

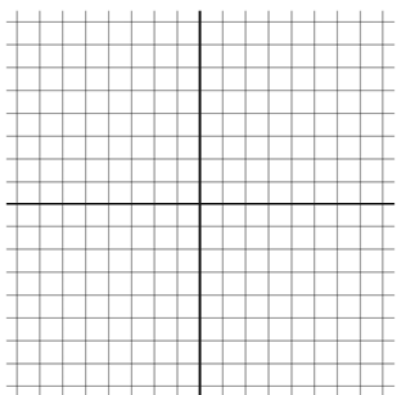
## **The Picture Tells the Linear Story**

Students investigate the relationship between constants and coefficients in a linear equation and the resulting slopes and y-intercepts on the graphs. This activity also helps students develop the concept of parallel lines.

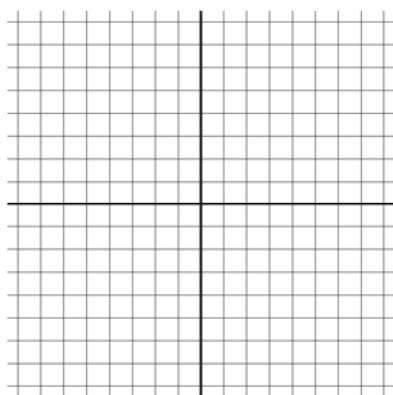
## *The Picture Tells the Linear Story*

Sketch each equation's graphs on the axes provided.  
Answer the questions for each family of equations.

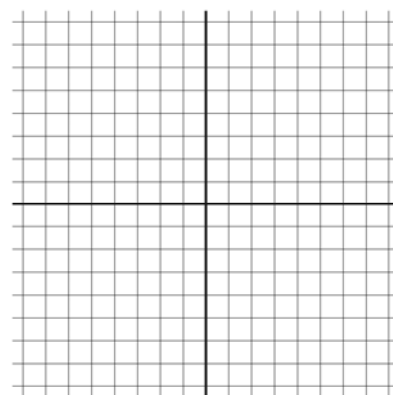
I.



$$y = x$$



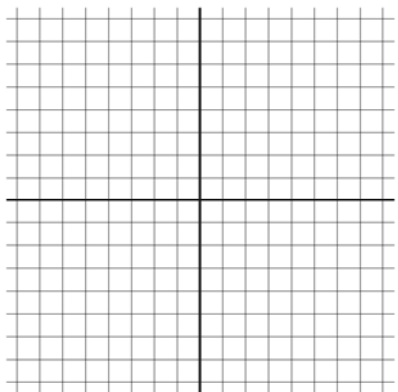
$$y = x + 6$$



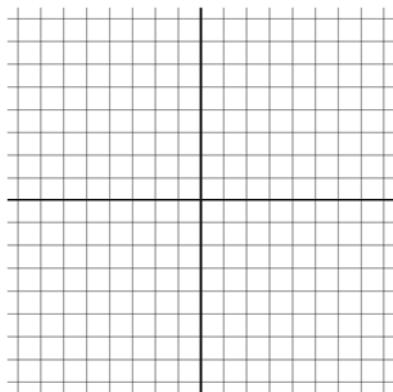
$$y = x - 4$$

1. How are the lines the same?
2. What is different about the lines?
3. Where does each line cross the y-axis?  
Line 1: \_\_\_\_\_  
Line 2: \_\_\_\_\_  
Line 3: \_\_\_\_\_
4. What happens to the graph when a constant is added to  $y = x$ ?
5. Write an equation for a line similar to those above but crosses the y-axis at 5.
6. Write an equation for a line similar to those above but crosses the y-axis at  $-2$ .

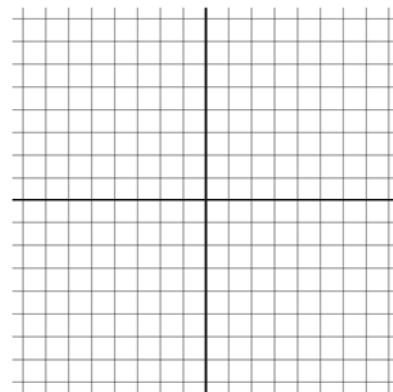
II.



