

Name: \_\_\_\_\_ Hour: \_\_\_\_\_

A l g e b r a

U n i t 2

B o o k l e t

# SLOPE

Definition:

EXAMPLE:

## FINDING SLOPE ON A GRAPH

①

②

③

④

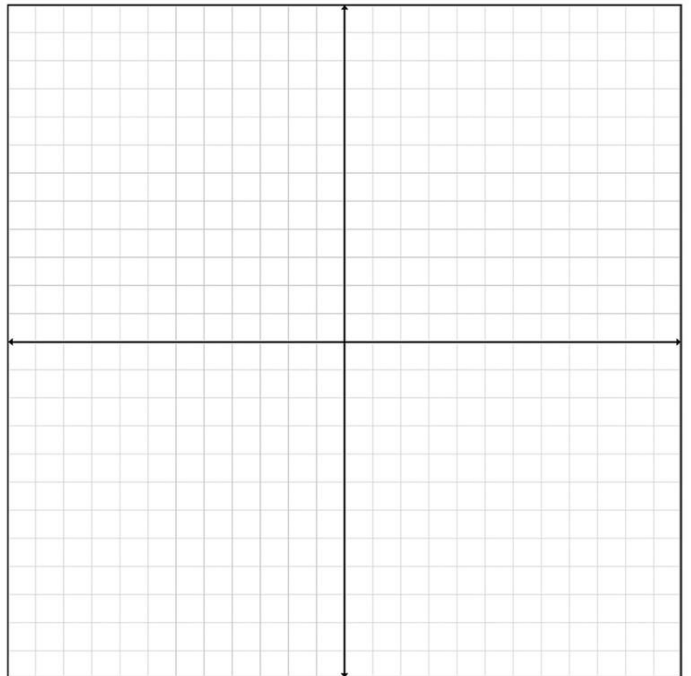
## FINDING SLOPE FROM POINTS

①

②

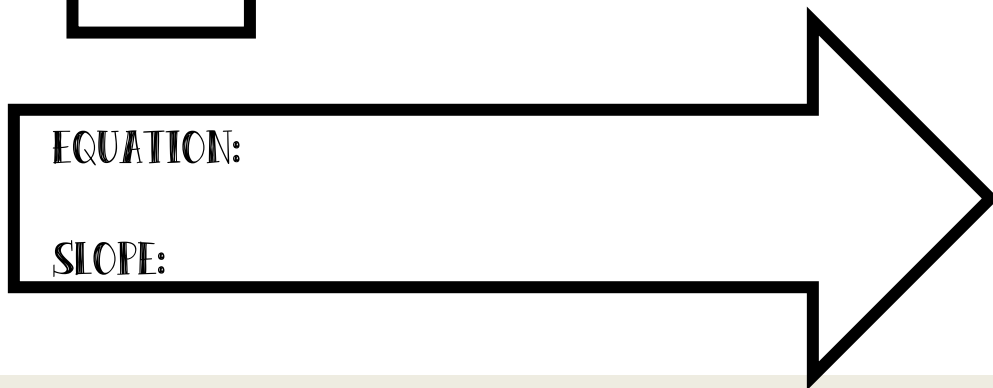
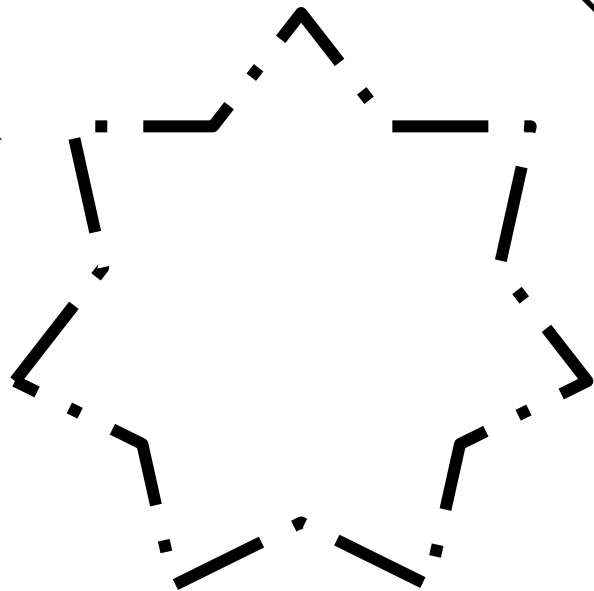
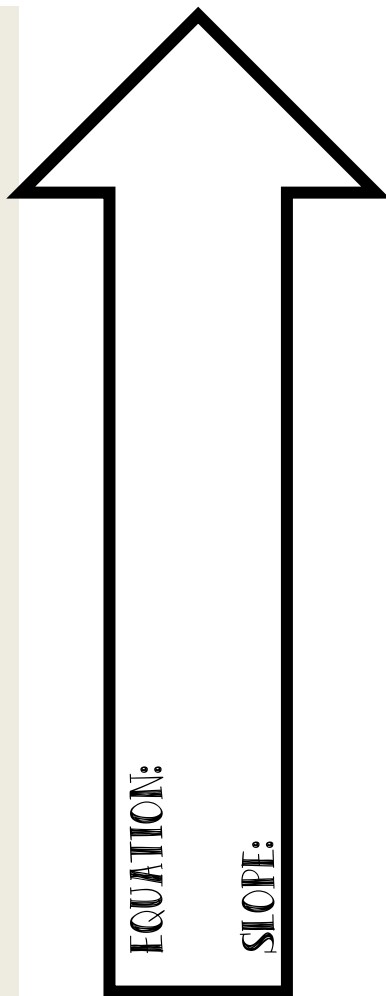
③

④



# HORIZONTAL AND VERTICAL LINES

**VERTICAL LINE**



**HORIZONTAL LINE**

# FORMS OF LINES

SLOPE-INTERCEPT FORM

STANDARD FORM

POINT-SLOPE FORM

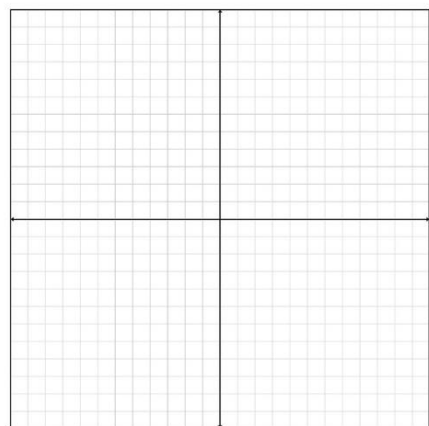
Tables:

Coordinates:

