Name ____________________ Period __________ Date ____________

UNIT 5
STUDENT PACKET

MathLinks GRADE 8

LINEAR FUNCTIONS

Parent (or Guardian) signature ______________________________

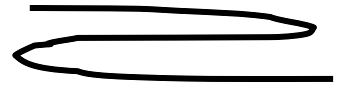
MY WORD BANK

Explain the mathematical meaning of each word or phrase, using pictures and examples when possible. See **Student Resources** for mathematical vocabulary.

linear function	parallel
slope of a line	slope-intercept form
point of intersection	*y*-intercept *x*-intercept

THE ROPE INVESTIGATION

Follow your teacher's directions to explore layers, cuts, and pieces in this rope problem. Use extra paper if needed.



(1)

(2)

(3)

(4)

(5)

SLOPE OF A LINE

We will explore the meaning of positive and negative slopes of lines. We will count to find slopes of lines on a grid. We will use the slope formula to find slopes of lines in the coordinate plane. We will recognize that line segments having the same slope are either on the same lines or on parallel lines.

[8.EE.6, 8.F.4; SMP3, 6, 8]

GETTING STARTED

1. Fill in the missing integers to make true equations.

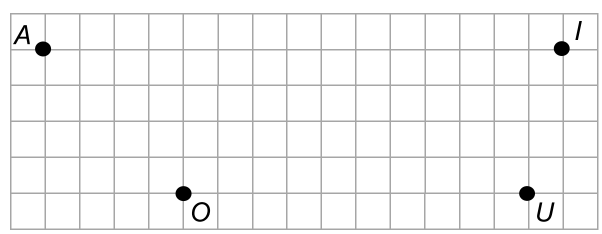
a. $8 - 2 = 8 +$ _____	b. $3 - 5 = 3 +$ _____	c. $6 - (-1) = 6 +$ _____

2. If *c* and *d* are positive numbers, answer the following questions.

a. Why does $\frac{c}{d} = \frac{-c}{-d}$?	b. Why does $\frac{-c}{d} = \frac{c}{-d}$?

3. Circle the expressions that are equivalent to $\frac{(3)-(-1)}{2-5}$: $\frac{(3)-(-1)}{5-2}$ $\frac{(-1)-(3)}{2-5}$ $\frac{(-1)-(3)}{5-2}$

4. Using the grid to the right, start with the given point, then follow directions to plot the next one.



a. Start at point *A*. Count 4 units down and 1 unit to the right. Plot point *N*. Draw $\overline{AN}$.

b. Start at point *O*. Count 3 units up and 2 units to the right. Plot point *F*. Draw $\overline{OF}$.

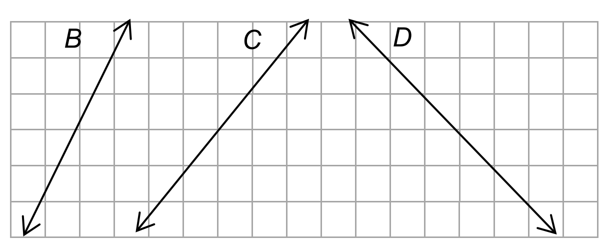
c. Start at point *I*. Count 1 unit down and 7 units to the left. Plot point *T*. Draw $\overline{IT}$.

d. Start at point *U*. Count 2 units up and 4 units to the left. Plot point *P*. Draw $\overline{UP}$.

5. Which looks steeper?

a. Line *B* or line *C*?

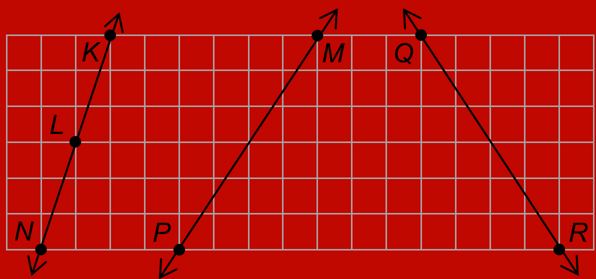
b. Line *C* or line *D*?



THE MEANING OF SLOPE

Follow your teacher's directions for (1) – (9).

(1) Slope is a measure of ______________ of a line.



Like reading words on a page, we read a graph from ________ to ________.

(2) Slope of a line is a __________ of __________.

Using two points on a line, we first count _______________, and then _______________.

First circle whether a line segment has a positive or negative slope (**+** or **–**). Then find the slope by counting.

(3) **+ –**	(6) **+ –**
(4) **+ –**	(7) **+ –**
(5) **+ –**	(8) **+ –**
	(9) **+ –**

10. What do you notice about the slope values for each boxed set of problems above?

11. Which value is greater, the slope of $\overline{NK}$ or the slope of $\overline{PM}$?

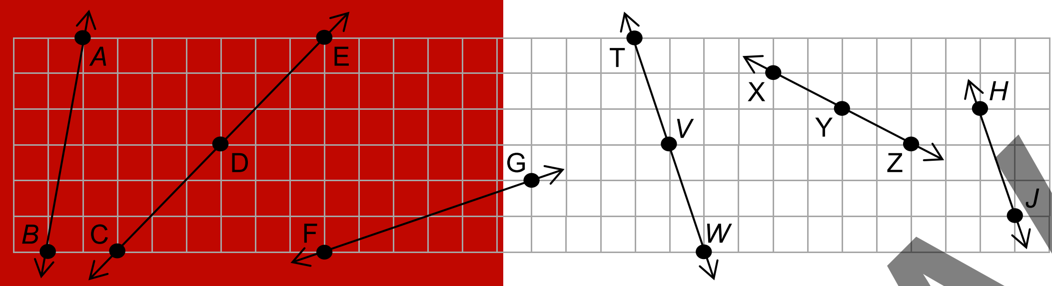
Which line segment is steeper $\overline{NK}$ or $\overline{PM}$?

12. How are the slope values in problems 6 – 7 related to the slope values in problems 8 – 9?

13. Which value is greater, the slope of $\overline{PM}$ or the slope of $\overline{RQ}$?

Which line is steeper $\overline{PM}$ or $\overline{RQ}$?

PRACTICE 1



Before counting, determine whether each slope is positive (**+**) or negative (**–**) and circle the appropriate symbol. Then find the slope of each line segment by counting.

1. Slope of $\overline{AB}$: **+** **–**	5. Slope of $\overline{TV}$: **+** **–**
2. Slope of $\overline{CD}$: **+** **–**	6. Slope of $\overline{WT}$: **+** **–**
3. Slope of $\overline{EC}$: **+** **–**	7. Slope of $\overline{XZ}$: **+** **–**
4. Slope of $\overline{FG}$: **+** **–**	8. Slope of $\overline{HJ}$: **+** **–**

9. Suppose a line has a positive slope. When finding the slope between two points on this line, one way is to count up and then ________. Another is down and then ________.
   Suppose a line has a negative slope. When finding the slope between two points on this line, one way is to count down and then ________. Another is up and then ________.

10. What do you notice about the slopes of line segments lying on the same line?

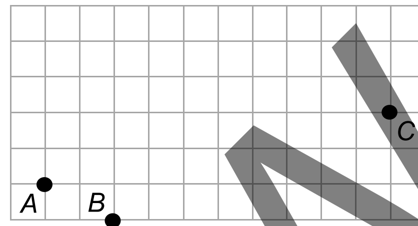
11. Which line segments from above must have the same slope as $\overline{XY}$? Explain.

12. Name two different lines above that are parallel and explain how you know. Then record the meaning of <u>parallel</u> in **My Word Bank**.

13. Stacy was looking at two line segments above and said, "The slope of $\overline{FG}$ is greater than the slope of $\overline{DE}$ because $\overline{FG}$ is longer than $\overline{DE}$. Critique her reasoning.