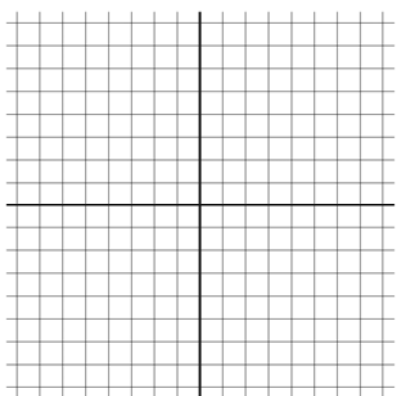
$$y = x$$



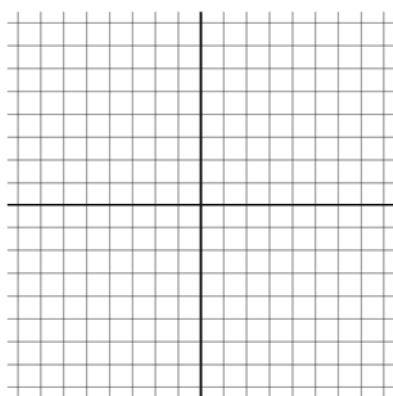
$$y = 2x$$



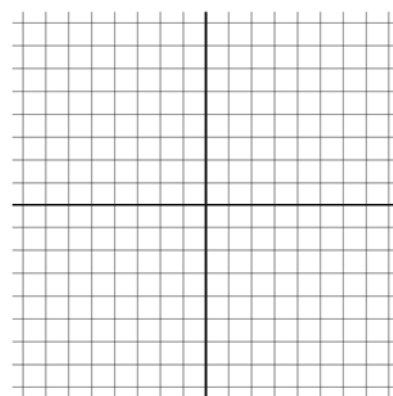
$$y = 5x$$



$$y = \frac{1}{2}x$$



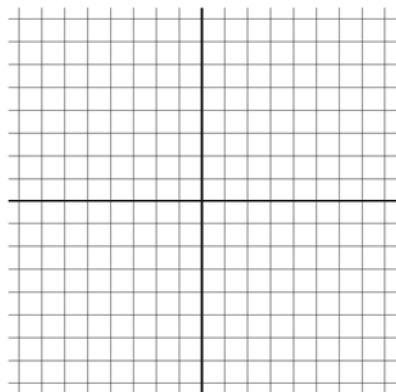
$$y = \frac{1}{3}x$$



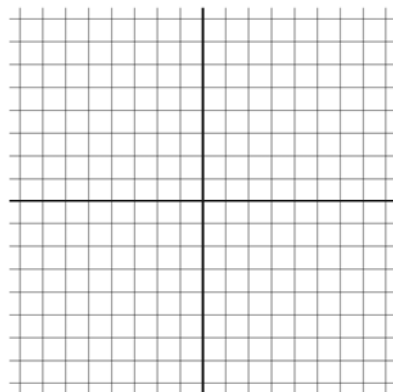
$$y = \frac{1}{4}x$$

1. How are all the graphs alike? Why?
2. Describe the differences in the graphs.
3. Which line appears the steepest?
4. What makes the difference?

III.



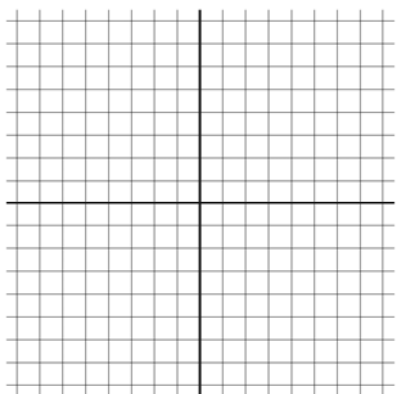
$$y = x$$



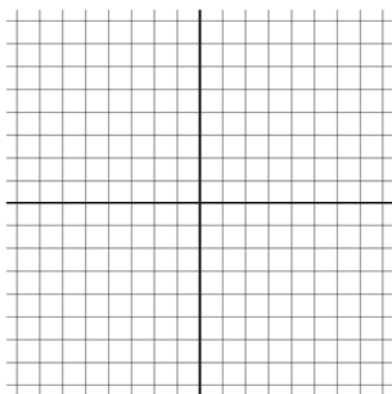
$$y = -x$$

1. How are the lines alike?
2. How are the lines different?

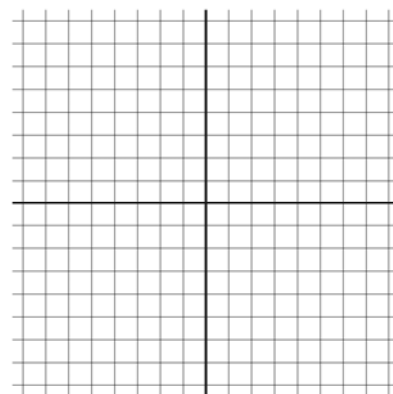
IV.



$$y = -x$$



$$y = -2x$$



$$y = -4x$$

1. Name 2 ways the lines are alike.
2. How are the lines different?
3. Which line appears the steepest?
4. What makes the difference?