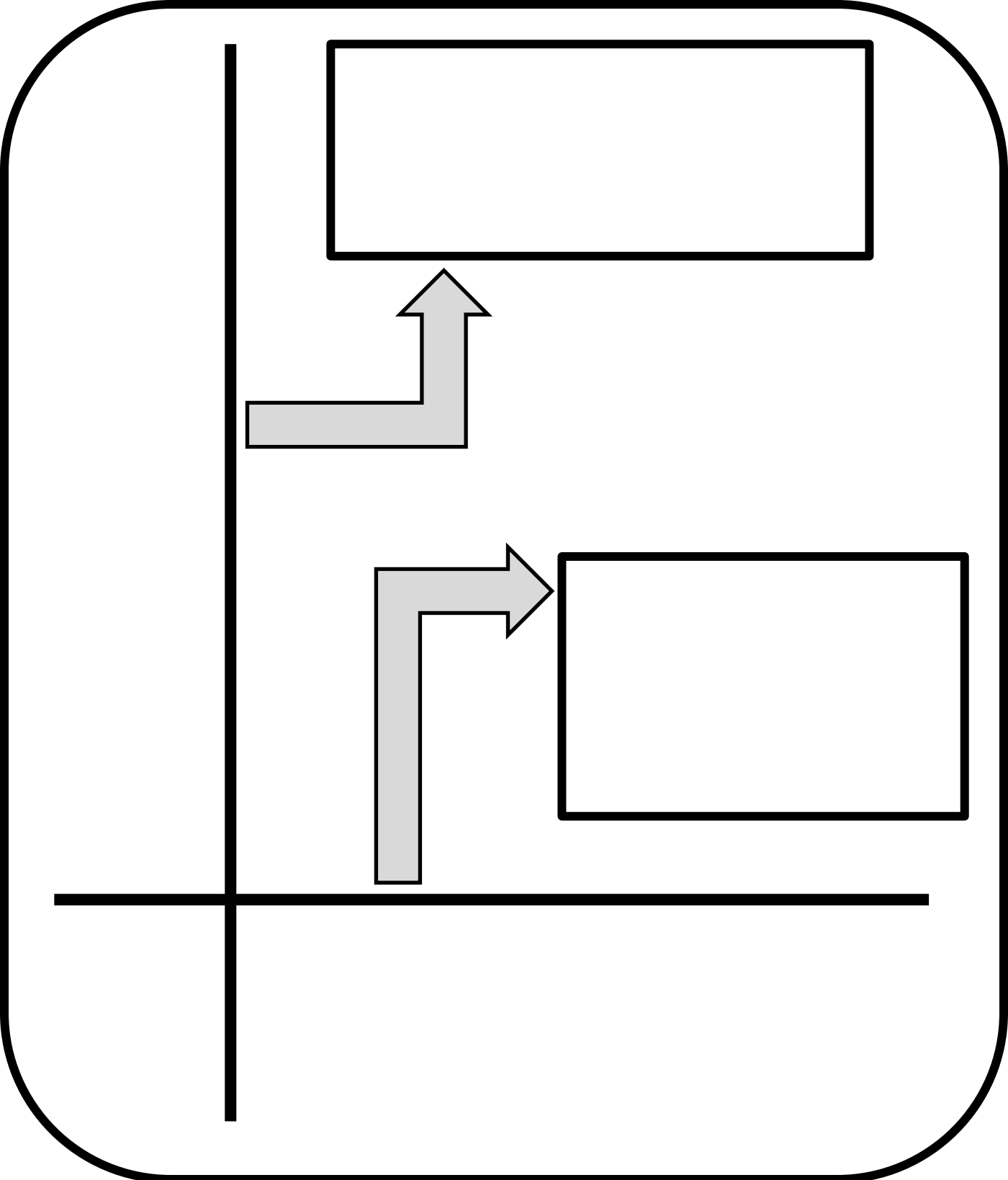
Linear

Situations:

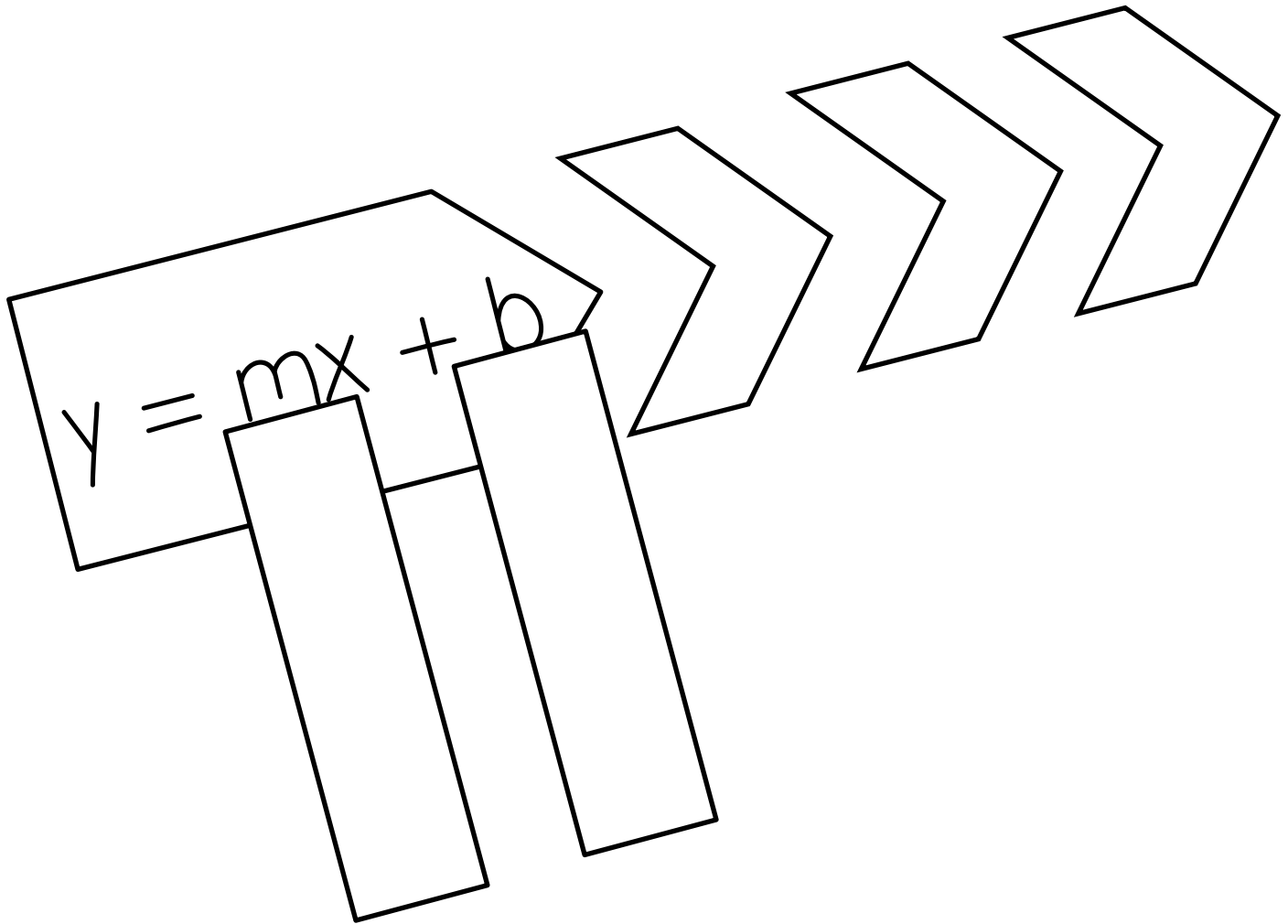
Graphs:



# INTERCEPTS



# MAKING EQUATIONS FROM SITUATIONS



# Go! Motion Detectors

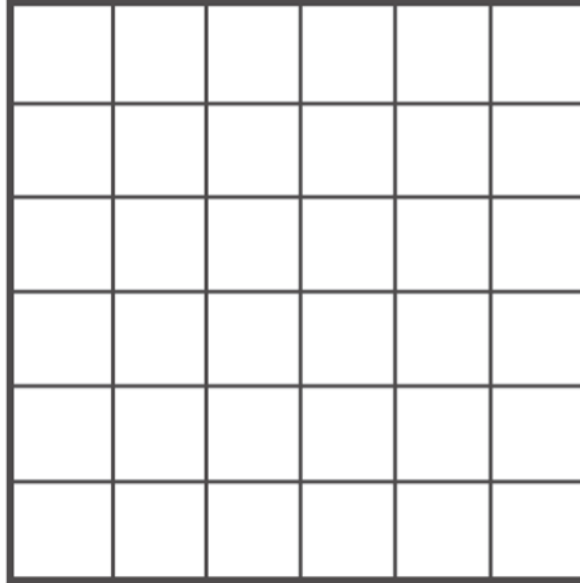
Before you begin

- Download software (from website or from CD)
- Plug cord into motion detector and computer – red/orange light should turn on.
- Open software.

