Unit 3 Notes

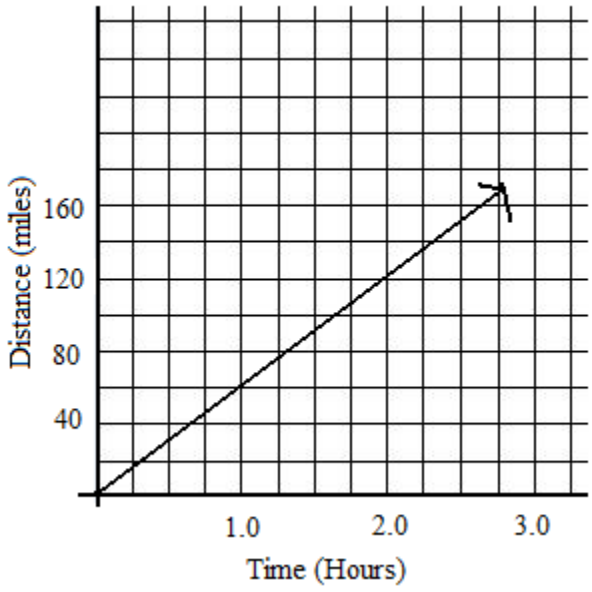
Rate of Change	The average rate of change calculates the amount of change in one item divided by the corresponding amount of change in another.

Examples

Heart Rate – beats per minute
60 miles per hour
1 birth per 4 hours
4.5 police officers per 1000 people
1.5 children per marriage
40 cases of lung cancer per 1000 smokers

Example One

The graph below shows the distance a train travels at a constant speed.



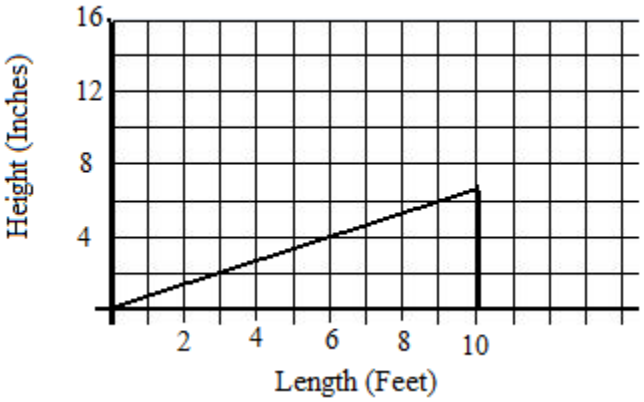
a.) Identify the rate of change

b.) What does your answer in part *a* mean?

c.) If the train travels for 4 hours, how far would it have traveled?

Example Two

The graph below shows the height of a staking ramp as you ride up the ramp.



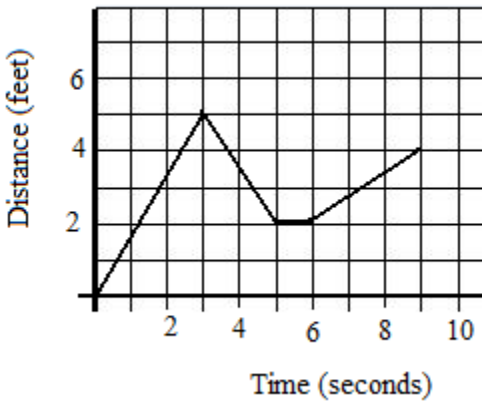
a.) Find the rate of change of the skating ramp represented in the drawing.

b.) Interpret your answer in part *a*.

c.) If the ramp continues to rise, what is its height if it is 15 feet in length?

Example Three

The graph below describes the distance a student walks from their desk.



a.) Identify the rate of change for the first 3 seconds

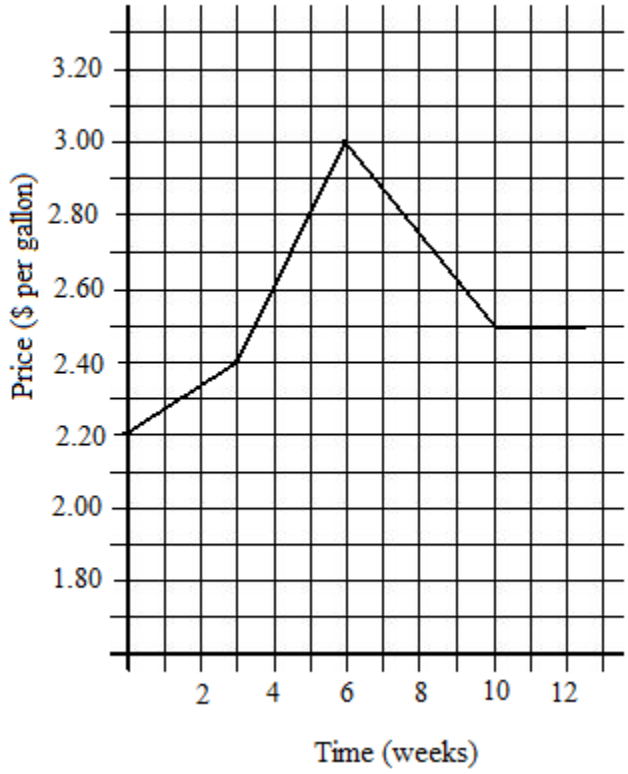
b.) Identify the rate of change between 3 and 5 seconds.