V. Use the information from the previous graphs to answer the following questions.

1. Where does each of the following cross the y-axis?

a.  $y = 2x + 7$  \_\_\_\_\_

b.  $y = -x + 11$  \_\_\_\_\_

c.  $y = \frac{1}{2}x - 8$  \_\_\_\_\_

2. Which of the lines below is the steepest? Explain how you know.

a.  $y = 2x + 7$

b.  $y = -x + 11$

c.  $y = \frac{1}{2}x - 8$

3. Where does each of the following cross the y-axis?

a.  $y = x + 8$  \_\_\_\_\_

b.  $y = 3x - 4$  \_\_\_\_\_

c.  $y = \frac{1}{2}x + 3$  \_\_\_\_\_

4. Which of the lines below is the steepest? Explain how you know.

a.  $y = x + 8$

b.  $y = 3x - 4$

c.  $y = \frac{1}{2}x + 3$

5. Where does each of the following cross the y-axis?

a.  $y = -x + 8$  \_\_\_\_\_

b.  $y = -2x + 5$  \_\_\_\_\_

c.  $y = -\frac{1}{3}x$  \_\_\_\_\_

6. Which of the lines below is the steepest? Explain how you know.

a.  $y = -x + 8$

b.  $y = -2x + 5$

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

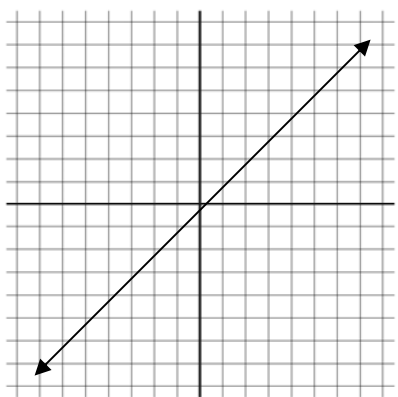
7. If a linear equation can be written in the form  $y = \mathbf{m}x + \mathbf{b}$ , where  $\mathbf{m}$  and  $\mathbf{b}$  represent any real values, explain the effect of  $\mathbf{m}$  on the graph of the equation.

8. Explain the effect of  $\mathbf{b}$  on the graph.

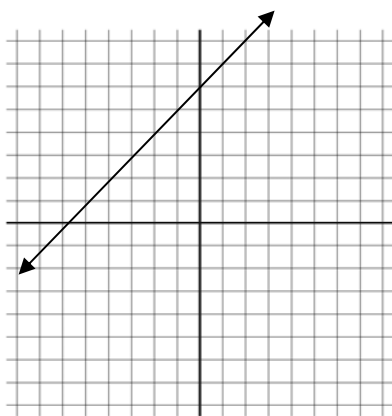
## *The Picture Tells the Linear Story Answer Key*

Sketch each equation's graphs on the axes provided.  
Answer the questions for each family of equations.

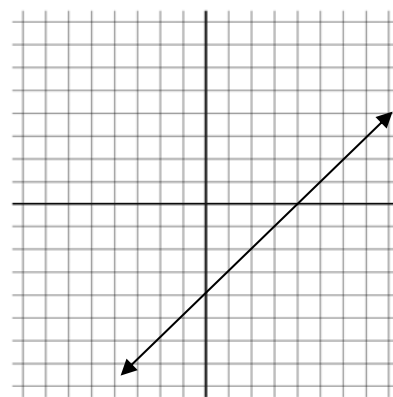
I.