PRACTICE 2

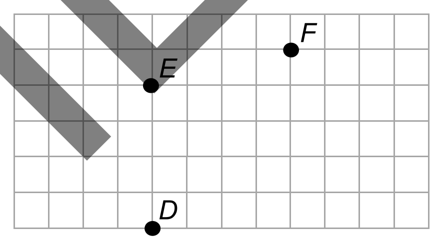
1. For each point, count vertical and horizontal distances to create a line segment with the given slope.



- From points *A* to *G*: $\frac{3}{4}$
- From points *B* to *H*: $\frac{6}{8}$
- From points *C* to *J*: $\frac{-3}{-4}$

What do you notice about the line segments above?

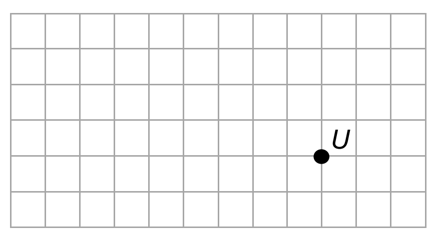
2. For each point, count vertical and horizontal distances to create a line segment with the given slope.



- From points *D* to *K*: $\frac{6}{-3}$
- From points *E* to *L*: -2
- From points *F* to *M*: $\frac{-4}{2}$

What do you notice about the line segments above?

3. Start at point *U*, and count vertical and horizontal distances to create four segments with the given slopes.

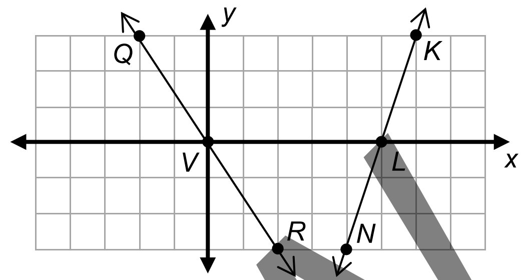


- From points *U* to *V*: $\frac{4}{-2}$
- From points *V* to *W*: $\frac{-2}{-6}$
- From points *W* to *Z*: $\frac{-4}{2}$
- From points *Z* to *U*: $\frac{2}{6}$

What do you notice about the figure above?

THE SLOPE FORMULA

Follow your teacher's directions for (1) – (6).



(1)

Name of line segment	(2)	(3)	(4)	(5)
Slope (positive $\rightarrow$ +) (negative $\rightarrow$ –)	**+ –**	**+ –**	**+ –**	**+ –**
Ordered pairs				
Calculate slope				

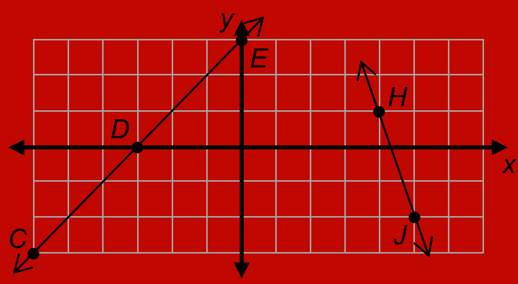
(6)

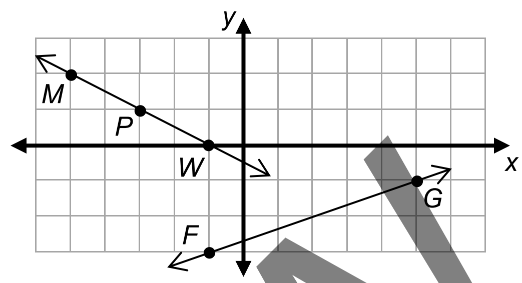
7. Doug said, "I prefer counting to using the formula when I find the slope of a line." Do you agree with Doug?

8. A line contains the points (500, 100) and (225, 75). Find the slope of this line.

9. Record the meaning of <u>slope of a line</u> in **My Word Bank**.

PRACTICE 3





Before calculating, determine whether each slope is positive or negative and circle **+** or **–**. Then use the slope formula to calculate the slope of each line segment. Check by counting.

1. Slope of $\overline{HJ}$: **+** **–**	2. Slope of $\overline{FG}$: **+** **–**
3. Slope of $\overline{CD}$: **+** **–**	4. Slope of $\overline{MW}$: **+** **–**
5. Slope of $\overline{EC}$: **+** **–**	6. Slope of $\overline{PM}$: **+** **–**

7. Find the slope of the line passing through points *A* and *B* below. Think about whether you will choose to graph the points and find the slope by counting, or use the slope formula.

   A (50, 100)
   B (20, 40)

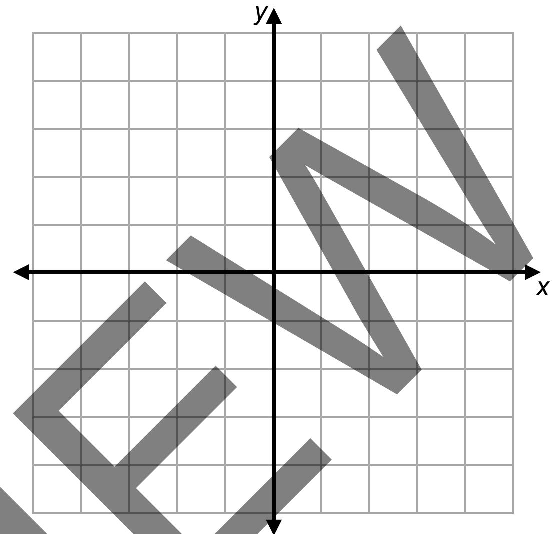
8. In your own words, explain how you can use any two ordered pairs on a line to calculate the slope of the line.

PRACTICE 4

For Sets 1 and 2 below, draw lines with the given points and slopes. Extend the lines so that they go through the majority of the grid.

Set 1	Through this point:	With this slope:	Another point on this line is:
1.	*A* (-2, 3)	$\frac{-2}{6}$	
2.	B (-4, -1)	$\frac{4}{2}$	
3.	C (4, 1)	$\frac{-2}{-1}$	
4.	D (2, -3)	$-\frac{1}{3}$	

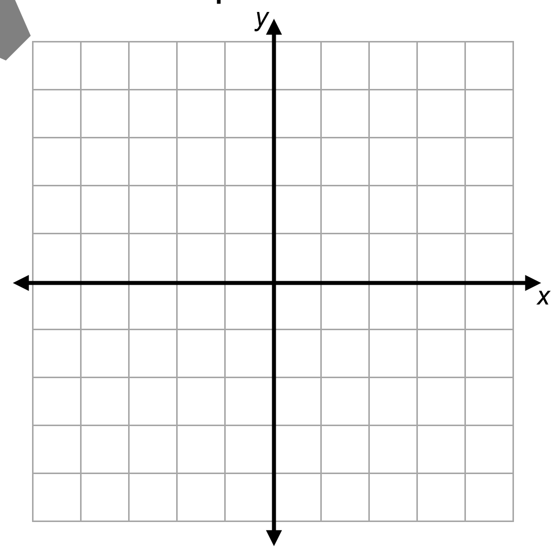
Graphs for Set 1



5. Why is it true that the polygon with vertices *ACDB* is a parallelogram?

Set 2	Through this point:	With this slope:	Another point on this line is:
6.	*E* (-4, 2)	$\frac{2}{4}$	
7.	F (0, 4)	$\frac{-8}{4}$	
8.	G (-2, -2)	$\frac{2}{-1}$	
9.	H (4, -4)	$\frac{2}{-6}$	

Graphs for Set 2



10. Why is it true that the polygon with vertices *EFHG* is a trapezoid?

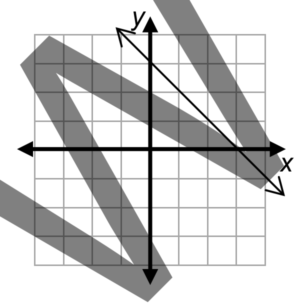
SLOPE-INTERCEPT FORM

We will find equations of lines in slope-intercept form.