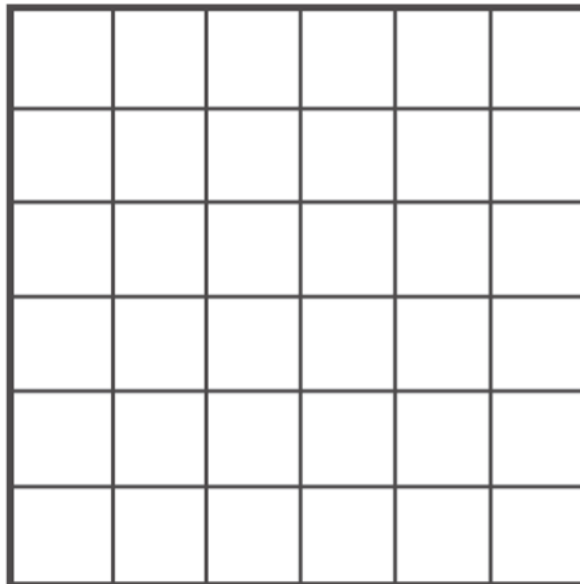
\*\*You will need one person to be in charge of the software and one person to be the participant.

\*\*You will only have 5 seconds to record movement on each trial.

1.) Have the walker start away 5 large paces away from the motion detector. Push START. Have the walker walk toward the detector. Draw the graph created. Make sure to write in all labels.



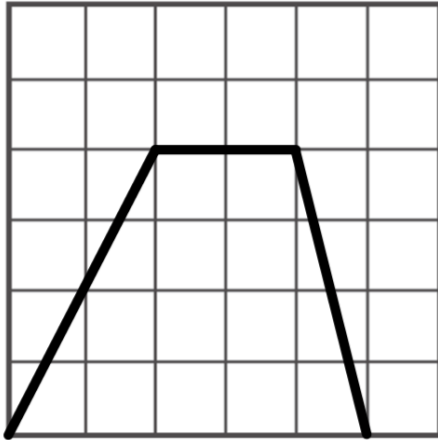
2.) Have the walker start close to the motion detector. Push START. Have the walker walk away from the detector. Draw the graph created. Make sure to write in all labels.



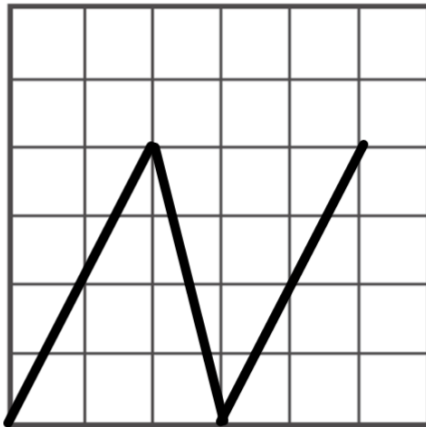
3.) Describe all of the things you notice about your two graphs. How do you make your line incline? How do you make your line decline?



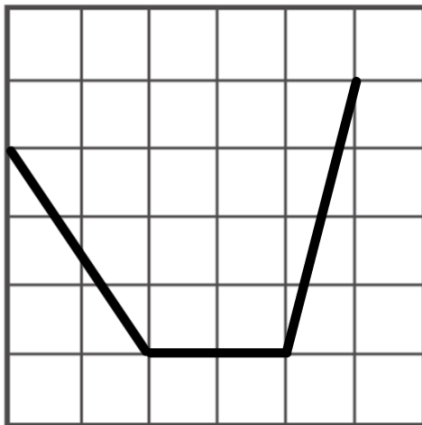
4.) How can you make a replica of this graph? Be specific. Then try it!



5.) How can you make a replica of this graph? Be specific. Then try it!



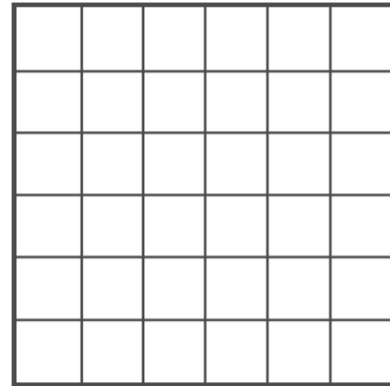
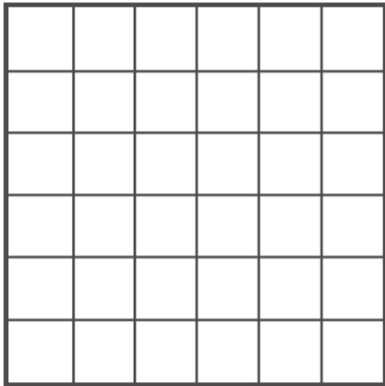
6.) How can you make a replica of this graph? Be specific. Then try it!



7.) What does the walker have to do to create the flat line (#4 & #6)

8.) Have your walker create a wave shaped graph. Draw your graph and then explain what the walker did.

9.) Have your walker create a “v” shaped graph. Draw your graph and then explain what the walker did.



**For questions 8 & 9...**

Explain if there is a functional relationship between your position from the motion detector and the time you are walking.

What is the domain of the graph?

What is the range of the graph?

Give a detailed description of how your position relative to the motion detector changes over the time intervals.

# Finding Rate of Change and Slope from Graphs, Tables, Coordinate Pairs, and Situations

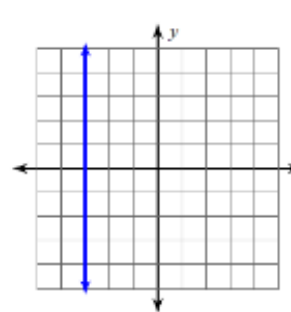
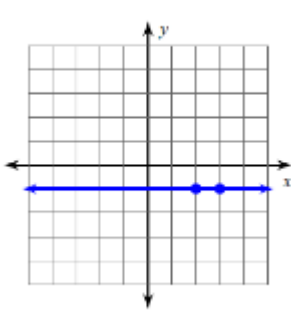
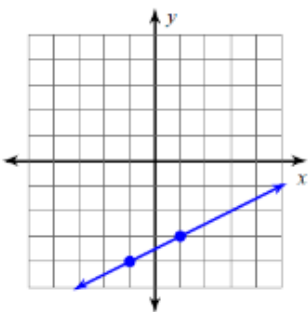
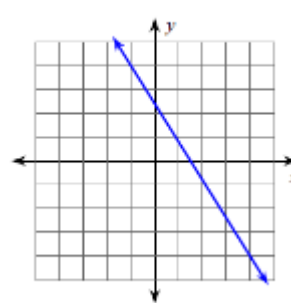
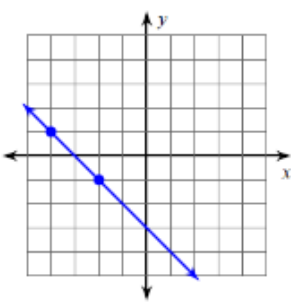
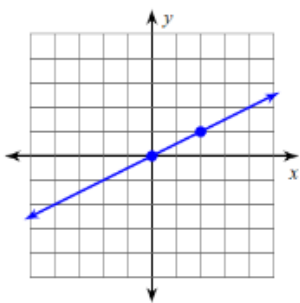
The mathematical definition of **slope** or **rate of change** is very similar to our everyday one. In math, slope is the ratio of the vertical and horizontal changes between two points on a surface or a line.

