(4) - 3$	-1
5	$\frac{1}{2}(5) - 3$	-0.5
arrow		

range
$y \geq -2$



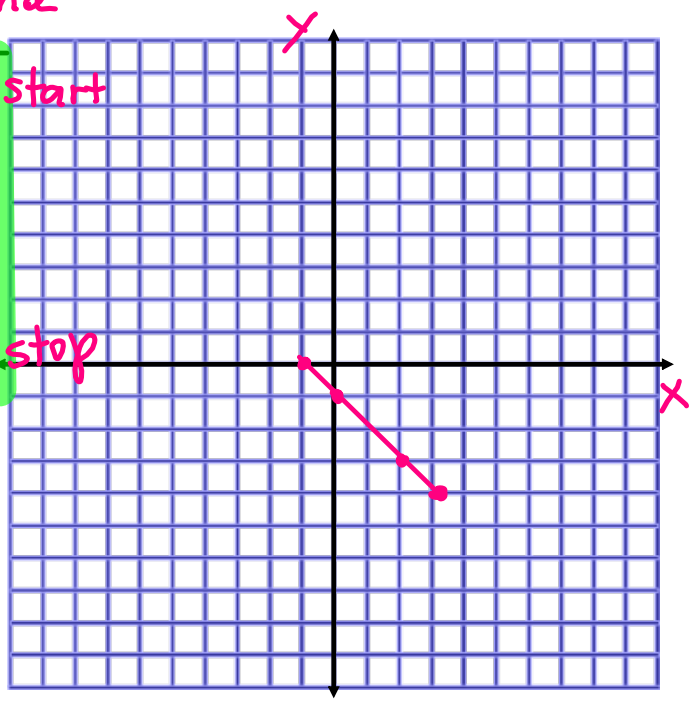
18. **Graph** the function y = -x - 1 with domain $-1 \le x \le 3$. Then **identify the range**.

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

beginning, end

y
0 start
-1
-3
-4 stop

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.