[8.EE.6, 8.F.2, 8.F.3, 8.F.4; SMP1, 4, 7]

GETTING STARTED

1. For the line graphed to the right, the *y*-intercept is _____ (a single number), and it is located on the *y*-axis with coordinates (_____, _____). The slope of this line is equal to _____.



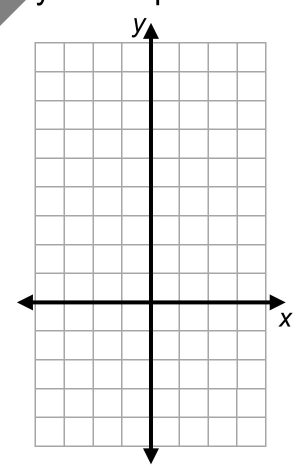
2. Record the meaning of <u>*y*-intercept</u> and <u>point of intersection</u> in **My Word Bank**.

For each function rule below, complete the table, graph the line, and identify the slope and *y*-intercept.

3.	***y* = 2*x***
x	***y***
0	
1	
2	
-1	
slope:	
y-intercept:	

4.	***y* = 2*x* + 4**
x	***y***
0	
1	
2	
-1	
slope:	
y-intercept:	

5.	***y* = 2*x* – 3**
x	***y***
0	
1	
2	
-1	
slope:	
y-intercept:	



6. Explain how to find the *y*-intercept of a line from looking at each of the following:
   a. a graph

   b. a table

   c. an equation

FINDING EQUATIONS OF LINES

Follow your teacher's directions for (1) – (9).
Let x = number of months elapsed and y = total dollars saved.

(1) Zara has $____ in the bank and saves $____ per month. Equation: ________________

(2) Emmett has $____ in the bank and saves $____ per month. Equation: ________________

(3) Aisha has $____ in the bank and saves $____ per month. Equation: ________________

(4) Drew has $____ in the bank and spends $____ per month. Equation: ________________

(5) Anita has $____ in the bank and saves $____ per month. Equation: ________________

(6) A linear function in slope-intercept form is ________________.

The slope is ____ . The y-intercept is ____ at the point (____, ____).

Another point on the line is (____, ____).

(7) A linear function in slope-intercept form is ________________.

The slope is ____. The y-intercept is ____ at the point (____, ____).

Another point on the line is (____, ____).

(8) A linear function in slope-intercept form is ________________.

The slope is ____. The y-intercept is ____ at the point (____, ____).

Another point on the line is (____, ____).

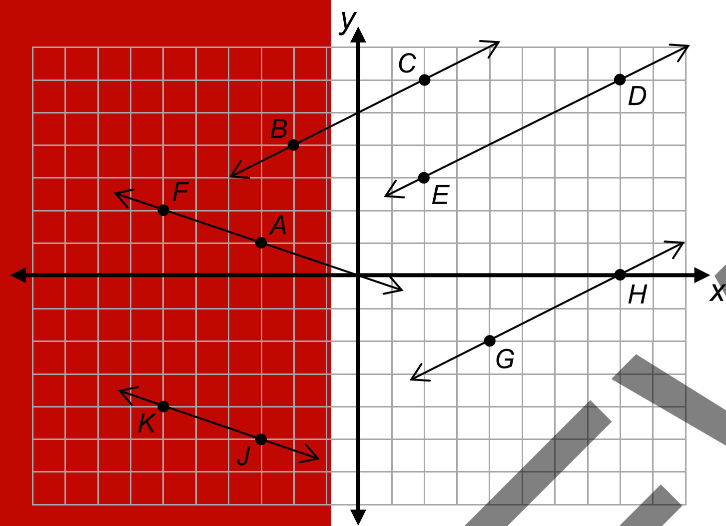
(9) The slope-intercept form of a line is ________________.

The slope is ____. The y-intercept is ___ at the point (____, ____).

Any point on the line is (____, ____).

10. Record the meanings of linear function of slope-intercept form in **My Word Bank**.

ANALYZING EQUATIONS OF LINES



Complete the table below for the lines in the graph above.

	Line	Slope (m)	y-intercept (b)	Ordered pair of y-intercept	Equation	Another point on the line
1.	$\overleftrightarrow{ED}$					
2.	$\overleftrightarrow{BC}$					
3.	$\overleftrightarrow{FA}$					
4.	$\overleftrightarrow{JK}$					
5.	$\overleftrightarrow{HG}$					

6. Which lines are parallel? Explain.

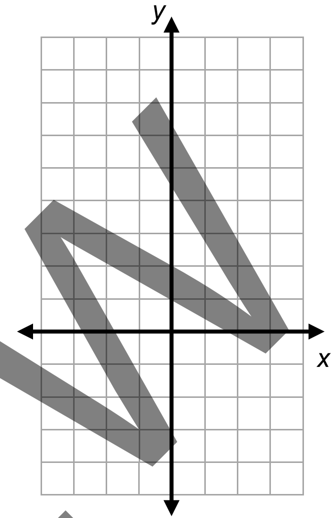
PRACTICE 5

For each function, complete the table, graph the line, and identify the slope and *y*-intercept.

1.	$y = 4x$
x	***y***
0	
1	
2	
-1	
m:	
b:	

2.	$y = 4x + 4$
x	***y***
0	
1	
2	
-1	
m:	
b:	

3.	$y = 4x - 3$
x	***y***
0	
1	
2	
-1	
m:	
b:	



Compare the three equations and graphs in **Getting Started** to the ones on this page.

4. How are the three equations above similar to the three in **Getting Started**?

5. How are the three graphs above similar to the three in **Getting Started**?

For the linear functions below, without making tables or graphs, complete each sentence.

6. For $y = 5x + 2$, the slope of this line is _____ and the *y*-intercept is _____.

7. For $y = x - 4$, the slope of this line is _____ and the *y*-intercept is _____.

8. For $y = 3x$, the slope of this line is _____ and the *y*-intercept is _____.

9. What can you say about two different lines with the same slope?

10. What can you say about two different line-segments with the same slope?

PRACTICE 6

Fill in the table below. Use the coordinate plane at the bottom of the page.

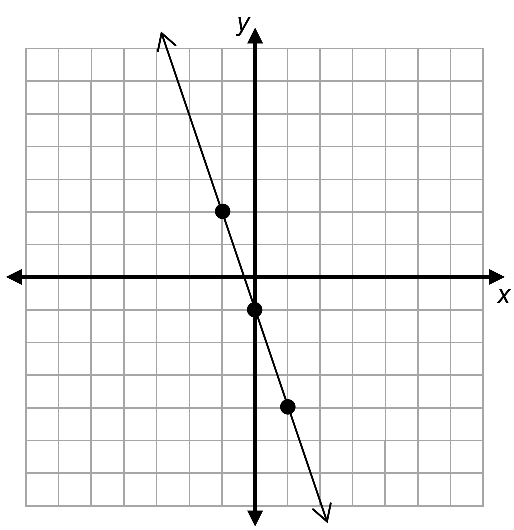
Description	Slope (m)	y-intercept (b)	Equation	Does this point lie on the line?
1. The line that is graphed below.				(-15, -46)
2. Graph the line that goes through (-1, 2) and has a slope of 2.				(-10, -24)
3. Graph the line that goes through the origin and the point (5, 6).				(10, 12)
4. Graph the line that goes through the points (2, 1) and (-2, 3).				(12, -4)

Write equations as described below. Do not graph.

5. Write the equation of a line that is parallel to $y = 3x + 2$ that goes through the point (0, -7).

6. Write the equation of a line that is parallel to $y = -5x + 8$ that goes through the origin.

7. Write the equation of a line that intersects $y = -5x + 8$ at the point (0, 8).



APPLICATIONS AND EXTENSIONS

We will revisit **The Rope Investigation** and **A Rectangle Paradox** (from Unit 2). We will connect representations (tables, graphs, equations) as we solve problems involving slope, intercept, and the slope-intercept form of a line. We will extend the meaning of slope to explore horizontal and vertical lines and derive an equation of a line using algebra.