c.) What is going on between the 5^{th} and 6^{th} second?

d.) Between which interval is the rate of change the greatest?

Example Four

The graph below shows the price of gasoline over a certain time period.

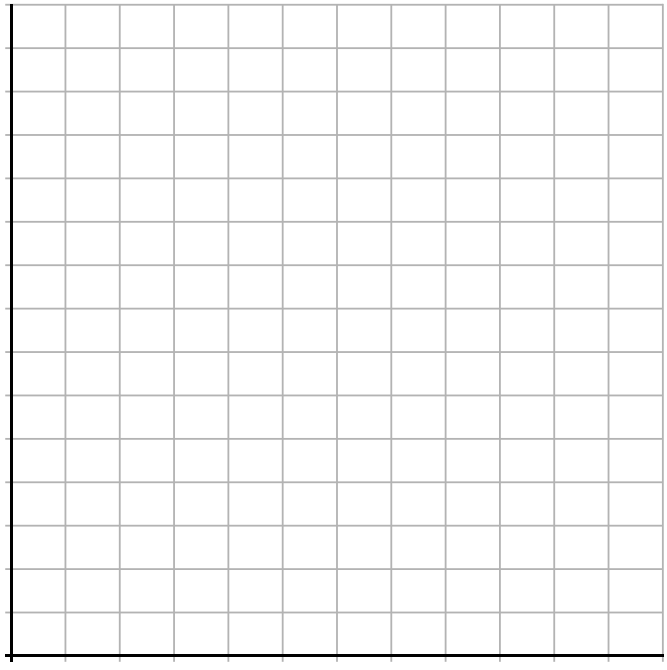


a.) Identify the rate of change the first 3 weeks. What does this mean?

b.) Identify the rate of change between weeks 6 and 10. What does this mean?

c.) When is the price of gas increasing the fastest?

Use the following information to draw a graph. Be sure to label the x and y-axis. Dave is swimming at a rate of 1.5 meters per second for a total of 60 seconds and then he stops swimming for 20 seconds. He then continues swimming at a rate of 1 meter per second for 40 seconds.



Rate of Change Word Problems

Example One

Cameron was driving a car at a constant speed on the New York State Thruway. He noticed that after driving for 1 hour he had 12 gallons of gas left. Then, after driving for a total of 3 hours, he had 8 gallons of gas left. Assume in this problem that there is a linear relationship between the amount of gasoline left and the time Cameron has been driving.

a.) Express the information given in this problem as two ordered pairs, where the independent variable (x-value) is time and the dependent variable (y-value) is the gallons of gasoline left.

b.) Identify the rate of change in this problem.

c.) Interpret what your answer in *part b* means.

d.) How long can Cameron drive before he runs out of gas?

Example Two

A corn stalk grows at a constant rate. At 3 weeks old, a corn stalk is 4 inches tall and at 15 weeks it is 46 inches tall.

a.) Express the information above as two ordered pairs.
x-value = y-value =

b.) Identify the rate of change in this problem.

c.) What does your answer in *part b* mean?

d.) If the corn stalk continued to grow at this rate, how tall would it be after 18 weeks?

Example Three

Tom is driving to Florida for vacation. After driving for 4 hours, Tom is 82 miles from home and after driving for 7 hours, Tom is 244 miles from home.

a.) Express the information above as two ordered pairs.
x-value = y-value =

b.) Identify the rate of change in this problem.

c.) What does your answer in *part b* mean?

d.) If Tom continues to drive at this same rate, how long would it take him to drive 650 miles?

Example Four

LeBron James scored 6 points after 18 minutes and scored a total of 39 points by the end of the game (48 minutes).

a.) Identify the rate of change in LeBron's points between the 18^{th} minute and the end of the game.

b.) What does your answer in *part a* mean?

c.) If LeBron plays for 58 minutes, how many points would he have scored total?