A linear equation has a constant rate of change. (The change from *one x value to the next x value* and *one y value to the next y value* is the same from one point to the next.)

## Finding Slope from a graph

The vertical change between two points is called the **rise**, and the horizontal change is called the **run**. The slope equals the rise divided by the run:  $Slope = \frac{rise}{run}$ . This simple equation is called the **slope formula**.

Find the slope for each of the graphs. Answer the questions below the graphs.



When the line is uphill, the slope is always \_\_\_\_\_.

When the line is downhill, the slope is always \_\_\_\_\_.

When the line is horizontal, the slope is always \_\_\_\_\_.

When the line is vertical, the slope is always \_\_\_\_\_.

## Finding Slope from table

Find the constant rate of change/slope in each table.

$$\text{Slope} = \frac{\text{change in } y}{\text{change in } x}$$

| x  | y  |
|----|----|
| 5  | 2  |
| 8  | 4  |
| 11 | 6  |
| 14 | 8  |
| 17 | 10 |

| x  | y  |
|----|----|
| -1 | 2  |
| -2 | 4  |
| -3 | 6  |
| -4 | 8  |
| -5 | 10 |

| x  | y  |
|----|----|
| 3  | -3 |
| 6  | -1 |
| 9  | 1  |
| 15 | 5  |
| 18 | 7  |

| n  | h(n) |
|----|------|
| 3  | -10  |
| 1  | -5   |
| -1 | 0    |
| -3 | 5    |
| -5 | 10   |

## Finding slope from coordinate pairs

The slope formula is  $m = \frac{y_1 - y_2}{x_1 - x_2}$

(2, 4), (4, 7)

(-3, 4), (-5, 8)

(0, 4), (8, -12)

(-17, 6), (-13, 4)

(-2, 8), (9, -4)

## Finding slope from word problems

The following graph represents Karen's Marathon.



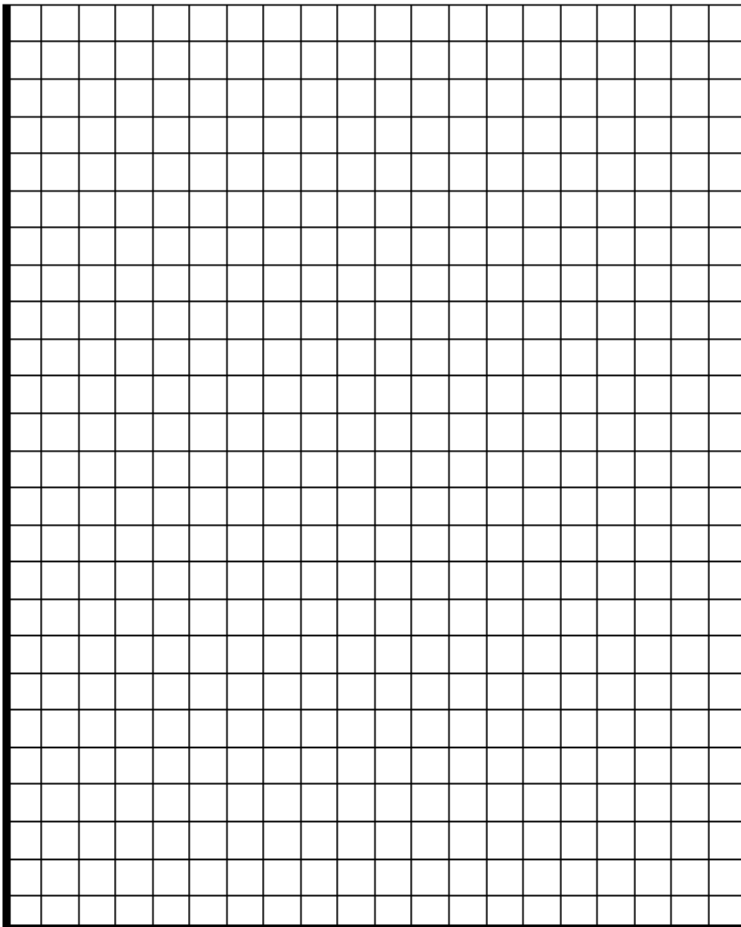
1. What is the rate of change for interval A? D? E?
2. Explain what you think might have happened during interval C.
3. If the rate of change for interval A had remained constant throughout the whole marathon, how long would it have taken Karen to finish the marathon?  
(There are approximately 26 miles in a marathon)

# Rate of Change

Imagine that you have been offered three jobs in the Columbia mall: cashier at Cinnabon, sales associate at L.L. Bean, and ticket taker at the movie theater. You are now weighing your options to see which of the three jobs would best work for you.

- Graph all of the situations on the quadrant below
  - Label axes
  - Label intervals
- Find the rate of change for each situation

1. Cinnabon: For 40 hours of work you would earn \$300.
2. L.L. Bean: For 20 hours of work you would earn \$150 plus an additional \$100 new employee bonus.
3. Movie Theater: You would receive a \$50 new employee bonus plus \$217.50 for 30 hours of work.

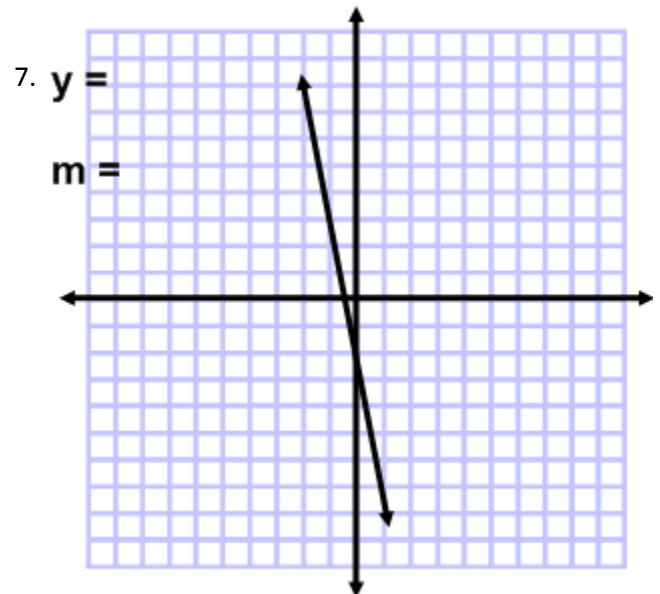
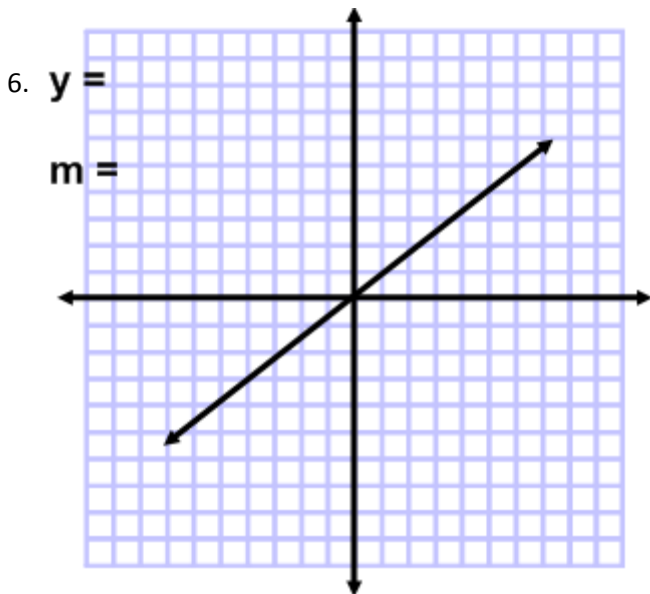


Follow Up:

- 1.) What does the rate of change tell us?
- 2.) What is the rate of change similar to?
- 3.) What do we need to make sure is included when we are talking about rate of change?