[8.EE.6, 8.F.2, 8.F.3, 8.F.4, 8.F.5; SMP1, 2, 3, 4, 6, 7, 8]

GETTING STARTED

Solve each equation for y. In other words, write it as $y =$ ______.

1. $10 = \frac{y}{7}$	2. $10 = \frac{y}{x}$	3. $10 = \frac{2y}{x}$	4. $10 = \frac{y+1}{x}$

Let x = number of minutes and y = degrees Fahrenheit.

5. In a lab, a liquid is brought to a starting temperature of 200° F. From there, it cools at a rate of 2 degrees per minute. Write the following: initial value: rate of change: equation: temperature after 20 minutes:	6. In the lab, another liquid is brought to a starting temperature of 50° F. From there, it is heated by 5 degrees per 30 seconds. Write the following: initial value: rate of change: equation: temperature after 20 minutes:

7. State the slope formula in your own words.

8. Use the slope formula to find the slope of a line between (-5, 2) and (3, 2).

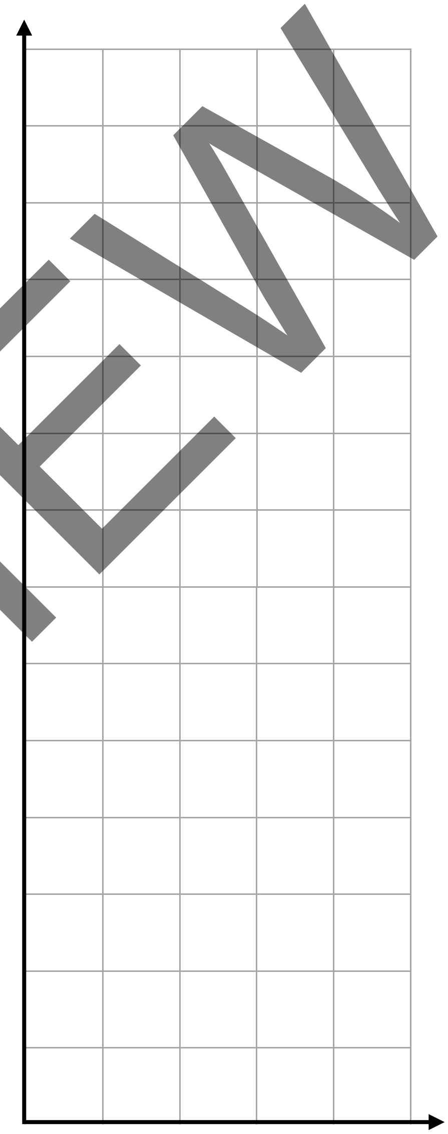
(You will learn more about this strange result later in this lesson!)

THE ROPE REVISITED

Follow your teacher's directions

(1)

# of layers (L) = 1	
# of cuts (C)	# of pieces (P)
Equation:	



(2)

(3)

PRACTICE 7

Graph the two pairs of lines as described below.

1. From point *P*, count 5 units up for every 2 to the right, making 2 more points. Connect the points with a line (line *P*).

   From point *Q*, count 7 units up for every 3 to the right, making 2 more points. Connect these points with a line (line *Q*).

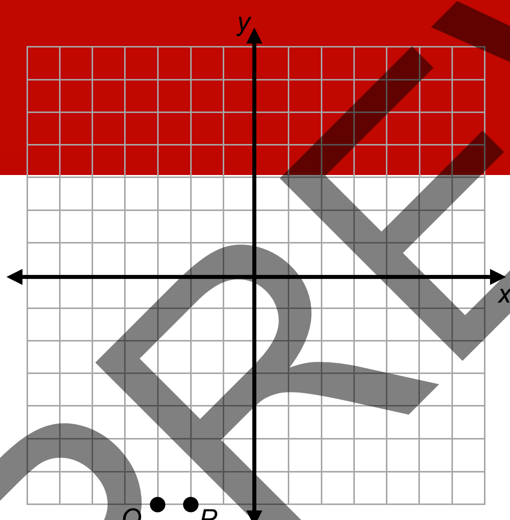
   slopes *P*: ______ *Q*: ______

   y-intercepts *P*: ______ *Q*: ______

   equations *P*: ________________

   Q: ________________

   Are these functions increasing or decreasing?



   Why are these lines NOT parallel?

   Which line is steeper?

2. From point *M*, count 2 units down for every 3 to the right, making 2 more points. Connect the points with a line (line *M*).

   From point *N*, count 3 units down for every 5 to the right, making 2 more points. Connect these points with a line (line *N*).

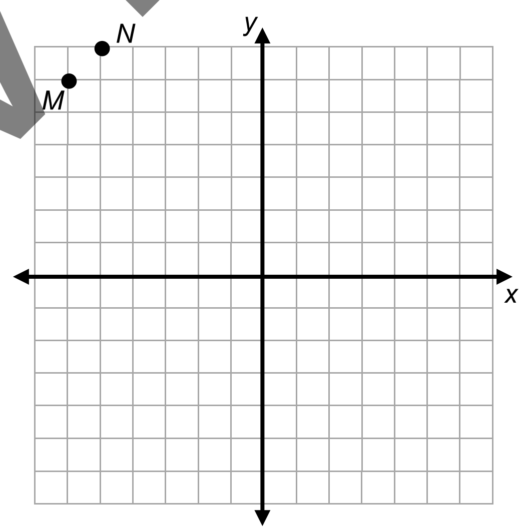
   slopes *M*: ______ *N*: ______

   y-intercepts *M*: ______ *N*: ______

   equations *M*: ________________

   N: ________________

   Are these functions increasing or decreasing?



   Why are these lines NOT parallel?

   Which line is steeper?

RECTANGLE PARADOX: A FRESH LOOK

Do you remember this problem from **Unit 2**? Rectangle I is cut apart and rearranged to form Rectangle II. If you find the area of these rectangles, you'll notice they are different. How can that possibly happen?

Verify the rectangle areas.

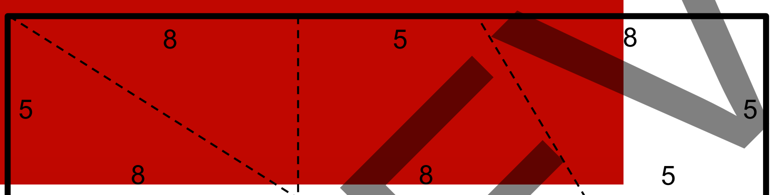
Rectangle I: length = _______u width = _______ u area = _______ u^2

Rectangle II: length = _______u width = _______ u area = _______ u^2

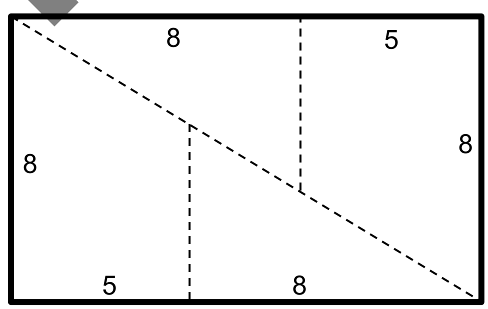
As you can see, the areas are very close! If you solved the problem in **Unit 2**, you proved that Rectangle I actually cannot be rearranged to form Rectangle II. And, in doing so, you probably used the Pythagorean theorem, which is one of the big ideas of that unit.

Your job is to use something you've learned in this unit to prove in a different way that Rectangle I cannot be rearranged to form Rectangle II. In other words, what's wrong with Rectangle II?

Rectangle I



Rectangle II



PRACTICE 8

Each table's values below represent a linear function. Fill in the missing values, list the *y*-intercepts (*b*), find the slopes of each line (*m*), circle whether each is an increasing (↑) or decreasing (↓) function, and write the equations in slope-intercept form.

