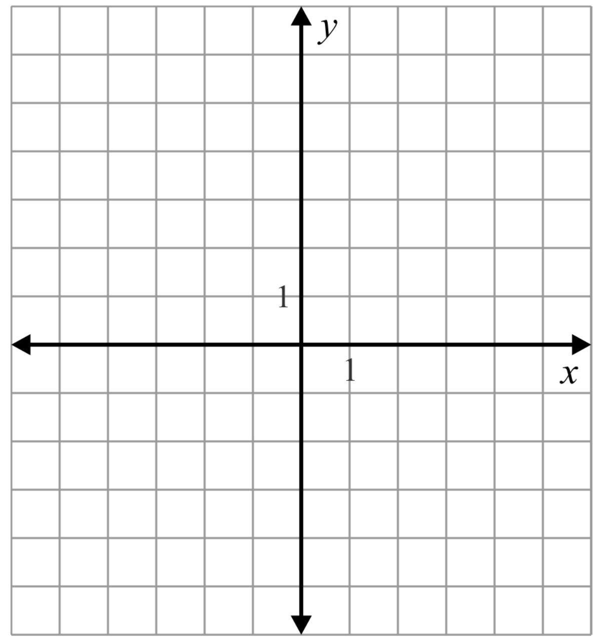
Slope-Intercept Equation 1

1. Below, you see tables of values for two lines.
   The equation of Line 1 is given, and is $y = -2x$.



Line 1:

$y = -2x$

x	y
−2	4
−1	2
0	0
1	−2
2	−4
3	−6

Line 2:

$y =$ ____________

x	y
−2	7
−1	5
0	3
1	1
2	−1
3	−3

a. What is the slope of Line 1? Of Line 2?

b. Graph both lines.

c. Where does Line 2 cross the y-axis?

d. Now compare the y-values in the tables. How do those y-values differ from each other?

How can we see that same difference in the two graphs? In other words, what geometric transformation can you use to transform the first line to the second?

e. Write an equation for Line 2, of the form "y = something".

f. Line 3 has the equation $y = -2x - 2$. How do the y-values of that line differ from those of Line 1?

Therefore, what geometric transformation can you use to transform Line 1 to Line 3?

2. Line L is a line through the origin, with slope m, and its equation is therefore $y = mx$.

a. What geometric transformation can you use to transform line L so that it crosses the y-axis at the point $(0, b)$?

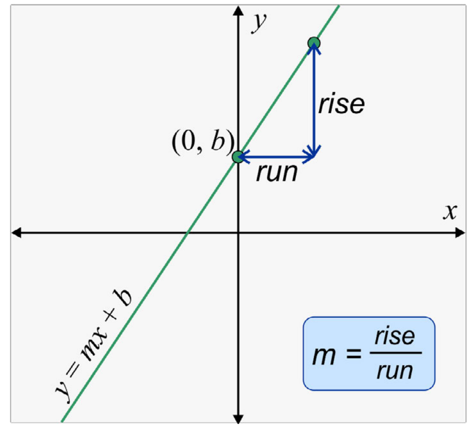
b. How would you change the equation $y = mx$ to reflect that change?

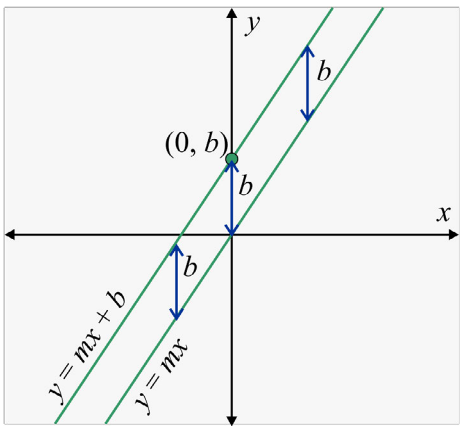
Every linear function — a line in the coordinate grid — **has an equation of the form** $\boldsymbol{y = mx + b}$.

In this equation, m is the slope. In the past, you have learned to call the parameter m the rate of change. This is the same concept as the slope.

What is the difference? Slope is used in the context of <u>graphing</u> and only applies to <u>lines</u>. Rate of change is used more generally, and can also be applied to functions that are not linear.

You have learned that the parameter b is the **initial value** — in other words, the value of the function when the independent variable is zero. In the context of graphing, we call it the ***y*-intercept**, because the line crosses the y-axis at the point $(0, b)$.