# SLOPE-INTERCEPT FORM

1. Write the equation for a line with the slope of 3 and a y-intercept of -5.
2. Write the equation for a line with the slope of  $\frac{1}{2}$  and a y-intercept of 8
3. Write the equation for a line with a slope of -1 and passing through the origin
4. Write the equation of an undefined line passing through (1, -1)
5. Write the equation of a line with a slope of 0 passing through (1, 6)

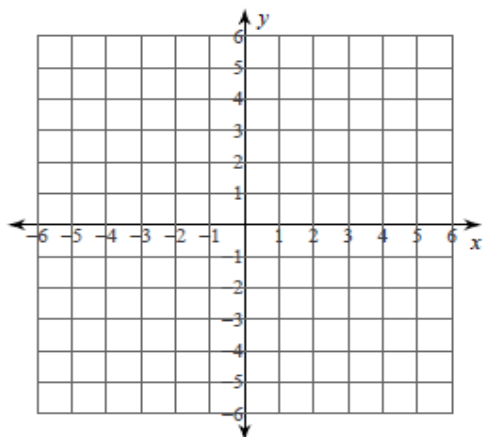


Then for questions 1-5, get a piece of graph paper and graph the equations.

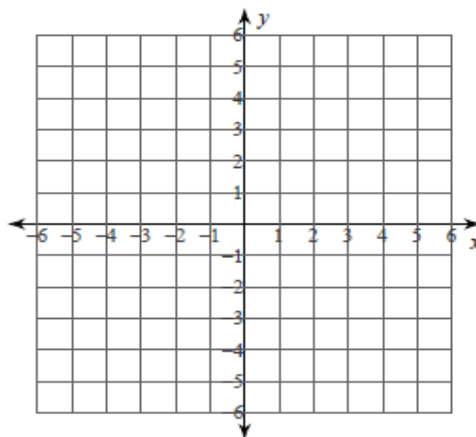
# Graphing Slope-Intercept Form

Sketch the graph of each line.

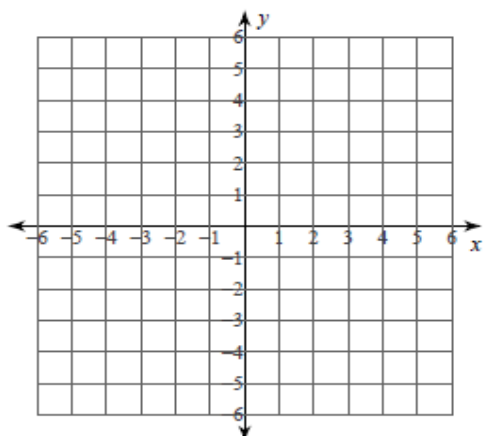
1)  $y = \frac{1}{4}x - 1$



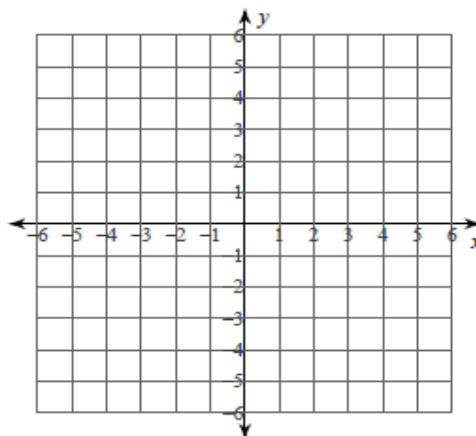
2)  $y = -x + 2$



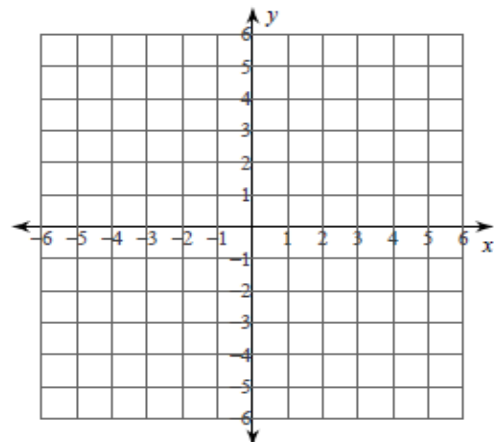
3)  $y = x + 1$



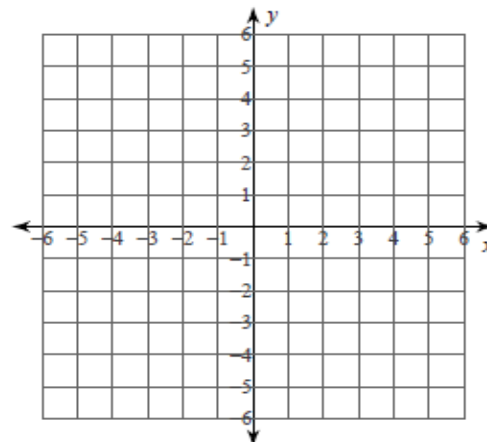
4)  $y = \frac{4}{3}x - 4$



5)  $y = -3x - 3$



6)  $y = 4$



## STANDARD FORM OF A LINE

Find the  $x$ - and  $y$ - intercepts of the given lines in standard form.

1.  $2x + 5y = 10$

2.  $3x + 8y = 24$

3.  $-2x + 7y = 14$

4.  $-9x - 2y = 18$

5.  $4x - 5y = 8$

6.  $25x + 100y = 200$

7.  $8x + 11y = 92$

8.  $12x - 36y = 72$

9.  $-70x + 90y = 630$

10.  $-10x + 5y = 45$

Write each equation in standard form using integer coefficients for  $A$ ,  $B$  and  $C$ .

11.  $y = \frac{3}{2}x + 10$

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

13.  $y = -\frac{7}{3}x + 5$

14.  $y = 5x + 8$

15.  $y = \frac{5}{6}x - 7$

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

17.  $y = -\frac{8}{15}x + \frac{1}{20}$

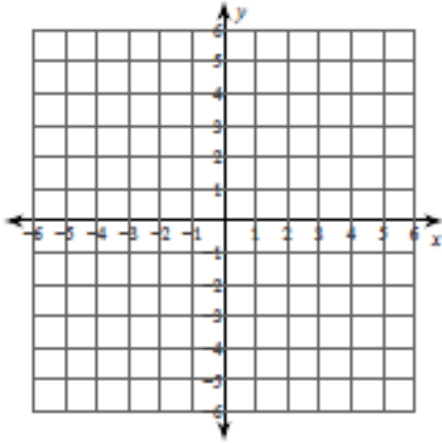
18.  $y = \frac{2}{5}x + \frac{5}{6}$



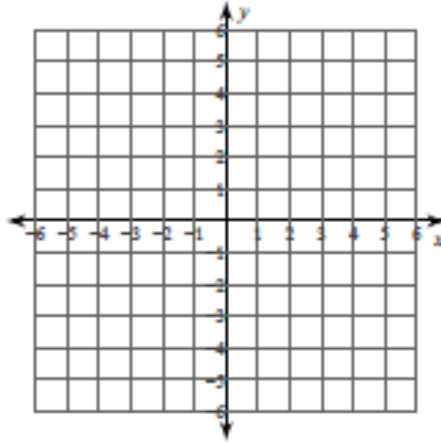
## Standard Form of a Line

Sketch the graph of each line.

