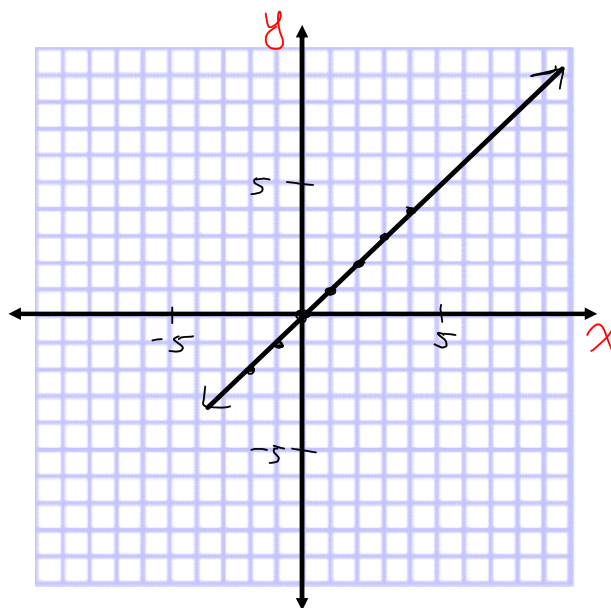


### 4.4 Investigating $y=ax$

The equation  $y=x$  describes a set of points on the coordinate plane that follow the "rule" that the x-coordinate is equal to the y-coordinate.

- Write down a list of points that satisfy the condition that  $y=x$  in the table. How many points are there?
- Graph the points in your table. What would the graph look like if you could graph ALL of the points that have  $y=x$ ?

X	Y
-2	-2
-1	-1
0	0
1	1
2	2
3	3
4	4
5	5



$$m = \frac{1}{1} = 1$$

$$y = x$$

$$y = 1x$$

$\curvearrowright m = 1$

- Communication**

  - -arrows on axes
  - -x and y axis labelled
  - -show scale on x and y axis
  - -arrows on line
  - -line is labeled with equation
  - -line extends to edges of graph

What is the slope of this line? 1

- The graph of  $y=x$  is called the "base" or "parent" function for all lines.
  - All other lines are transformations of this line.