Try These

1. Takeru "The Tsunami" Kobyashi eats 4 Nathan's hot dogs in 2 minutes and 56 hot dogs in 12 minutes.
   a.) Identify the rate of change in the number of hot dog Kobyashi eats between the 2^{nd} and 12^{th} minute.

   b.) What does your answer in *part a* mean?

   c.) How many hot does could Kobyashi eat in 15 minutes if he eats at the same rate?

2. The Williams family is on their way home from a vacation traveling at a constant speed. After 2 hours in the car, they are 200 miles from home; after 5 hours in the car, they are 80 miles from home.
   a.) Identify the rate of change during this time interval.

   b.) What does your answer in *part a* mean?

   c.) How far were they from their house when they started driving?

3. A boy is 29 inches tall when he is 1 year old and 66 inches tall when he is 15 years old.
   a.) Identify the rate of change during this time interval.

   b.) What does your answer in *part a* mean?

   c.) If he continues to grow at the same rate, how tall will he be when he is 20 years old?

Graphing from Slope-Intercept Form

Remember Slope-Intercept Form? $y = mx + b$

m = b =

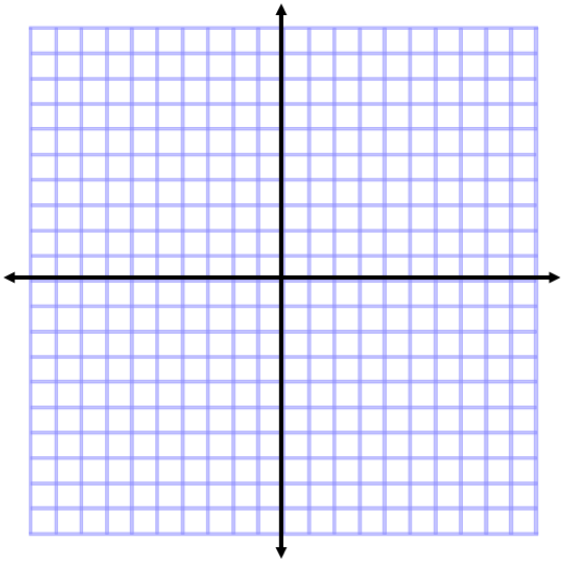
Steps to Graphing from Slope-Intercept Form

1. Plot the y-intercept on the y-axis
2. Use the slope as $\frac{rise}{run}$ to find additional points.
3. Draw the line using a straight edge.