When comparing the lines $\boldsymbol{y = mx}$ and $\boldsymbol{y = mx + b}$, the latter line is located b units above the former, if b is positive, and b units below it if b is negative.

In other words, if we translate the line $y = mx$ by $|b|$ units up or down (up when $b > 0$ and down when $b < 0$), we get the line with the equation $y = mx + b$.

It is easy to plot a line when its equation is given in the slope-intercept form of $\boldsymbol{y = mx + b}$. We can simply plot y-intercept point $(0, b)$, and then use the slope to find another point on the line.

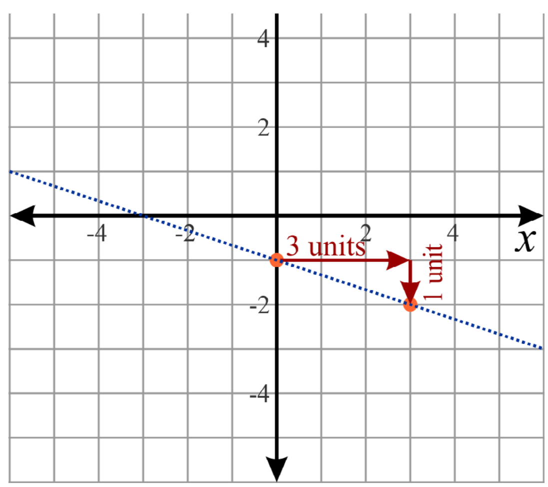
Example 1. Plot the line $y = -\frac{1}{3}x - 1$.

The y-intercept is -1, so we draw the point $(0, -1)$.

The slope is $-1/3$. Draw the horizontal run as 3 units, then turn, and draw the "rise" as 1 unit going <u>down</u> (since the slope is negative).

Draw a point there.

Now, simply use those two points to draw a line through them.



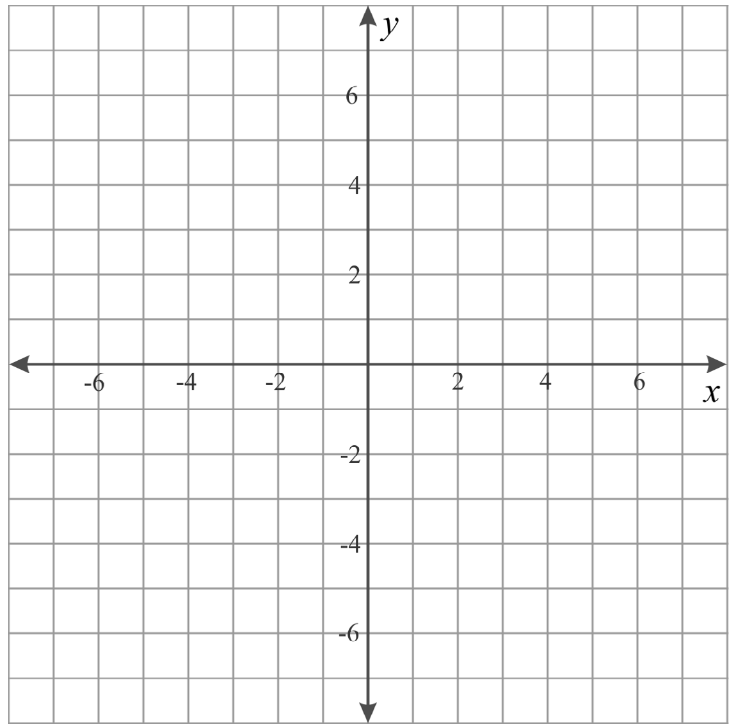
3. Graph the following lines.

