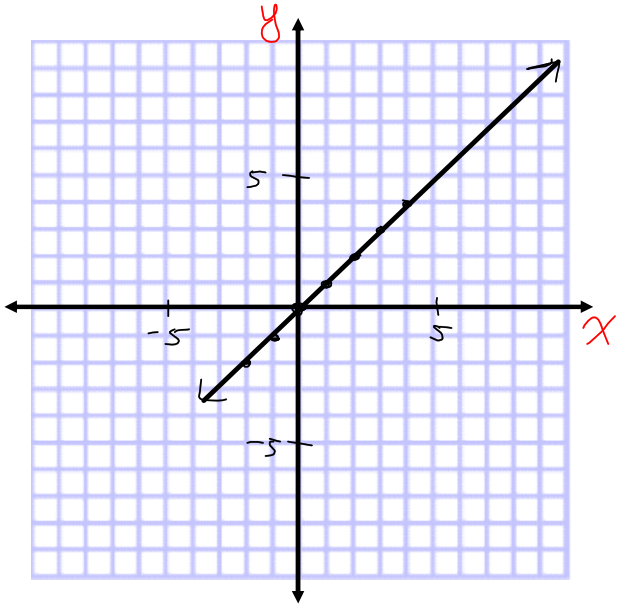
4.4 Investigating y=ax

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

+1 +1 +1 +1 +1 +1



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

$y = x$

$y = 1x$

$m = 1$

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 the 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

slope= 2

X	Y
-2	-6
-1	-3
0	0
1	3
2	6
3	9

slope= 3

hint: choose x-values that divide evenly by 2

hint: choose x-values that divide evenly by 4

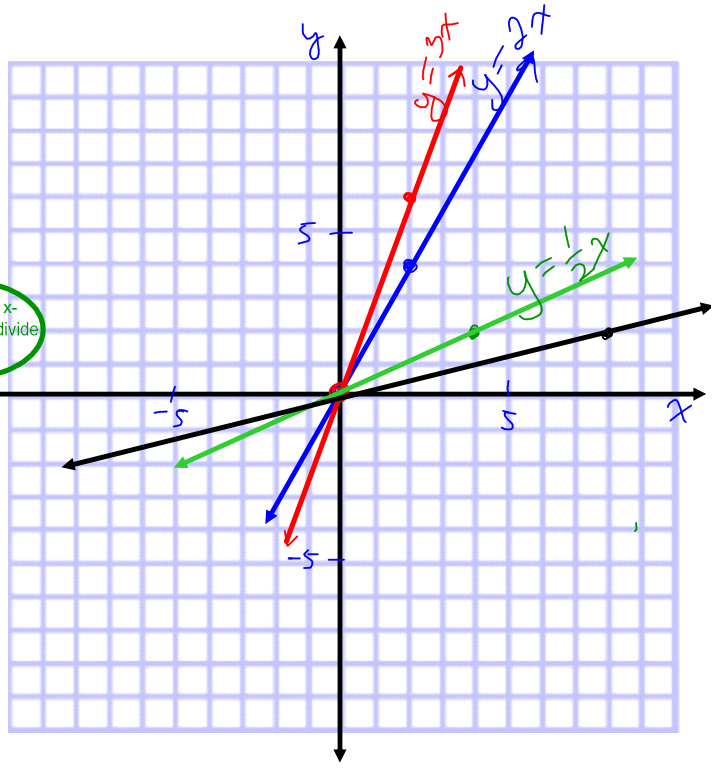
c) $y = \frac{1}{2}x$ **d) $y = \frac{1}{4}x$**