1. Graph $y = 4x + 3$

   Slope =

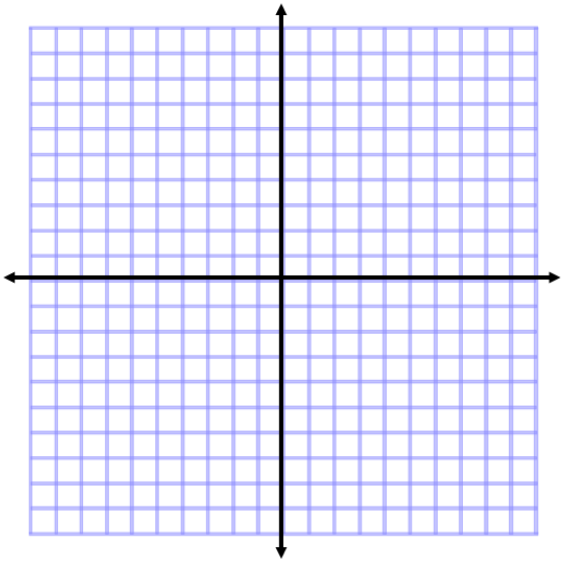
   y-intercept =



2. Graph $y = -\frac{1}{2}x - 2$

   Slope =

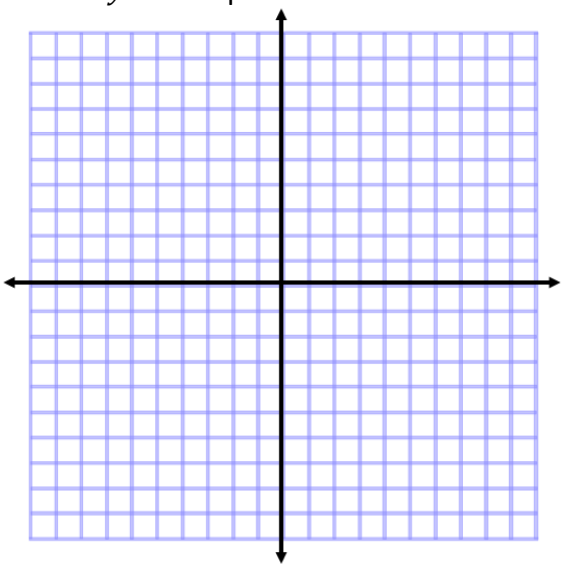
   y-intercept =



3. Graph $y = \frac{3}{5}x - 5$

   Slope =

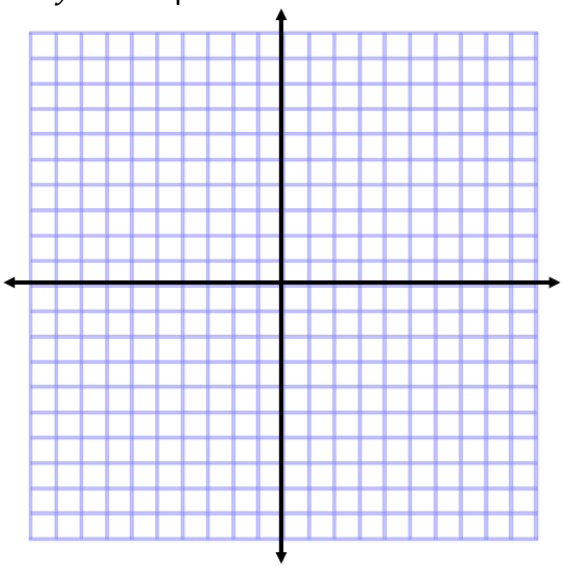
   y-intercept =



4. Graph $y = -3x + 4$

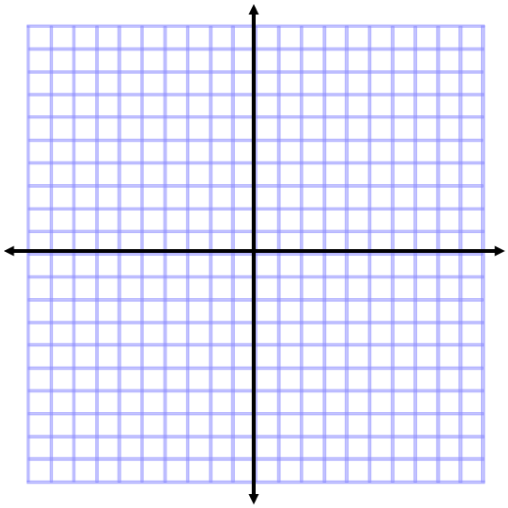
   Slope =

   y-intercept =



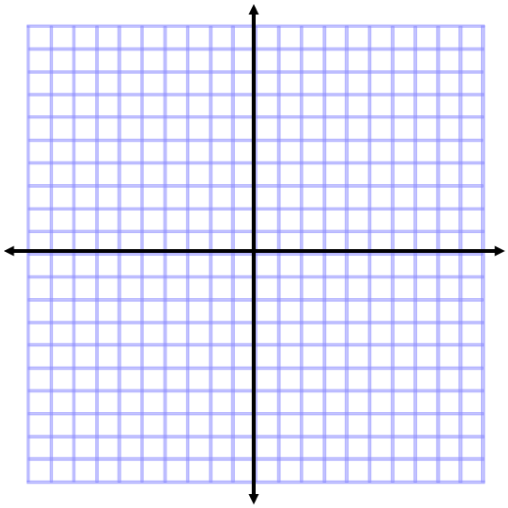
5. Graph $y = \frac{4}{3}x - 3$

Slope = y-intercept =



6. Graph $y = x + 4$

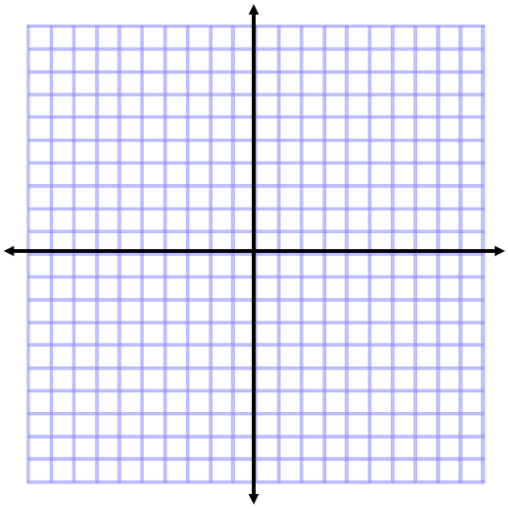
Slope = y-intercept =



Try These. Graph each equation.