1.

x	*y*
0	
1	6
2	22
3	38
4	
b =	*m* =
↑ or ↓ equation:	

2.

x	*y*
0	
1	18
2	14
3	10
4	
b =	*m* =
↑ or ↓ equation:	

3.

x	*y*
0	
1	6
2	22
3	38
4	
b =	*m* =
↑ or ↓ equation:	

4.

x	*y*
0	
1	18
2	14
3	10
4	
b =	*m* =
↑ or ↓ equation:	

5. Which of the four tables represents the graph of a line that is …

   a. the steepest? Explain.

   b. the flattest? Explain.

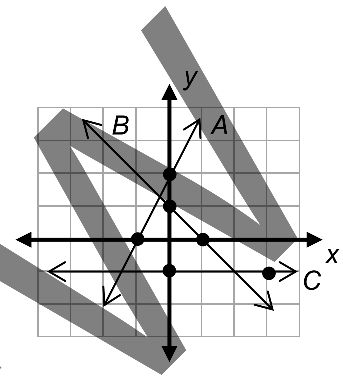
6. Challenge: find the *x*-intercept of the line represented in problem 1. Show work.

PRACTICE 8
Continued

7. State why the graphs of *A*, *B*, and *C* below represent linear functions.

8. Fill in the table.

		Line *A*	**Line *B***	**Line *C***
a.	*y*-intercept			
b.	slope			
c.	increasing or decreasing			
d.	equation in slope-intercept form			



9. A line goes through the origin and the point (-15, -20). Without graphing, write the equation of this line in slope-intercept form.

10. A line goes through the origin and the points (0, 9) and (6, -21). Without graphing, write the equation of this line in slope-intercept form.

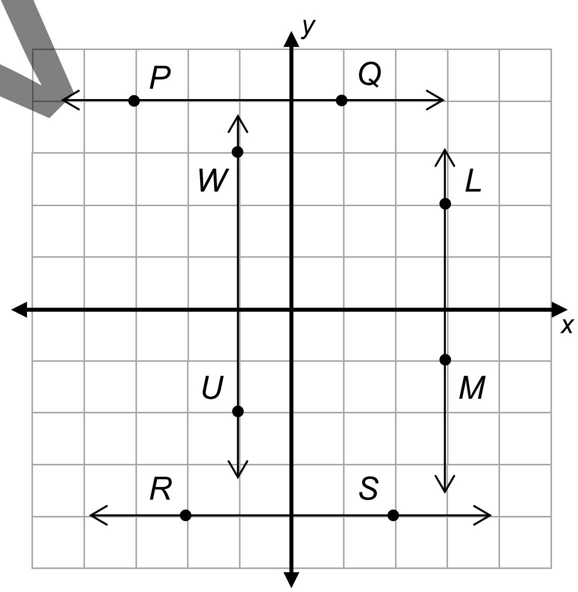
11. Circle all the equations below that represent proportional relationships and explain how you know.

$y = -5x + 1$ $y = -\frac{5}{8}x$ $y = 22x + 17$ $y = 39x$

HORIZONTAL AND VERTICAL LINES

Use the grid below and fill in the table. First circle H if the line is horizontal or V if it is vertical. Then complete the columns.

Line	Two points on the line	Slope calculation	*y*-intercept (if it exists)	Equation
1. $\overleftrightarrow{PQ}$ H V	*Q* (_____) *P* (_____)			
2. $\overleftrightarrow{WU}$ H V	*U* (_____) *W* (_____)			
3. $\overleftrightarrow{LM}$ H V	*M* (_____) *L* (_____)			
4. $\overleftrightarrow{RS}$ H V	*S* (_____) *R* (_____)			



5. Explain why a *y*-intercept does not exist for the vertical lines to the right.

6. What is the slope of a horizontal line?

   Is it possible to write the equation of a horizontal line in slope-intercept form?

7. For $\overleftrightarrow{WU}$, what is true of all of the *x*-coordinates?

   What is true of all of the *y*-coordinates?

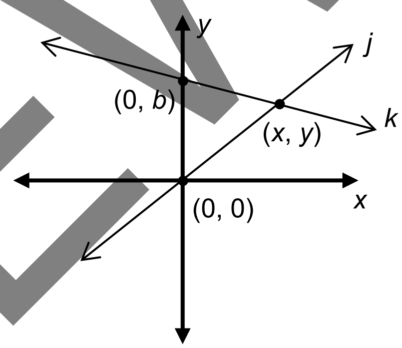
8. What is the slope of a vertical line?

9. Is it possible to write the equation of a vertical line in slope-intercept form?

DERIVING EQUATIONS OF LINES

1. Solve for *y*. $3 = \frac{y-4}{x}$	2. Find the slope of a line that goes through the points (*f*, *g*) and (*c*, *d*).

Use the graph at the right for problems 3 and 4.



3. Line *j* goes through the origin and a point (*x*, *y*).

   a. Its *y*-intercept is ______.

      Does this line represent a proportional relationship?

   b. Use the two points given on line *j* to find its slope (*m*). Then solve this slope equation for *y*.

$$m = \frac{y - \square}{x - \square}$$

4. Line *k* goes through the points (0, *b*) and (*x*, *y*).

   a. Its *y*-intercept is ____.

   b. Does this line represent a proportional relationship?

   c. Use the two points given on line *k* to find its slope (*m*). Then solve this slope equation for *y*.

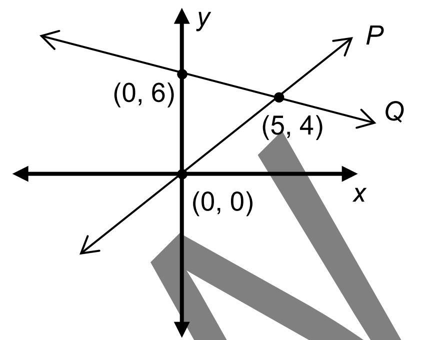
$$m = \frac{y - \square}{x - \square}$$

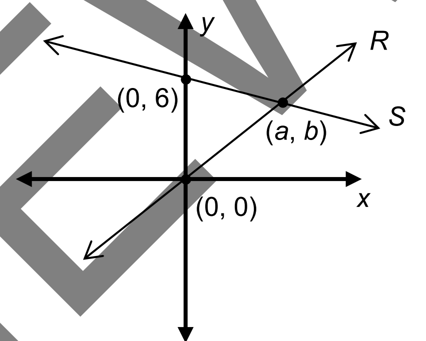
5. The results of problems 3 and 4 illustrate that:

   - for any line with slope *m* and *y*-intercept 0, its equation is ______________; and
   - for any line with slope *m* and *y*-intercept *b*, its equation is ______________.

PRACTICE 9: EXTEND YOUR THINKING

Problems 1 – 4 refer to lines *P*, *Q*, *R*, and *S*.





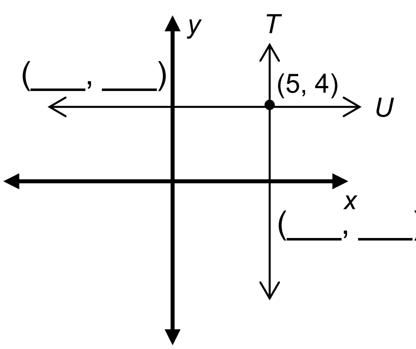
Use the slope formula to find the slope of lines between the two given points. Then write the equations of the lines in slope-intercept form.