X	Y
-4	-2
-2	-1
0	0
2	1
4	2

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

X	Y
-8	-2
-4	-1
0	0
4	1
8	2
12	3

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



∴ 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

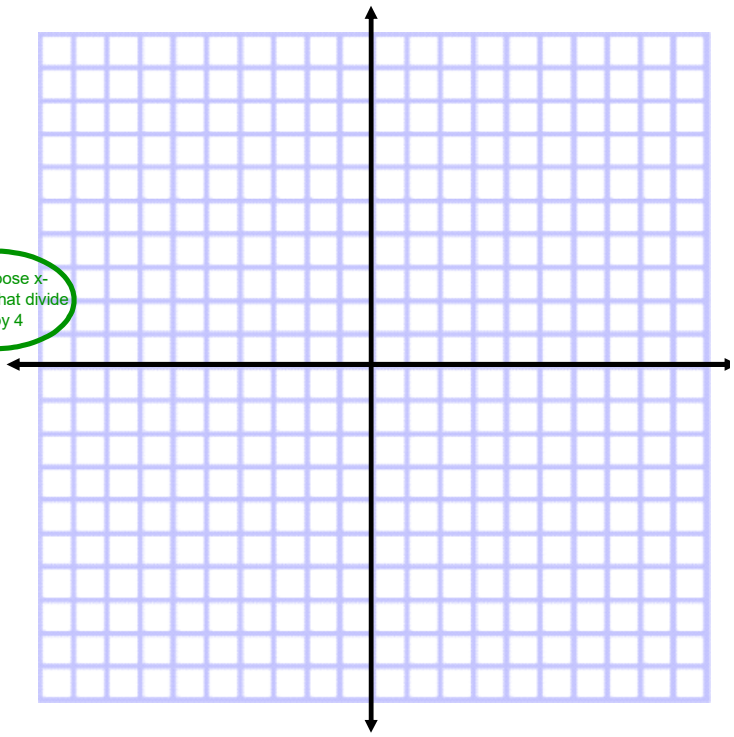
b) y = -3x

X	Y

slope= -3

hint: choose x-values that divide evenly by 4

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



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

X	Y

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

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

X	Y

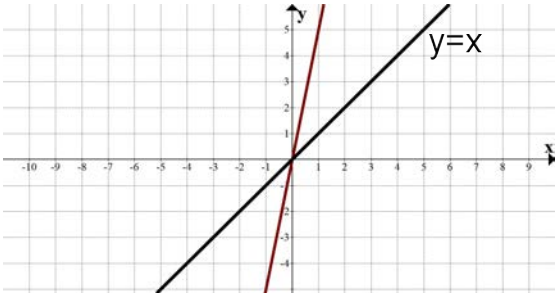
slope= $-\frac{1}{4}$

Summary : y = ax

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

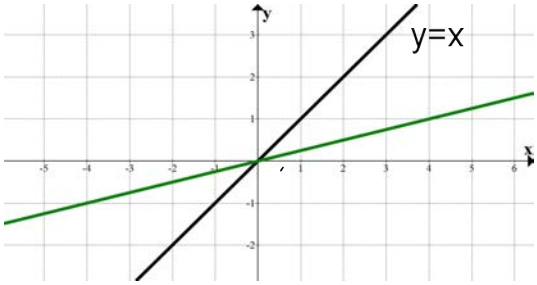
If a>1, then the line is steeper than y=x.

$y = 5x$



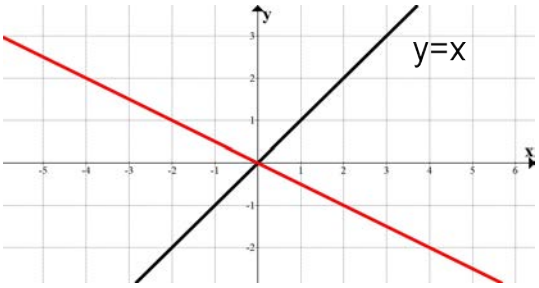
If 0<a<1, then the line is less steep than y=x.

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



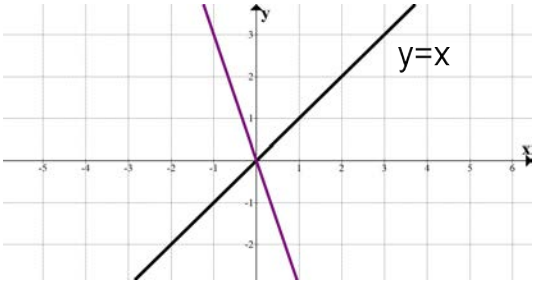
If -1<a<0, then the line is less steep than y=x,
and is sloped in a negative direction.