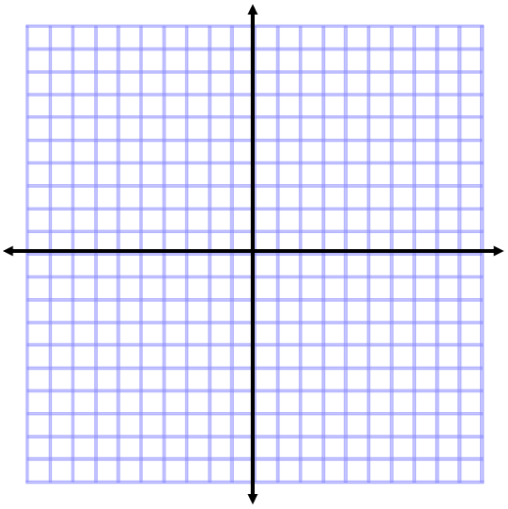
1. $y = -4x - 1$

Slope = y-intercept =



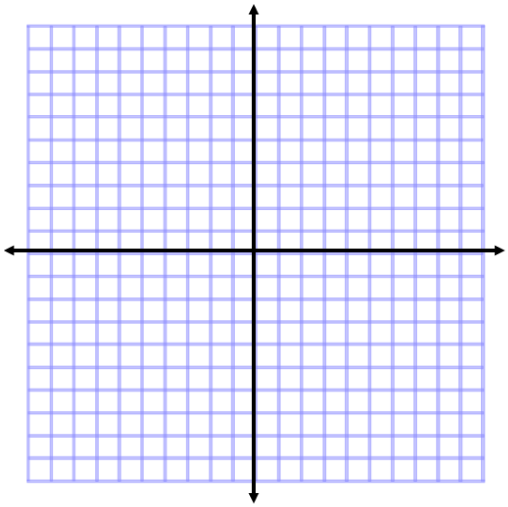
2. $y = \frac{3}{5}x - 2$

Slope= y-intercept =



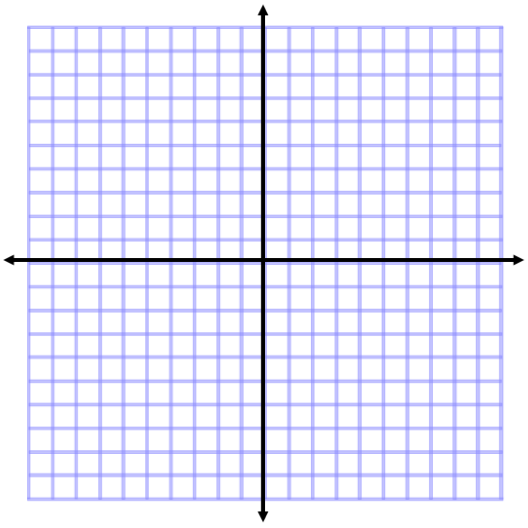
3. $y = 5x - 7$

Slope = y-intercept =



4. $y = -\frac{4}{5}x + 3$

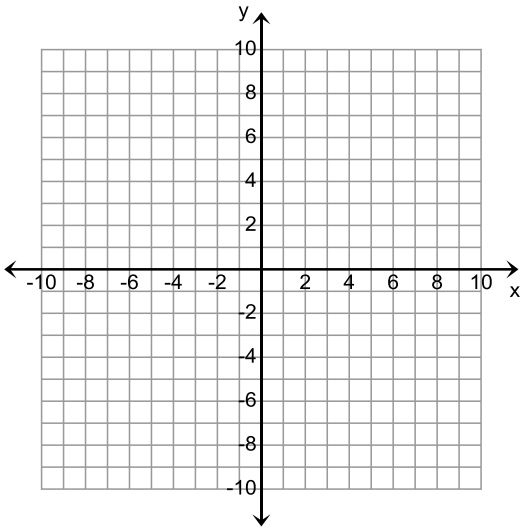
Slope= y-intercept =



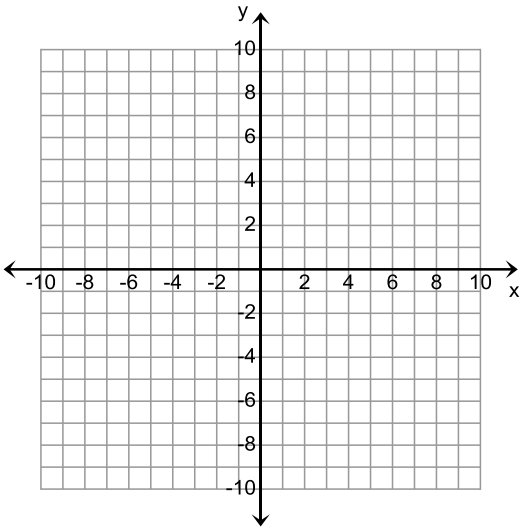
Graphing from Standard Form

There are 2 different methods in graphing an equation in standard form. YOU pick which one you want to use.