**Ex. 1** Generate points for each equation, then graph the line. Determine the slope of each line.

a)  $y = 2x$

b)  $y = 3x$

x	y
-2	-4
-1	-2
0	0
1	2
2	4
3	6

x	y
-2	-6
-1	-3
0	0
1	3
2	6
3	9

slope = 2

slope = 3

hint: choose x-values that divide evenly by 2

hint: choose x-values that divide evenly by 4

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

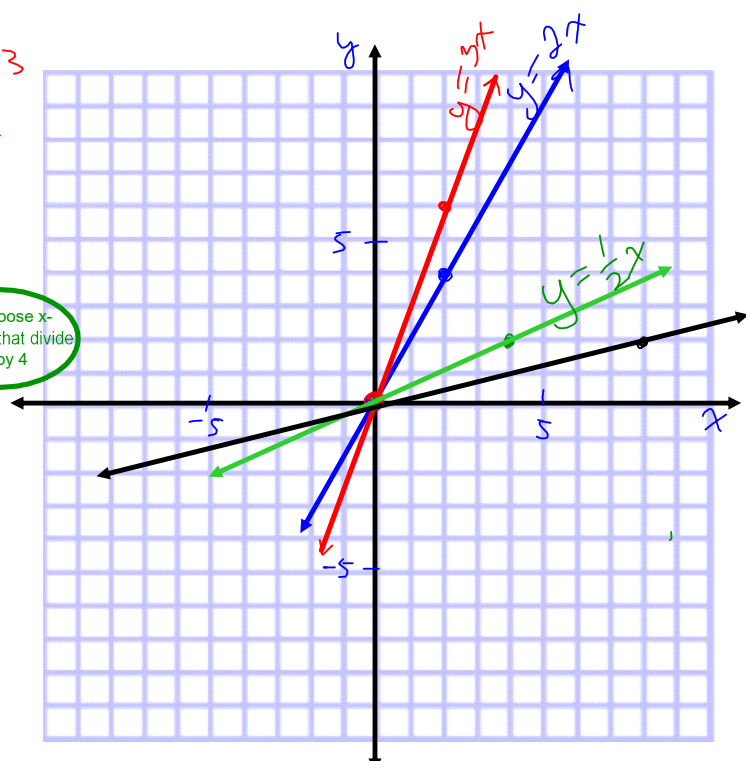
d)  $y = \frac{1}{4}x$

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

x	y
-8	-2
-4	-1
0	0
4	1
8	2
12	3

slope =  $\frac{1}{2}$

slope =  $\frac{1}{4}$



$\therefore$  The larger the slope, the steeper the line

**Ex. 2** Generate points for each equation, then graph the line.  
Determine the slope of each line.

a)  $y = -2x$

x	y

slope = -2

hint: choose x-values that divide evenly by 2

b)  $y = -3x$

x	y

slope = -3

hint: choose x-values that divide evenly by 4

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

x	y

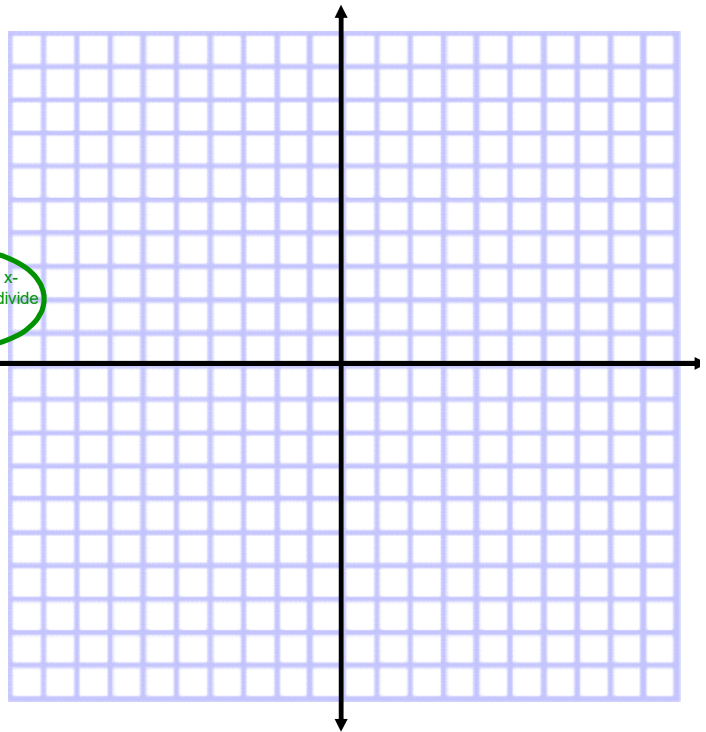
slope =  $-\frac{1}{2}$

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

x	y

slope =  $-\frac{1}{4}$

∴ The closer the slope is to zero, the flatter the line

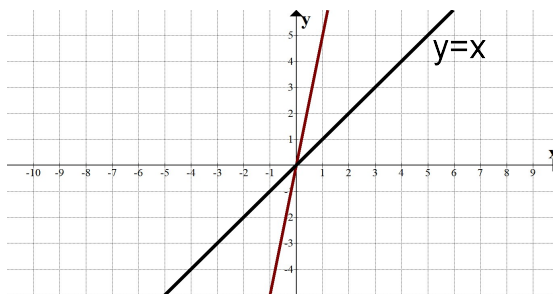


### Summary : $y = ax$

- represents the equation of line that goes through  $(0,0)$  and has a slope of "a"

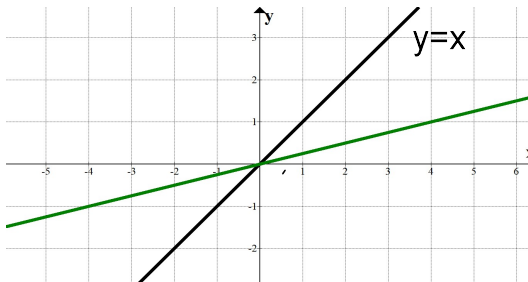
If  $a > 1$ , then the line is steeper than  $y=x$ .

$$y = 5x$$



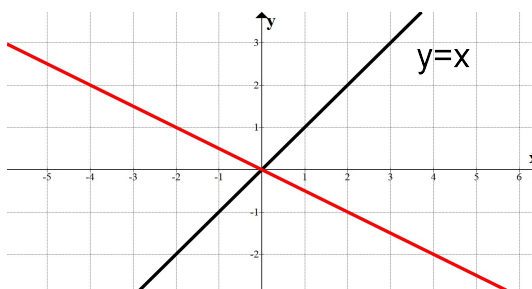
If  $0 < a < 1$ , then the line is less steep than  $y=x$ .

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



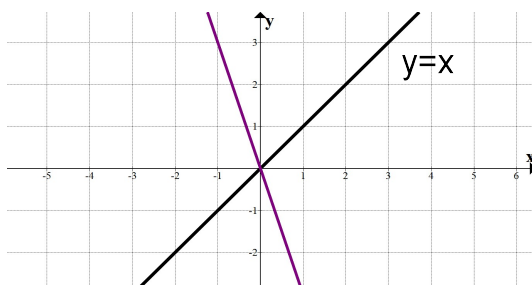
If  $-1 < a < 0$ , then the line is less steep than  $y=x$ , and is sloped in a negative direction.