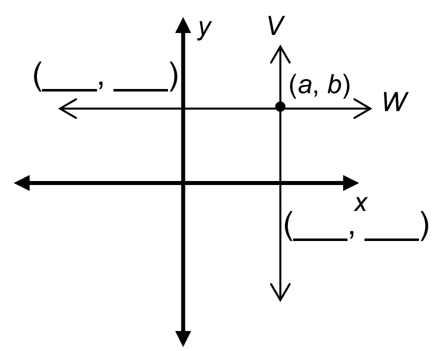
	Line	Slope	Equation
1.	*P*		
2.	*Q*		
3.	*R*		
4.	*S*		

5. Record the meaning of <u>x-intercept</u> in **My Word Bank**.

Problems 6 – 10 refer to lines *T*, *U*, *V*, and *W*.

6. For each line, label the coordinates where the lines cross the *x*-axis or *y*-axis.





Name the *x*-intercept or *y*-intercept for each line. Then write an equation for each line.

	Line	*x*-intercept	*y*-intercept	Equation
7.	*T*			
8.	*U*			
9.	*V*			
10.	*W*			

REVIEW

MATCHING ACTIVITY: LINEAR FUNCTION REPRESENTATIONS

1. Your teacher will give you some cards. Match the equations, tables, and graphs.
2. Fill in the missing information.

A. Equation: $y = 2x + 4\frac{1}{2}$ Table match: Graph match: Slope: *y*-intercept:	B. Equation: $y = 2x$ Table match: Graph match: Slope: *y*-intercept:	C. Equation: $y = -2x + 4$ Table match: Graph match: Slope: *y*-intercept:
D. Equation: $y = \frac{1}{2}x$ Table match: Graph match: Slope: *y*-intercept:	E. Equation: $y = \frac{1}{2}x + 4$ Table match: Graph match: Slope: *y*-intercept:	F. Equation: $y = -\frac{1}{2}x$ Table match: Graph match: Slope: *y*-intercept:

3. Circle all the equations below whose graphs are lines parallel to $y = -5x + 4$.

   $y = -5x + 1$ $\quad$ $5x + y = -1$ $\quad$ $y = 5x + 4$ $\quad$ $y = 5x$ $\quad$ $y = -5x$

4. Circle all the equations below whose graphs have the same *y*-intercept as $y = -5x + 4$.

   $y = -2x + 4$ $\quad$ $x + y = -4$ $\quad$ $y = 5x + 4$ $\quad$ $y = x - (-4)$ $\quad$ $y = -5x$

5. Write the equation of a line that…
   a. is parallel to the graph of $y = 2x + 7$ and goes through (0, -3).
   b. is parallel to the graph of $y = -\frac{2}{3}x - 4$ and goes through (0, 5).

6. Picture a (non-vertical) line that goes through the origin. What is its *y*-intercept?

POSTER PROBLEMS: LINEAR FUNCTIONS

Part 1: Your teacher will divide you into groups.

- Identify members of your group as A, B, C, or D.
- Each group will start at a numbered poster. Our group start poster is _____.
- Each group will have a different colored marker. Our group marker is _____.

Part 2: Do the problems on the posters by following your teacher's directions.

Poster 1 (or 5)	**Poster 2 (or 6)**	**Poster 3 (or 7)**	**Poster 4 (or 8)**
$y = 3x + 1$	$y = 3x – 1$	$y = -3x + 1$	$y = -3x$

A. Copy the equation. Make a table. For the *x*-values, choose 0, one negative number, and two positive numbers.

B. Graph the line. Scale the *x*-axis and *y*-axis as needed. State whether this linear function represents a proportional relationship and how you know.

C. By looking at the equation, the table, and the graph, write the slope and the *y*-intercept. Then write one equation with the same slope and a different *y*-intercept, and another equation with a different slope and the same *y*-intercept.

D. Double check the slope by choosing two points on the line and calculating it using the slope formula. Show all work.

Part 3: Return to your seats. Work with your group.

Use your "start problem." Be prepared to share answers with the class.

1. Write an equation that:
   a. has the same *y*-intercept as your line, and twice the slope.

   b. has the same *y*-intercept as your line, and the slope is the reciprocal of your "start" line.

2. Which line has the greatest slope? Which line is the steepest?

OPEN MIDDLE PROBLEMS: LINEAR FUNCTIONS

1. Using the digits 0 – 9, no more than once each, create a table of values such that the points graphed are all along the same line.

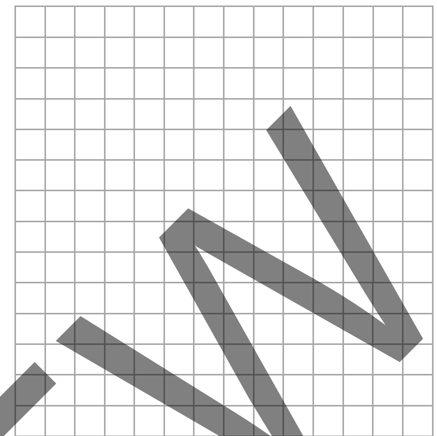
   For your line, write the:

   slope: ______

   y-intercept: ______

   equation: ___________

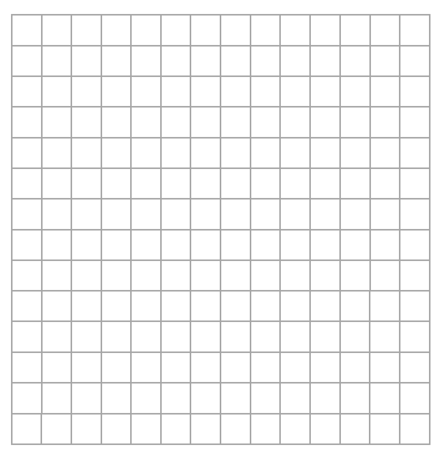
x	*y*



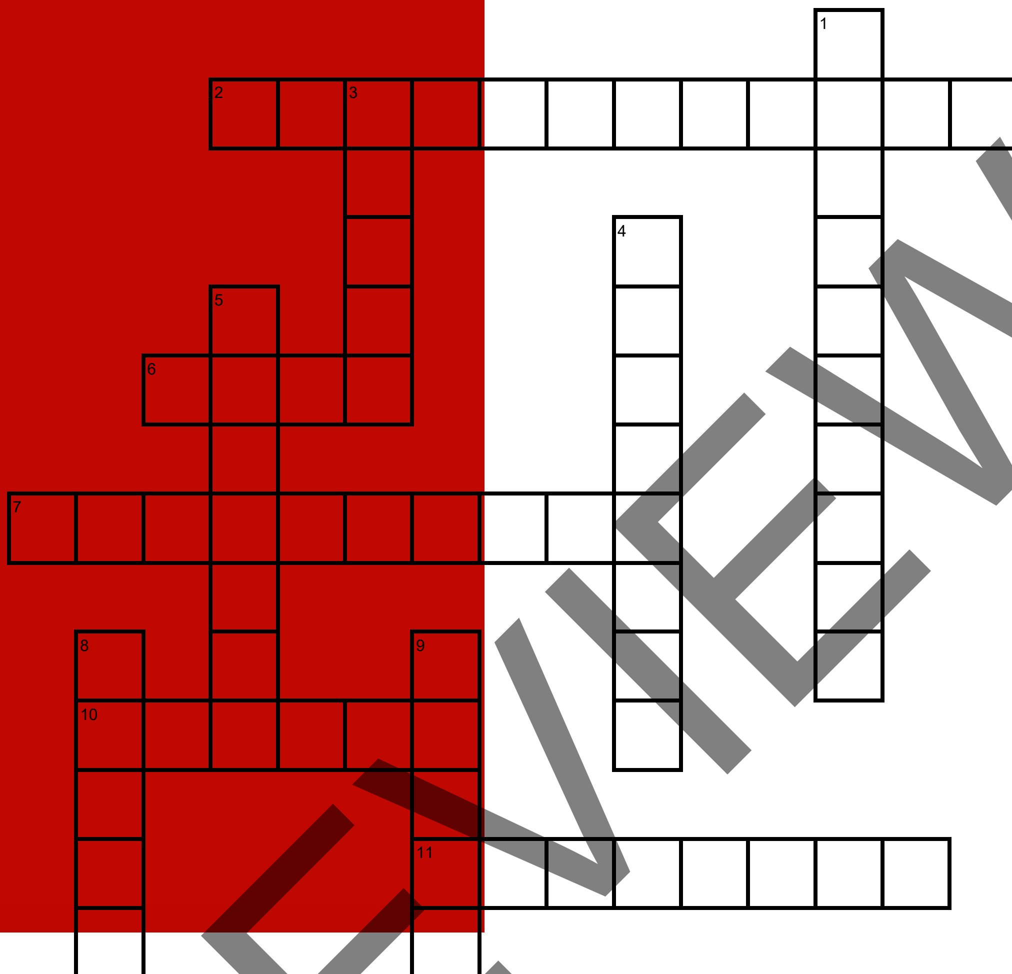
There is a line that goes through the origin and point (*a*, *b*). Find values for *a* and *b* to satisfy each condition for problems 2 – 3. Use only the digits 1 – 9, no more than once each for each problem.