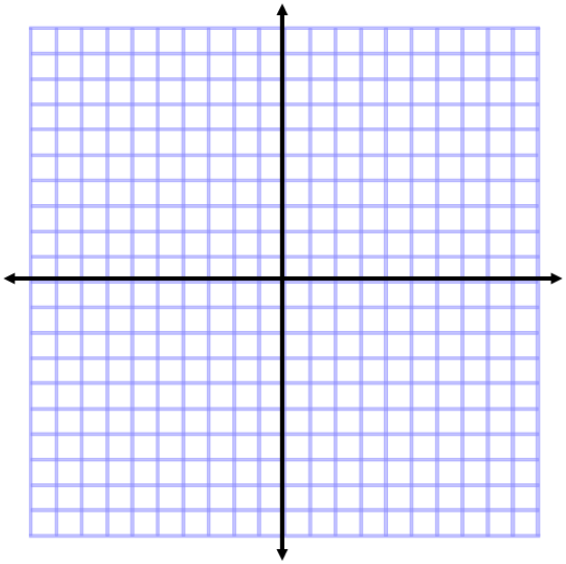
Method 1 **Convert the equation to Slope-Intercept Form**	**Method 2** **Graph using the x- and y-intercepts.**
Graph $6x + 3y = 12$	Graph $6x + 3y = 12$



x	*y*
	0
0	

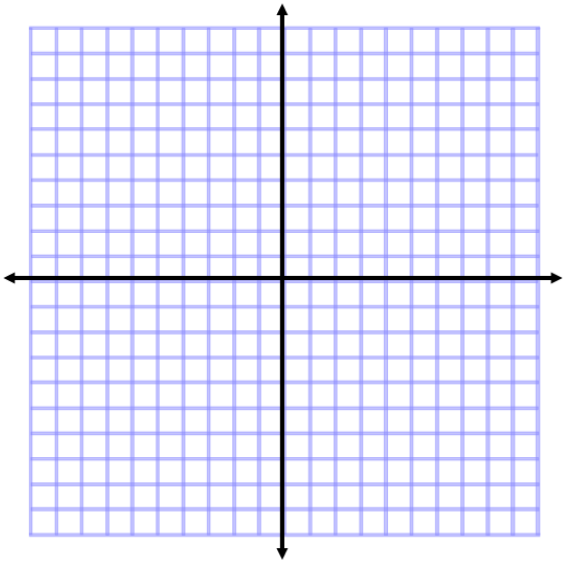


Graph $-4x - 2y = 16$ Use whichever method you find easier.