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



If  $a < -1$ , then the line is steeper than  $y=x$ , and is sloped in a negative direction.

$$y = -3x$$



**Ex. 3** Generate points for each equation, then graph the line.  
Determine the y-intercept for each line.

a)  $y = x + 3$

x	y
-2	1
-1	2
0	3
1	4
2	5

y-int= 3

b)  $y = x + 1$

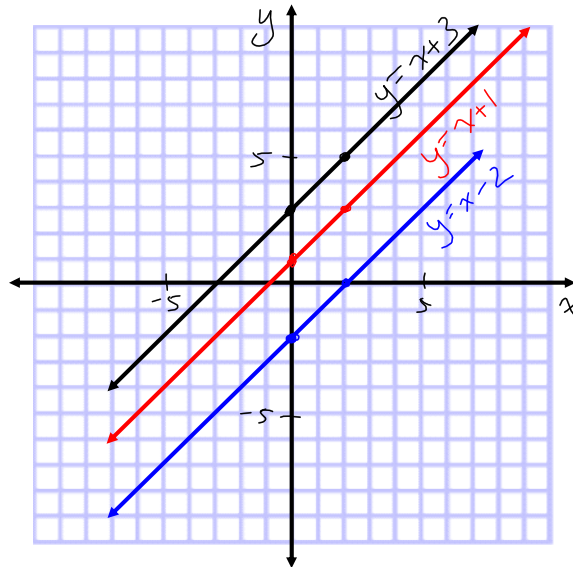
x	y
-2	-1
-1	0
0	1
1	2
2	3

y-int= 1

c)  $y = x - 2$

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

y-int= -2

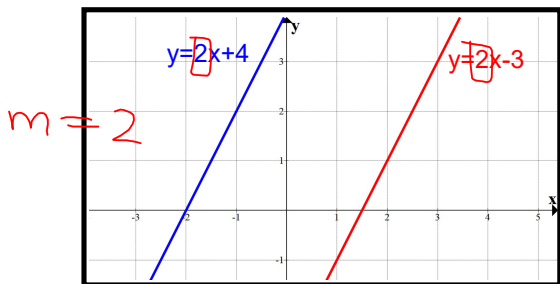


**Summary:  $y = x + b$**

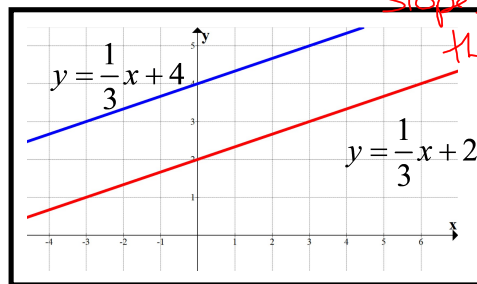
- represents the equation of a line with slope=1 and a y-intercept=b.
- if  $b > 0$ , the line is translated up b units
- if  $b < 0$ , the line is translated down b units

Ex. 4 Look at the graphs and equations of each pair of lines.  
 What do you notice about the graphs? the slopes?

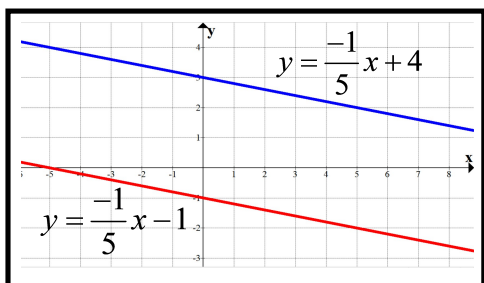
*Parallell!!  
 Slopes are the same!*



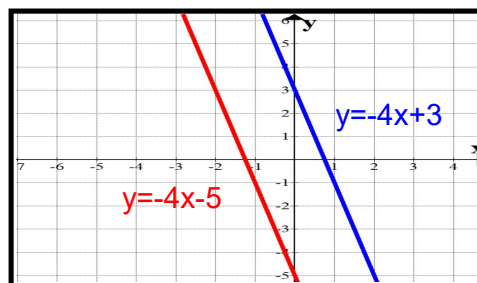
slope 1 2 slope 2 2



slope 1 \_\_\_\_\_ slope 2 \_\_\_\_\_



slope 1 \_\_\_\_\_ slope 2 \_\_\_\_\_



slope 1 \_\_\_\_\_ slope 2 \_\_\_\_\_

**Conclusion:**  
 Parallel lines have slopes that are equal.