2. The greatest positive slope possible. The equation for this line is:	3. The least positive slope possible. The equation for this line is:

4. There is a line that goes through points (*c*, *d*) and (*e*, *f*). Use the digits 1 – 9 no more than once each to find four coordinates to create the slope of a line as close to zero as possible.



VOCABULARY REVIEW



Across

2 Where lines cross is a point of _____.

6 The slope of the line $y = 9x + 15$ (in words)

7 The value of x that corresponds to $y = 0$ in an equation (hyphenated word)

10 A ___ function's graph is a straight line.

11 Lines that never meet

Down

1 The value of y that corresponds to $x = 0$ in an equation (hyphenated word)

3 Representation of entries of input and output values

4 Symbolic representation such as $y = -4x + 7$

5 The y-intercept of the line $y = 9x + 15$ (in words)

8 A measure of the steepness of a line

9 Visual representation that displays coordinates

SPIRAL REVIEW

1. **READY-X.** Solve for the values of R, E, A, D, Y, X. Sums of rows and columns are indicated at the end of each row and column.

COLUMNS

ROWS	1	2	3	
1	A	Y	X	**21**
2	A	D	X	**20**
3	A	E	R	**22**
4	A	A	R	**21**
	32	**22**	**30**	

R = _____ E = _____ A = _____ D = _____ Y = _____ X = _____

2. Solve each equation.

a. $12 = 9 - 3x + 6x$	b. $0.5 - (3.2n - 3.1) + 5.9n = 11.7$
c. $5(m + 8) = 28$	d. $\frac{-(f+7)}{8} = -1.5$

SPIRAL REVIEW
Continued

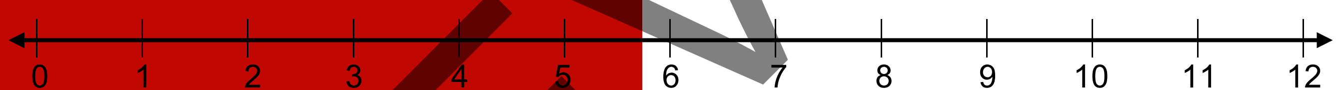
3. Solve for *x*.

a. $4y + x = 22$	b. $7 + y - x = 18$	c. $x + 5x - (y + 10) = 8 + 2y$

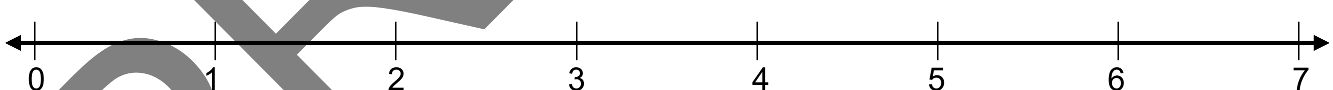
4. Graph each set below.

Set A			Set B			Set C		
π	3π	$\frac{1}{2}\pi$	$\sqrt{18}$	$\sqrt{25}$	$\sqrt{10}$	2^2	$\sqrt{4}$	$\left(\sqrt{4}\right)^2$

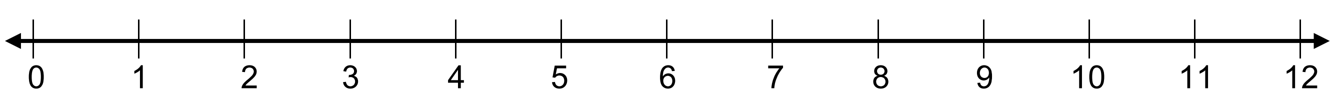
Set A



Set B



Set C



SPIRAL REVIEW
Continued

5. Determine whether each number is rational or irrational.

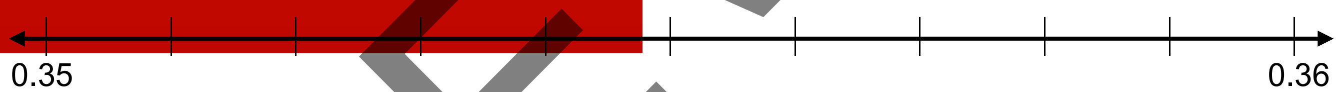
Number	$\sqrt{11}$	$-4\frac{1}{3}$	$\frac{8}{\sqrt{4}}$	0.121121112…	0.121212…
Rational					
Irrational					

6. Olivia and Addie agree that the value of $\sqrt{30}$ is in between 5 and 6. Olivia thinks that $\sqrt{30}$ is closer to 5. Addie thinks that $\sqrt{30}$ is closer to 6.

   a. Which student do you think is more accurate?

   b. What would you say to the other student to help her understand her error?

7. Number the tick marks on the line below. Continue the decimal pattern for each given number. Complete the table. Graph the points.



	Given number (continue each pattern)	**Write with a repeat bar** (if possible)	**Does the decimal terminate?**	**Write as a fraction** (if possible)
D	0.3535 __ __ __ __…			
U	0.3555 __ __ __ __…			
C	0.35000 __ __ __ __…			
K	0.353353335 __ __ __ __…			

REFLECTION

1. **Big Ideas**. Shade all circles that describe big ideas in this unit. Draw lines to show connections that you noticed.

- Use transformational geometry to investigate congruence and similarity ○
- ○ Extend applications of volume to cylinders, cones, and spheres
- Explore bivariate data ○
- ○ Complete the real number system
- Solve linear equations in one variable and linear systems in two variables ○
- ○ Discover and apply properties of lines, angles, and triangles, including the Pythagorean Theorem
- Create, analyze, and use linear functions in problem solving ○
- ○ Explore exponents and roots, and very large and very small quantities

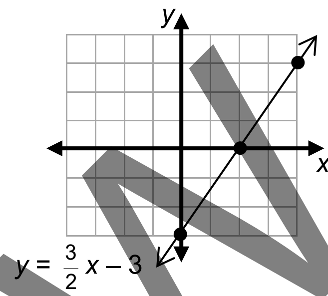
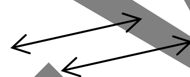
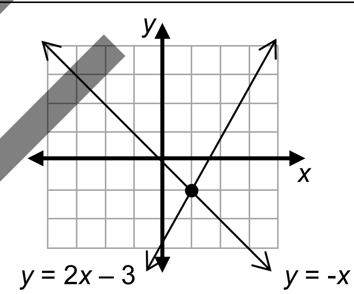
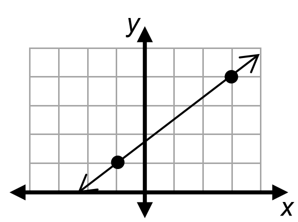
Give an example from this unit of one of the connections above.