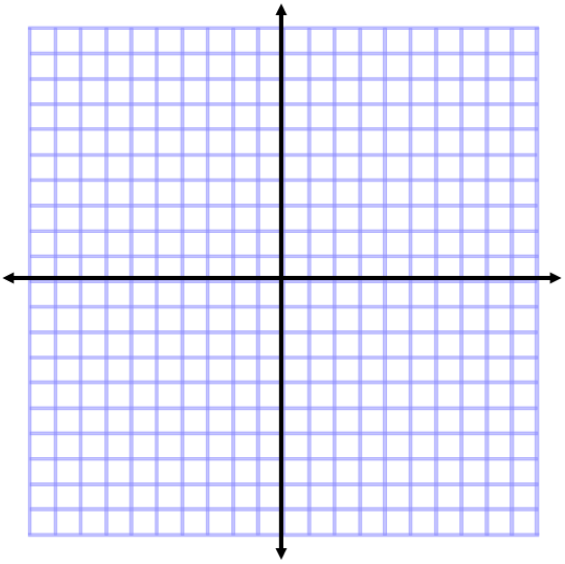


Try These

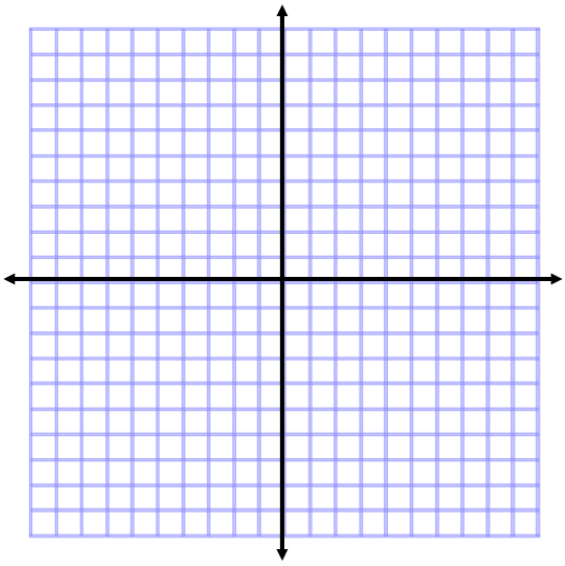
1. Graph $-4x + 3y = 12$



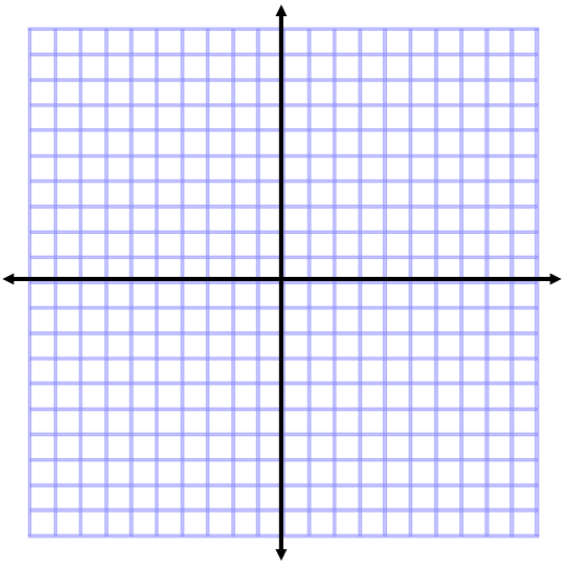
2. Graph $x - 4y = 8$



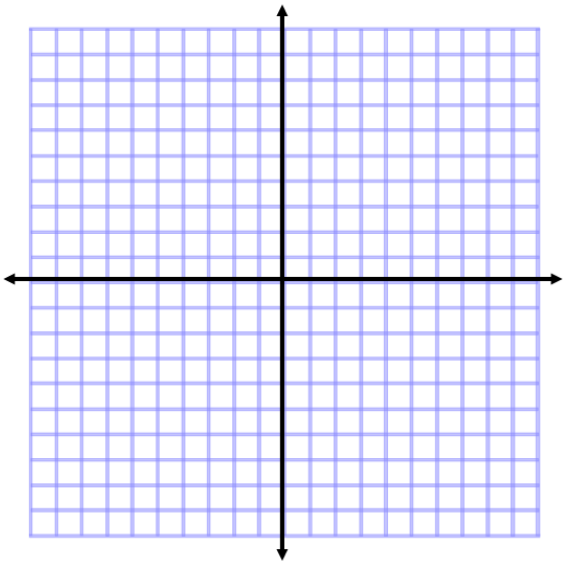
3. Graph $-3x - 5y = -15$



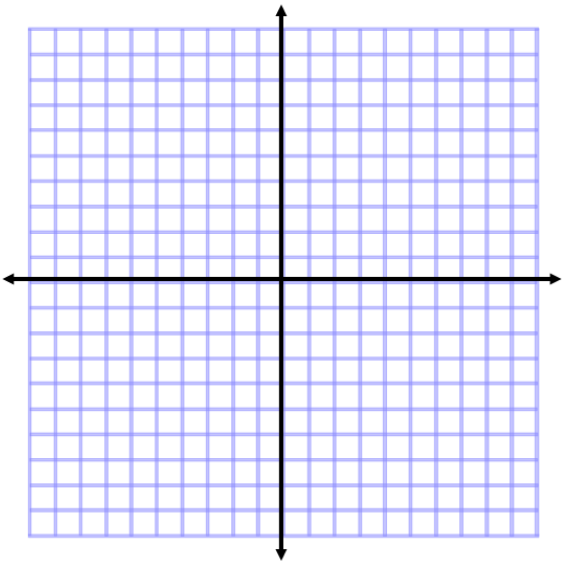
4. Graph $8x + 6y = -24$



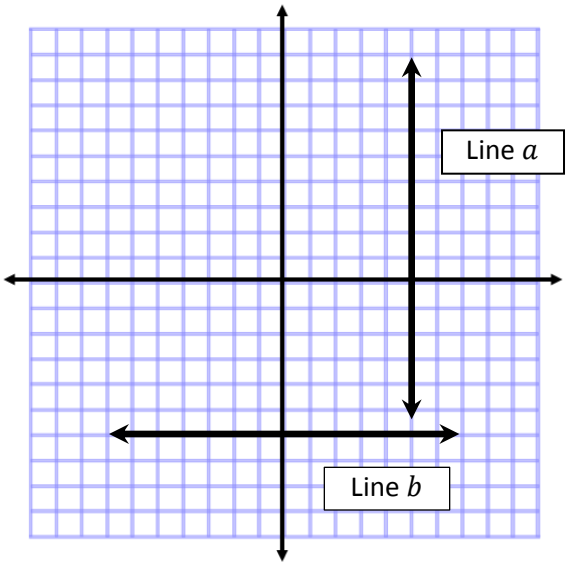
5. Graph $x - 3y = -9$



6. Graph $2x + y = 8$



Graphing Horizontal and Vertical Lines



Points on Line a	Points on line b

Horizontal Line

$y = b$

which crosses the y-axis at b

Vertical Line

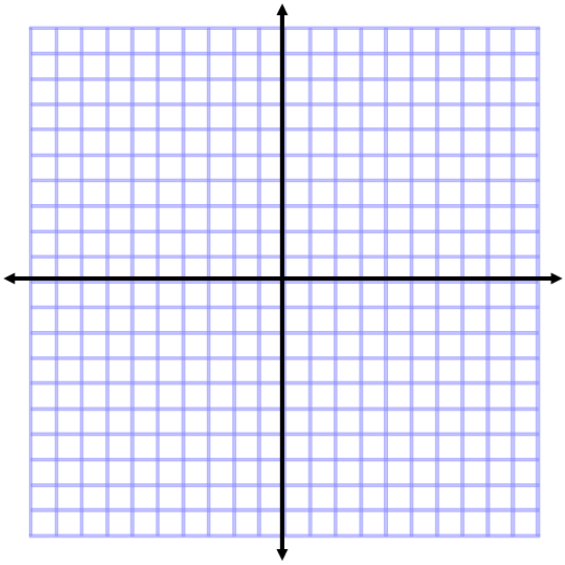
$x = a$