$$y = x$$



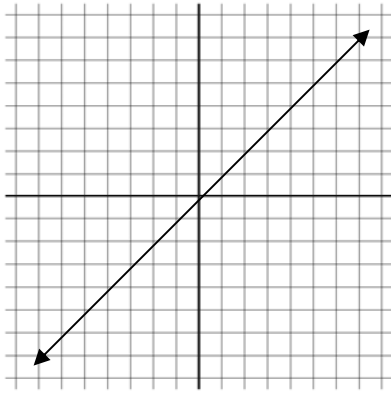
$$y = x + 6$$



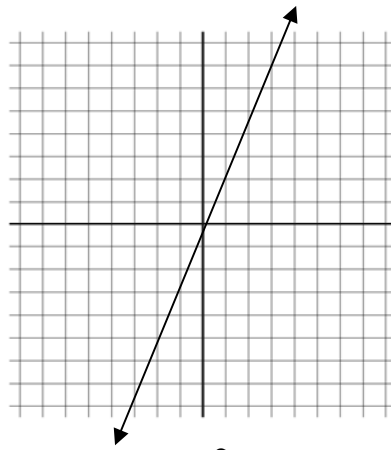
$$y = x - 4$$

1. How are the lines the same?  
*All have the same steepness and are going up to the right.*
2. What is different about the lines?  
*Each line crosses the y-axis at a different place (different y-intercept)*
3. Where does each line cross the y-axis?  
Line 1: (0, 0) or origin  
Line 2: (0, 6)  
Line 3: (0, -4)
4. What happens to the graph when a constant is added to  $y = x$ ?  
*The graph moves up or down on the y-axis.*
5. Write an equation for a line similar to those above but crosses the y-axis at 5.  
 $y = x + 5$
6. Write an equation for a line similar to those above but crosses the y-axis at -2  
 $y = x - 2$

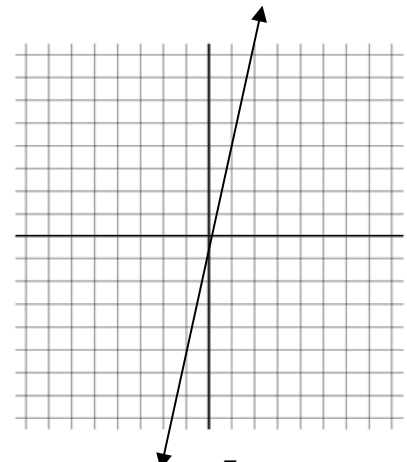
II.



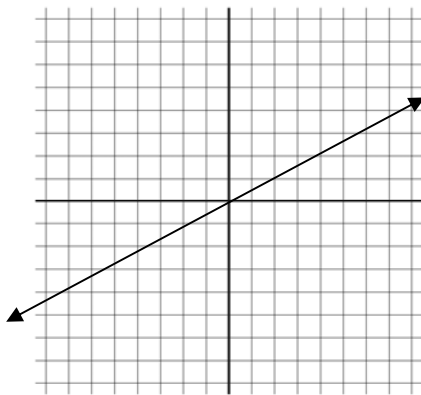
$$y = x$$



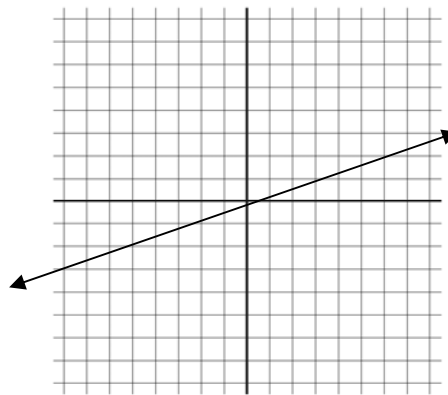
$$y = 2x$$



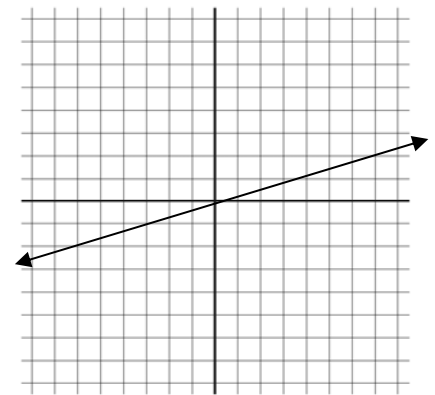
$$y = 5x$$



$$y = \frac{1}{2}x$$



$$y = \frac{1}{3}x$$



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

1. How are all the graphs alike? Why?

*All the graphs pass through the origin because the constant is understood to be 0.*

2. Describe the differences in the graphs.

*Each line has a different steepness.*

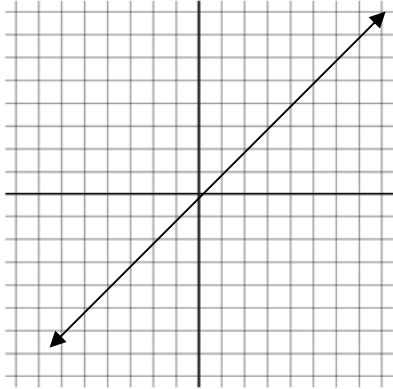
3. Which line appears the steepest?