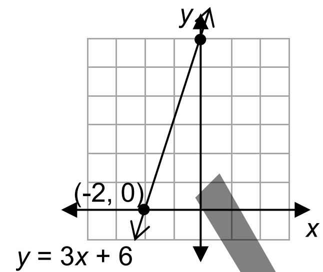
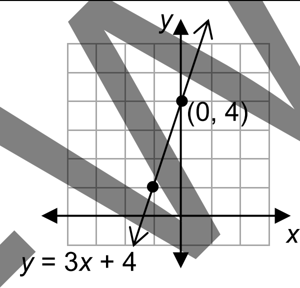
2. **Unit Progress.** Go back to **Monitor Your Progress** on the cover and complete or update your responses. Explain something you understand better now than before.

3. **Mathematical Practice.** Describe a situation where you manipulated numbers and algebraic symbols, and then connected those back to a real situation or context [SMP2]. Then circle one more SMP on the back of this packet that you think was addressed in this unit and be prepared to share an example.

4. **Making Connections.** How are proportional relationships and linear functions the same? How are they different?

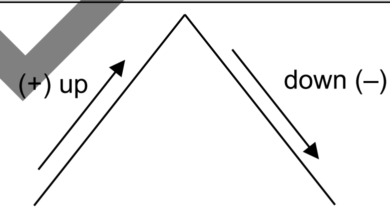
STUDENT RESOURCES

Word or Phrase	Definition
linear function	A linear function (in variables x and y) is a function that can be expressed in the form $y = mx + b$. The graph of $y = mx + b$ is a straight line with slope m and y-intercept b. The graph of the linear function $y = \frac{3}{2}x - 3$ is a straight line with slope $m = \frac{3}{2}$ and y-intercept $b = -3$. 
parallel	Two lines in a plane are parallel if they do not meet. 
point of intersection	A point of intersection of two lines is a point where the lines meet. The two straight lines in the plane with equations $y = -x$ and $y = 2x - 3$ have point of intersection (1, -1). 
slope-intercept form	The slope-intercept form of the equation of a line is the equation $y = mx + b$, where m is the slope of the line, and b is the y-intercept of the line. The equation $y = 2x + 3$ determines a line with slope 2 and y-intercept 3.
slope of a line	The slope of a line is the vertical change (change in the y-value) per unit of horizontal change (change in the x-value). If the difference in x is 0, we consider the slope to be undefined, a graphical representation of this situation is a vertical line.  The slope of the line through (-1, 1) and (3, 4) is $\frac{3}{4}$: $\text{slope} = \frac{(\text{difference in } y)}{(\text{difference in } x)} = \frac{4-1}{3-(-1)} = \frac{3}{4}$

Word or Phrase	Definition
x-intercept	The <u>*x*-intercept</u> of a line is the *x*-coordinate of the point at which the line crosses the *x*-axis. It is the value of x that corresponds to $y = 0$. The *x*-intercept of the line $y = 3x + 6$ is -2. If $y = 0$, then $x = -2$. 
y-intercept	The <u>*y*-intercept</u> of a line is the *y*-coordinate of the point at which the line crosses the *y*-axis. It is the value of y that corresponds to $x = 0$. For the line $y = 3x + 4$, the *y*-intercept is 4. If $x = 0$, then $y = 4$. 

Slope

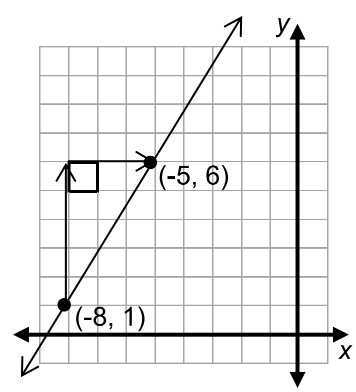
One way to think about slope (m) is to imagine that the line is a portion of a mountain. Just as we read from left to right, we will move up and down the mountain from left to right. When moving up the mountain, the slope is positive. When moving down the mountain, the slope is negative. The steeper the mountain, the greater (in absolute value) the slope.



The slope (m) of a line is computed as: $\frac{\text{vertical change}}{\text{horizontal change}}$ as you move from one point to another on the same line, or $\frac{\text{difference in } y \text{ coordinates}}{\text{difference in } x \text{ coordinates}}$ as you move from one point to another on the same line.

To use counting to determine slope, first move in a vertical direction and find the directed distance, and then move in a horizontal direction and find the directed distance.

If A (-8, 1) and B (-5, 6) are points on a line, then count 5 units up and then 3 units to the right. $m = \frac{5}{3}$



To use coordinates to determine slope (m), find the quotient of the difference in the *y*-coordinates and the difference in the *x*-coordinates.

If A (-8, 1) and B (-5, 6) are points on a line, then

$$m = \frac{\text{difference in } y}{\text{difference in } x} = \frac{6-1}{-5-(-8)} = \frac{5}{3}.$$

If (a, b) and (c, d) are points on a line, then

$$m = \frac{\text{difference in } y}{\text{difference in } x} = \frac{d-b}{c-a}.$$ This formula is the definition of the slope of a line.

Horizontal and Vertical Lines

The slope (m) of a line is computed as:

$$\frac{\text{difference in } y \text{ coordinates}}{\text{difference in } x \text{ coordinates}}$$ as you move from one point to another on the same line.

Horizontal Lines

A horizontal line is a line parallel to the *x*-axis. Every point on a horizontal line has the same *y*-coordinate, and the vertical change between any two positions on the line is zero. Hence,

$$\text{slope} = \frac{\text{vertical change}}{\text{horizontal change}} = \frac{0}{\text{horizontal change}} = 0.$$

horizontal

The slope of a horizontal line is zero.

Vertical Lines

vertical

A vertical line is a line parallel to the *y*-axis. Every point on a vertical line has the same *x*-coordinate, and the horizontal change between any two points on the line is zero. Hence,

$$\text{slope} = \frac{\text{vertical change}}{\text{horizontal change}} = \frac{\text{vertical change}}{0}$$ is undefined,

since division by zero is undefined.

The slope of a vertical line is undefined.

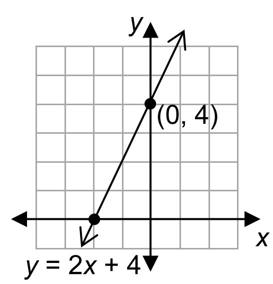
The Slope-Intercept Form of Linear Equations

Slope-intercept form of a linear equation is $y = mx + b$, where m = slope of the line and b = the *y*-intercept.

Find the equation of a line with a slope of $-\frac{1}{3}$ and the *y*-intercept is -5.

Since $y = mx + b$, then $y = -\frac{1}{3}x - 5$.

Find the equation of the line that passes through the points (0, 4) and (-2, 0).



First plot the points on a graph.
Notice that the *y*-intercept is 4.
Count or compute to find the slope,

$$m = \frac{4-0}{0-(-2)} = 2$$

Therefore, the equation of the line is $y = 2x + 4$.

COMMON CORE STATE STANDARDS

STANDARDS FOR MATHEMATICAL CONTENT	
8.EE.B	**Understand the connections between proportional relationships, lines, and linear equations.**
8.EE.6	~~Use similar triangles to explain why the slope m is the same between any two distinct points on a non-vertical line in the coordinate plane;~~ derive the equation y = mx for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b.
8.F.A	**Define, evaluate, and compare functions.**
8.F.2	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change.*
8.F.3	Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; ~~give examples of functions that are not linear. *For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.*~~
8.F.B	**Use functions to model relationships between quantities.**
8.F.4	Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.
8.F.5	Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

STANDARDS FOR MATHEMATICAL PRACTICE	
SMP1	Make sense of problems and persevere in solving them.
SMP2	Reason abstractly and quantitatively.
SMP3	Construct viable arguments and critique the reasoning of others.
SMP4	Model with mathematics.
SMP5	Use appropriate tools strategically.
SMP6	Attend to precision.
SMP7	Look for and make use of structure.
SMP8	Look for and express regularity in repeated reasoning.

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