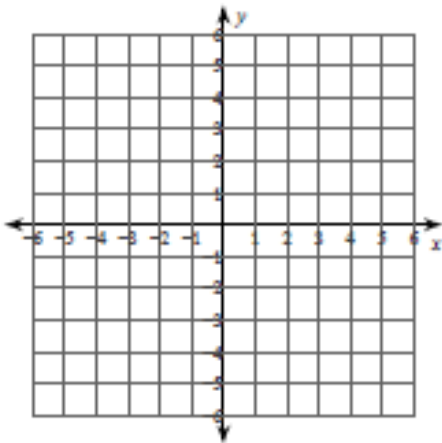
1)  $4x + y = 0$



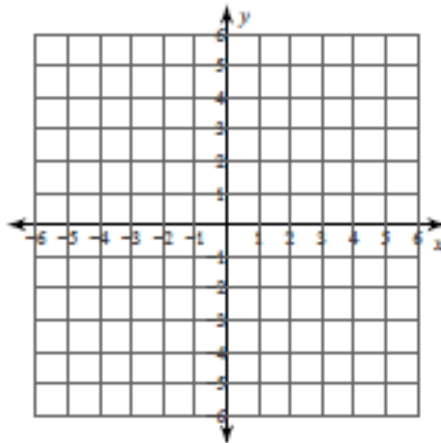
2)  $10x - 3y = -15$



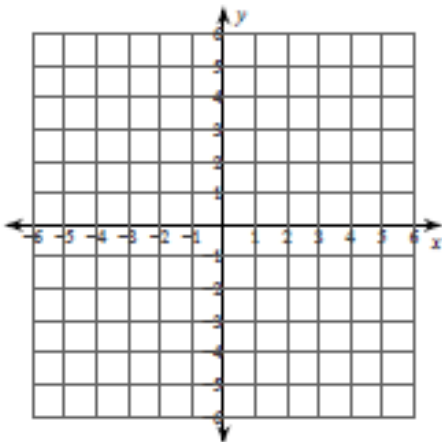
3)  $x + y = -3$



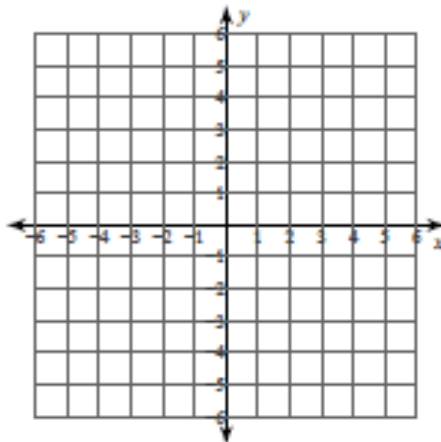
4)  $x = 5$



5)  $7x + 2y = -10$



6)  $x - 2y = -6$



# Point-Slope Form

Complete the following steps for each of the three equations and ordered pairs below.

a.  $y - 1 = 2(x - 3)$

b.  $y + 4 = -3(x - 2)$

c.  $y - 5 = \frac{1}{3}(x + 6)$

(3, 1), (-3, -1), (0, -5)

(-2, 4), (2, -4), (0, 2)

(-6, 5), (6, -5), (0, 7)

## STEP 1 • Solutions

Record the two ordered pairs that are solutions of the equation.

a. \_\_\_\_\_

b. \_\_\_\_\_

c. \_\_\_\_\_

## STEP 2 • Slope

Find the slope between the two ordered pairs (that were solutions), simplify. Record your answers below.

a. slope = \_\_\_\_\_

b. slope = \_\_\_\_\_

c. slope = \_\_\_\_\_

## STEP 3 • Graph

Plot the two ordered pairs on graph paper. Use a straightedge to draw the line that passes through the points.

## STEP 4 • Equation

Rewrite each equation so it is in slope-intercept form.

a.  $y =$  \_\_\_\_\_

b.  $y =$  \_\_\_\_\_

c.  $y =$  \_\_\_\_\_

**DRAW CONCLUSIONS • Use your observations to complete these exercise**

1. Are each of the original equations linear? How do you know? *Explain.*
2. What are the slopes and  $y$ -intercepts of the lines you drew in Step 3?
3. Do your answers to Exercise 2 agree with the slopes and  $y$ -intercepts of the equations you wrote in Step 4?
4. What is the slope of the line with equation  $y - 7 = 5(x - 12)$ ?
5. By inspection, how could you tell the slope of each of the original equations?
6. Name a point through which the line  $y - 7 = 5(x - 12)$  passes.
7. For each of the original equations you recorded two ordered pairs that satisfied the equation in Step 1. One was the  $y$ -intercept.

Complete the statement: The other point had the same \_\_\_\_\_ as in the equation, but \_\_\_\_\_ signs.

Complete the statement: When the equation of a line is  $y - a = m(x - b)$  the line passes through the point \_\_\_\_\_ and has slope \_\_\_\_\_.

# POINT-SLOPE FORM

Write an equation in point-slope form of the line that passes through the given point and has the given slope.

1  $(2, 7); m = -4$

2  $(12, 5); m = -3$

3  $(4, -5); m = 6$

4  $(-6, -2); m = 3$

5  $(7, -6); m = \frac{1}{2}$

6  $(-8, 2); m = -\frac{3}{4}$

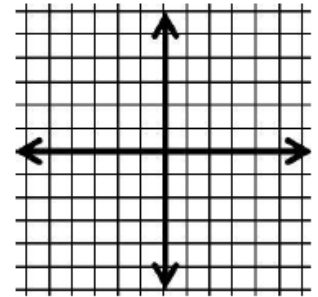
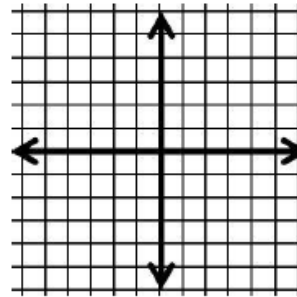
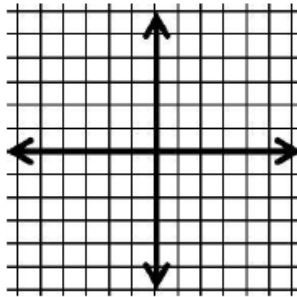
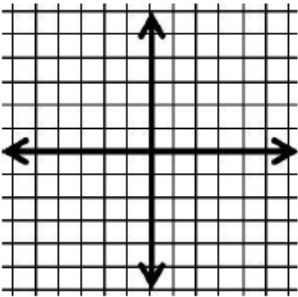
Graph the equations below.