which crosses the x-axis at a

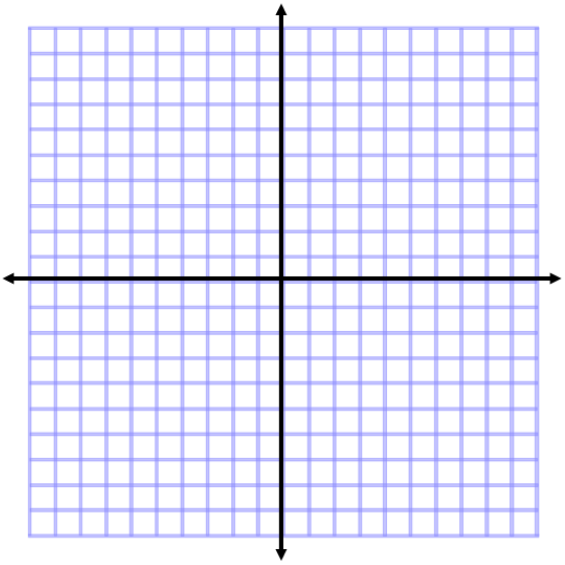
Identify whether the equation represents a horizontal line or a vertical line:

1. $y = 4$
2. $y = -3$
3. $x = 2$
4. $x = 0$

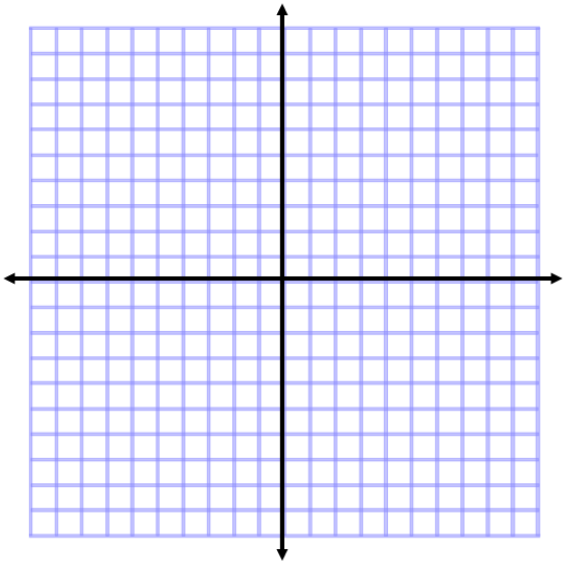
5. Graph each of the following lines on the same coordinate:
   Line a: $y = -4$
   Line b: $x = 3$



6. Graph each of the following lines on the same coordinate:
   Line c: $y = -2$
   Line d: $y = -4$



7. Graph each of the following lines on the same coordinate:
   Line e: $x = -4$
   Line f: $y = 3$



8. Graph each of the following lines on the same coordinate:
   Line g: $x = 0$
   Line h: $x = 5$