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



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

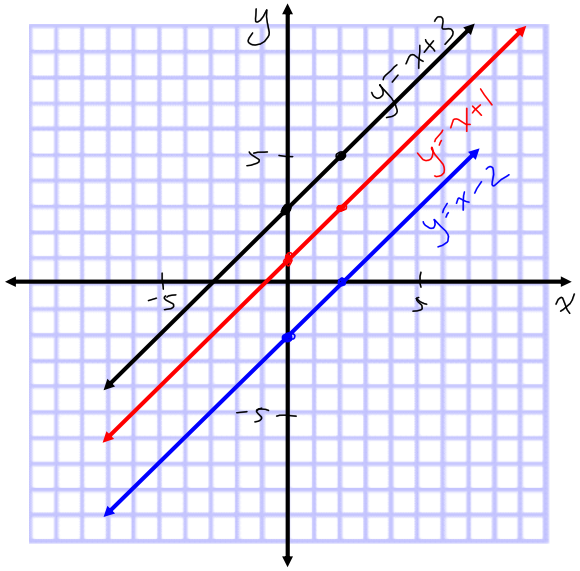
x	y
-2	-1
-1	0
0	1
1	2
2	3

y-int= 1

c) y = x - 2

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

y-int= -2



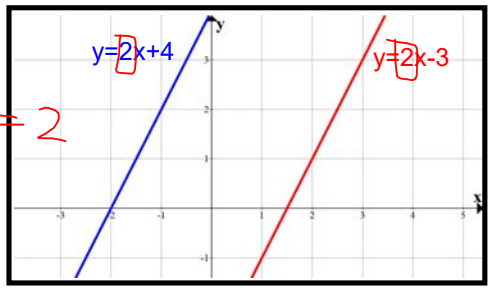
Summary: y = x + b

- 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

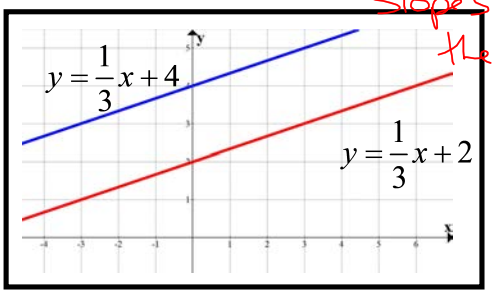
Ex. 4 **Look at the graphs and equations of each pair of lines.**

What do you notice about the graphs? the slopes?

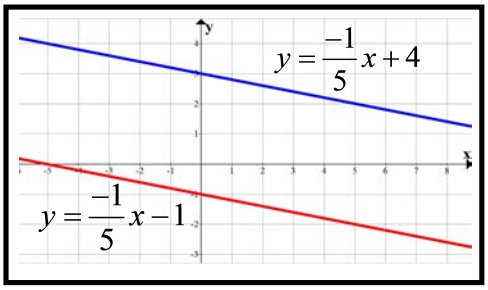
Parallel!
Slopes are the same!



slope 1 2 slope 2 2



slope 1_____ slope 2 _____



slope 1_____ slope 2 _____

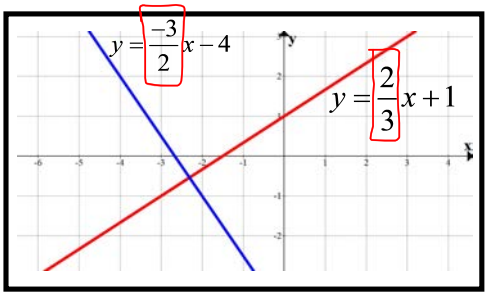
slope 1_____ slope 2 _____

Conclusion:

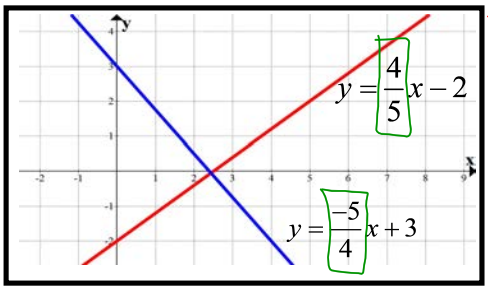
Parallel lines have slopes that are equal.

Ex. 5 **Look at the graphs and equations of each pair of lines.** All perpendicular!

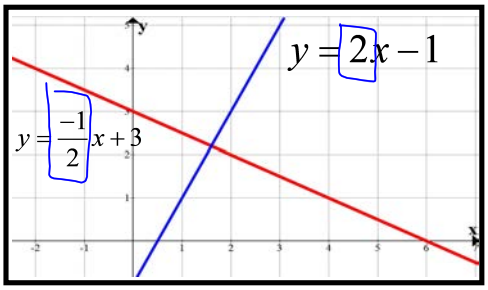
What do you notice about the graphs? the slopes?



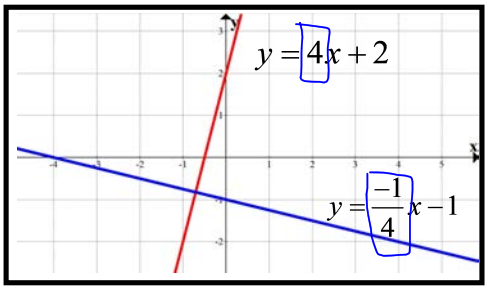
slope 1 $-\frac{3}{2}$ slope 2 $\frac{2}{3}$



slope 1 $-\frac{5}{4}$ slope 2 $\frac{4}{5}$



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



slope 1 4 slope 2 $-\frac{1}{4}$

Conclusion:

Perpendicular lines have slopes that are **negative reciprocals.**

- Flip the fraction
- Change the sign

Ex. 6 **Order the equations of these lines from least steep to steepest.**

a)

$y = \frac{1}{7}x + 4$ (1)

$y = \frac{1}{2}x + 5$ (2)

$y = 3x - 4$ (3)

$y = 5x - 2$ (4)

b)

$y = \frac{-1}{2}x + 5$ (2)

$y = \frac{1}{5}x - 7$ (1)

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

$y = 2x - 3$ (3)

Ex. 7 **Match the lines that are parallel to each other.**

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

$y = 3x - 4$

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

$y = 5x - 5$

$y = 5x - 4$

$y = 3x + 5$

Ex. 8 **Match the lines that are perpendicular to each other.**

$y = -5x + 3$

$y = \frac{1}{5}x + 2$

$y = \frac{-1}{5}x - 7$

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

$y = 5x - 3$

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