7  $y + 4 = -3(x + 2)$

8  $y + 3 = -2(x - 2)$

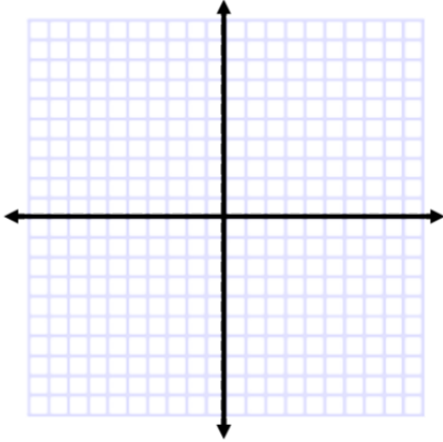
9  $y - 1 = 3(x + 6)$

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

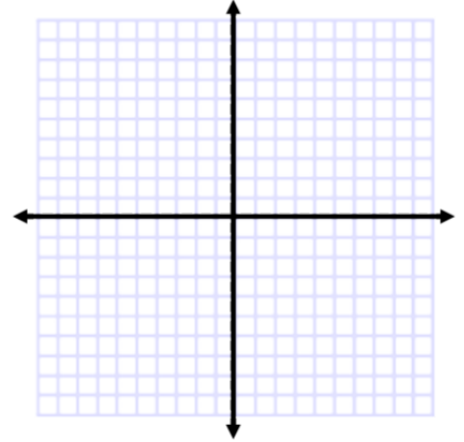


# graphing all forms of lines

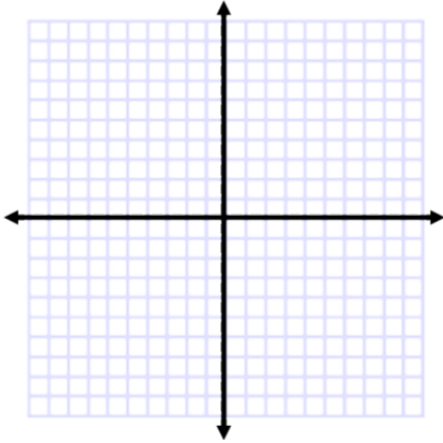
1.) Graph.  $y = \frac{1}{3}x - 2$



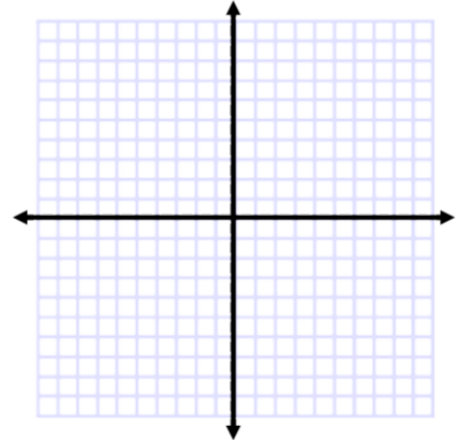
2.) Convert to Slope-Intercept form, then graph.  $3y + 6 = -2x$



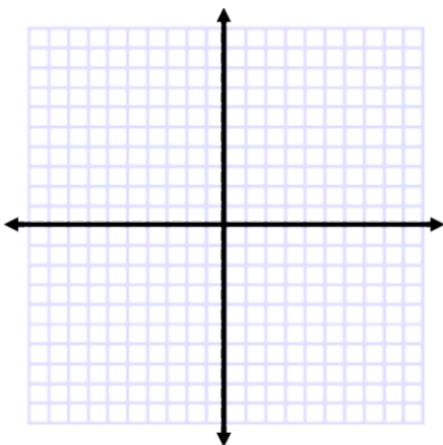
3.) Graph.  $y = -3x + 7$



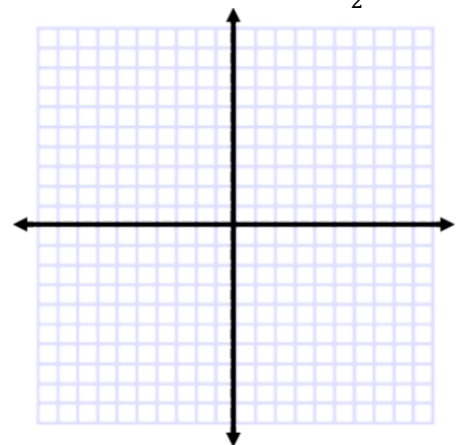
4.) Find the intercepts, then graph.  $2x + 3y = 12$



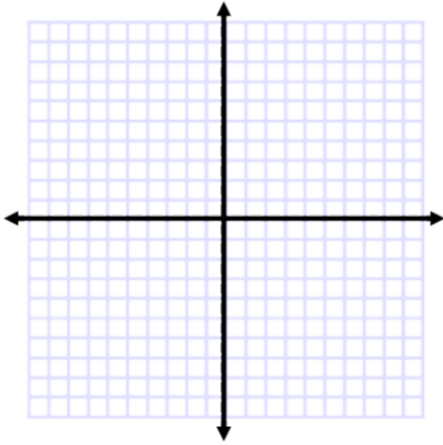
5.) Find the intercepts, then graph.  $2x + 5y = 6$



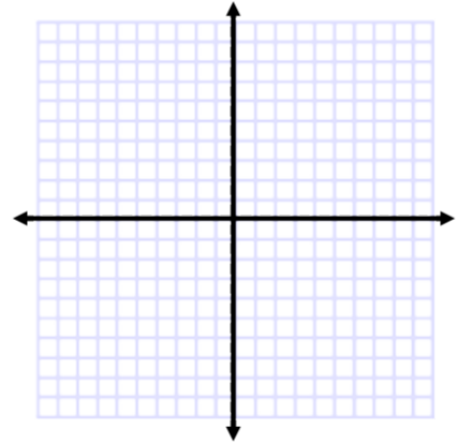
6.) Write in standard form, then graph.  $y = \frac{1}{2}x - 3$



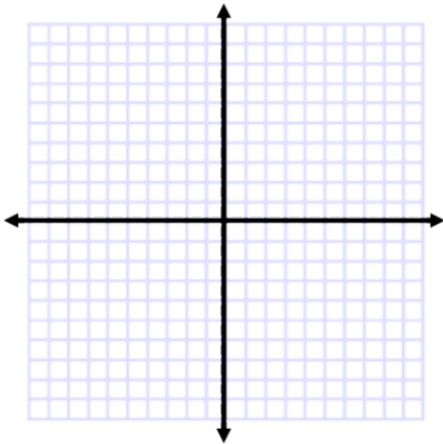
7.) Graph.  $y - 2 = (x - 3)$



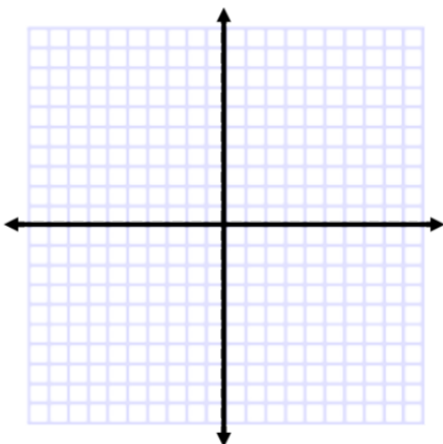
8.) Graph.  $y - 4 = -(x - 5)$



9.) Write an equation for the line in point-slope form, then graph.  $(-1, 0), (1, 2)$ .

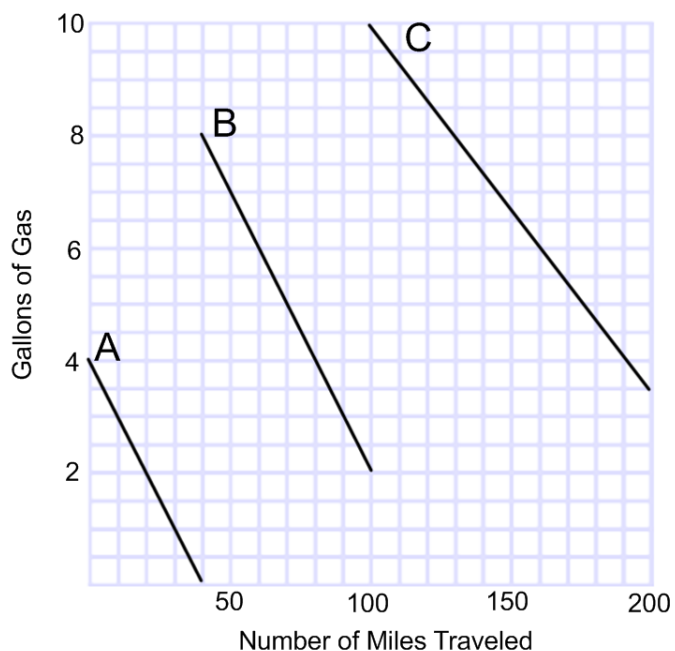


10.) Write an equation in point-slope form for the line through  $(-6, 1)$ , and a slope of  $\frac{2}{3}$ . Then graph.