*$y = 5x$*

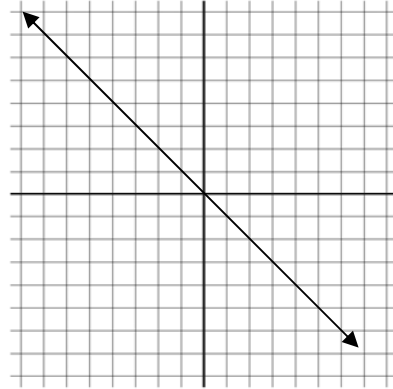
4. What makes the difference?

*The coefficient of  $x$  determines the steepness of the line.*

III.



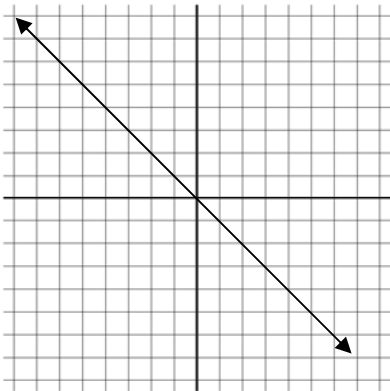
$$y = x$$



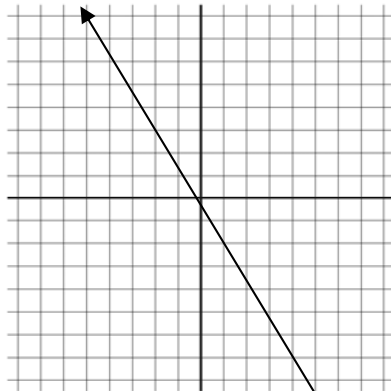
$$y = -x$$

1. How are the lines alike?  
*They both cross the y-axis at the origin.*
2. How are the lines different?  
*The first graph is increasing; the second graph is decreasing*

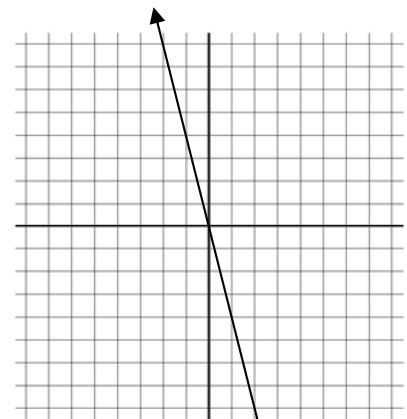
IV.



$$y = -x$$



$$y = -2x$$



$$y = -4x$$

1. Name 2 ways the lines are alike.
  - *All the lines pass through the origin*
  - *Each line is decreasing*
2. How are the lines different?  
*The lines decrease at different rates; different steepness*
3. Which line appears the steepest?  
 $y = -4x$
4. What makes the difference?  
*The larger the coefficient of  $x$ , the steeper the line.*



V. Use the information from the previous graphs to answer the following questions.

1. Where does each of the following cross the y-axis?

a.  $y = 2x + 7$  (0, 7)

b.  $y = -x + 11$  (0, 11)

c.  $y = \frac{1}{2}x - 8$  (0, -8)

2. Which of the lines below is the steepest? Explain how you know.

a.  $y = 2x + 7$   $y = 2x + 7$  is the steepest since the coefficient of  $x$  is the largest.

b.  $y = -x + 11$

c.  $y = \frac{1}{2}x - 8$

3. Where does each of the following cross the y-axis?

a.  $y = x + 8$  (0, 8)

b.  $y = 3x - 4$  (0, -4)

c.  $y = \frac{1}{2}x + 3$  (0, 3)

4. Which of the lines below is the steepest? Explain how you know.

a.  $y = x + 8$   $y = 3x - 4$  is the steepest since the coefficient of  $x$  is the largest.

b.  $y = 3x - 4$

c.  $y = \frac{1}{2}x + 3$

5. Where does each of the following cross the y-axis?

a.  $y = -x + 8$  (0, 8)

b.  $y = -2x + 5$  (0, 5)

c.  $y = -\frac{1}{3}x$  (0,0)

6. Which of the lines below is the steepest? Explain how you know.

a.  $y = -x + 8$   $y = -2x + 5$  is the steepest since the coefficient of  $x$  is the largest.

b.  $y = -2x + 5$

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

7. If a linear equation can be written in the form  $y = \mathbf{m}x + \mathbf{b}$ , where  $\mathbf{m}$  and  $\mathbf{b}$  represent any real values, explain the effect of  $\mathbf{m}$  on the graph of the equation.

*The value of  $\mathbf{m}$  makes the line more or less steep.*

8. Explain the effect of  $\mathbf{b}$  on the graph.

*The value of  $\mathbf{b}$  moves the graph up or down the y-axis (determines where the line will cross the y-axis)*