## Intercepts

The graph to the right shows how the amount of gas in a car's tank varied as a function of the number of miles traveled on a trip.



1. Write a description interpreting the graph for this situation.
  
2. Give the numeric values for the slopes of each segment and include an interpretation of each slope. Be sure to show how you found each of the slopes.

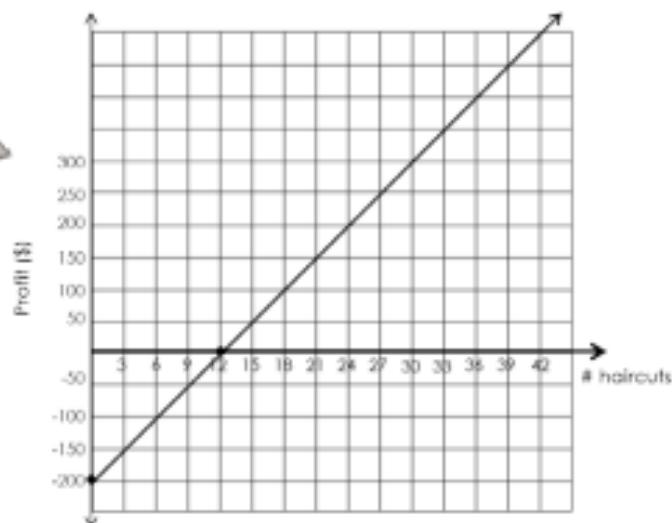
| Segment | Slope | Interpretation of slope in relation to the situation |
|---------|-------|--|
| A       |       |  |
| B       |       |  |
| C       |       |  |

3. Identify the y-intercept and explain what it means for the situation.
  
4. Identify the x-intercept and explain what it means for the situation.

# Intercepts

## The Hair Stylist

**Adrienne is a hairstylist at a new age salon. She pays a monthly fee to rent a station at the salon. The graph below represents the profit she makes each month based on the number of haircuts she performs.**



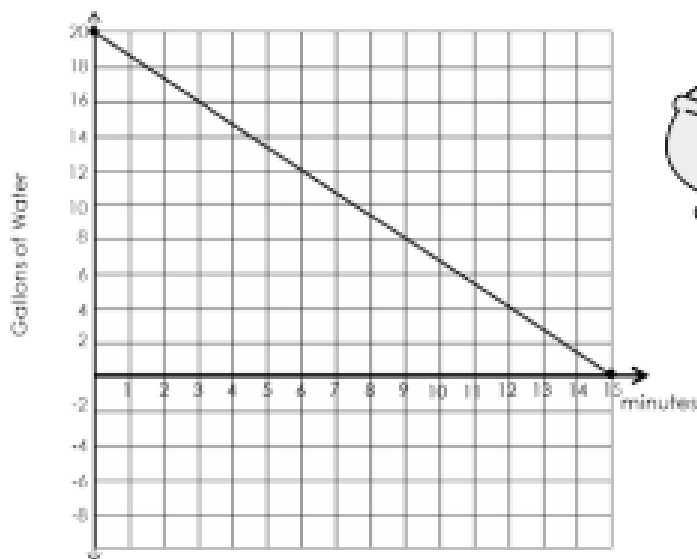
Use the graph to answer the questions below.

- 1) If Adrienne does 21 hair cuts, what is her profit? \_\_\_\_\_
- 2) What is the slope of the line? \_\_\_\_\_
- 3) What do the numbers in the slope represent in the context of the problem?  
\_\_\_\_\_
- 4) What is the x-intercept? (\_\_\_\_, \_\_\_\_)
- 5) What do the values (x, y) of the x-intercept mean in the context of the problem?  
\_\_\_\_\_
- 6) What is the y-intercept? (\_\_\_\_, \_\_\_\_)
- 7) What do the values (x, y) of the y-intercept mean in the context of the problem?  
\_\_\_\_\_



## The Bath Tub

**Billy Bob has an ancient bathtub that drains slower than the dickens. He filled up his tub and then let the water drain out to see how long it would take to drain. The graph below represents the number of gallons of water remaining in the tub and the time in minutes.**



Use the graph to answer the questions below.

- 1) How many gallons of water are in Billy Bob's tub after 6 minutes? \_\_\_\_\_
- 2) What is the slope of the line? \_\_\_\_\_
- 3) What do the numbers in the slope represent in the context of the problem?  
\_\_\_\_\_
- 4) What is the x-intercept? (\_\_\_\_, \_\_\_\_)
- 5) What do the values (x, y) of the x-intercept mean in the context of the problem?  
\_\_\_\_\_
- 6) What is the y-intercept? (\_\_\_\_, \_\_\_\_)
- 7) What do the values (x, y) of the y-intercept mean in the context of the problem?  
\_\_\_\_\_

# WRITING EQUATIONS FOR SITUATIONS

Consider the tile patterns to the right.



Figure 1

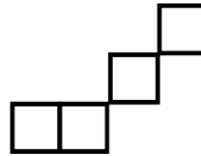


Figure 2

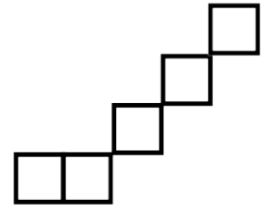


Figure 3

a.) Draw Figure 0 and Figure 4

b.) Create and complete a table showing the figure numbers and the number of tiles in each figure. Extend your table out to Figure 5. Be sure to include Figure 0.

c.) What is the growth rate for this tile pattern? Explain how you know.

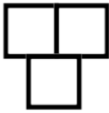
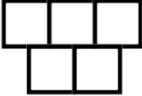
d.) Write an equation that represents the number of tiles in each Figure number.

e.) If you were to graph the equation in part (d), what would be the y-intercept? Do you need to graph the equation to find this out? Explain completely.

f.) What does the growth rate tell you about the graph? Explain completely.

# **Tile Patterns**

Look at the table with the patterns below. Fill in the remaining spaces.

| Figure 0 | Figure 1  | Figure 2  | Figure 3 | Figure 4 | Figure 5  |
|----------|---|---|----------|----------|-----------|
|          |  |  |          |          |           |
|          | 3 blocks  |   |          |          | 11 blocks |

- What is the growth rate for this tile pattern? Explain how you know.
- Write an equation that represents the number of tiles in each Figure number.
- If you were to graph the equation in part (d), what would be the y-intercept? Do you need to graph the equation to find this out? Explain completely.
- What does the growth rate tell you about the graph? Explain completely.

# **Tile Patterns**

Draw your own pattern.

| Figure 0 | Figure 1 | Figure 2 | Figure 3 | Figure 4 |
|----------|----------|----------|----------|----------|
|          |          |          |          |          |

Write an equation to represent your pattern. Tell what each part of your equation represents.