a. $y = x + 4$

b. $y = -2x + 3$

c. $y = 3x - 1$

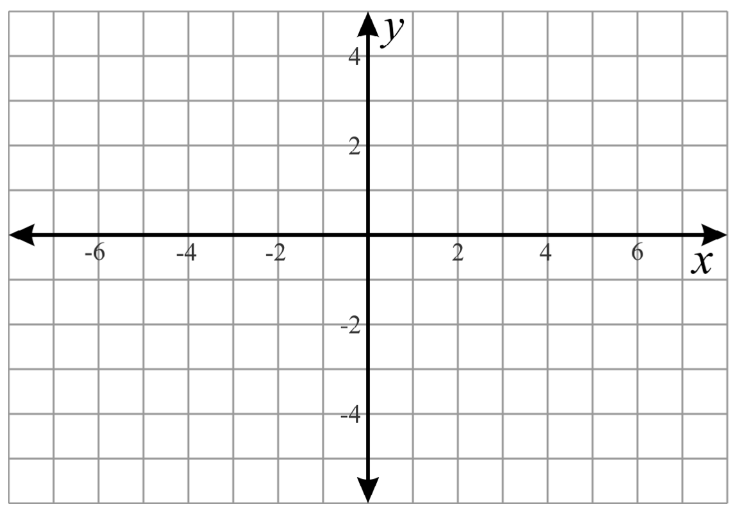
d. $y = -\frac{2}{3}x + 5$



4. **a.** Graph the two linear functions
$y = (2/3)x - 2$ and
$y = (2/3)x + 1$.

b. How do the *y*-values of these two linear functions differ?

For example, when $x = 58$, what is the difference between the *y*-values of these two functions?

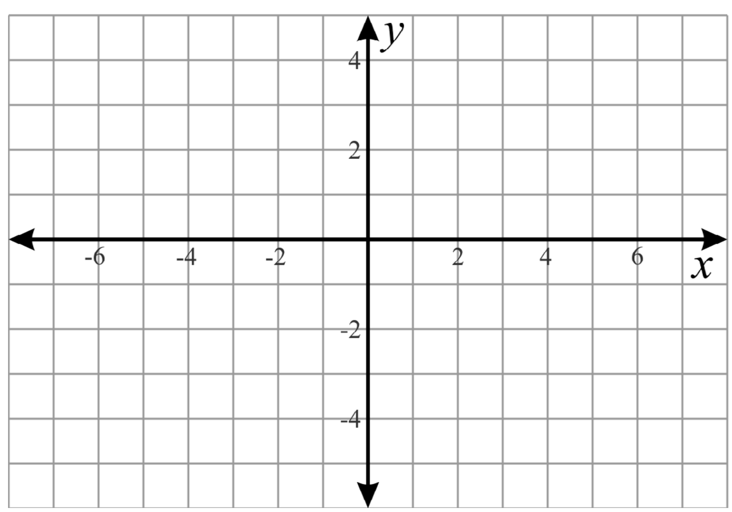


5. Graph the following lines.

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

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

c. $y = \frac{1}{3}x - 4$



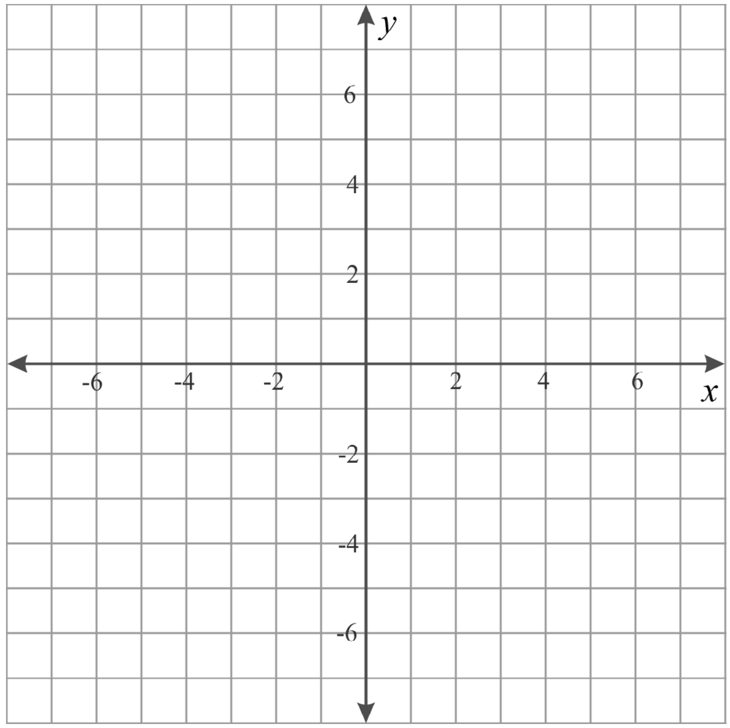
6. Graph the following lines.

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

b. $y = \frac{5}{4}x - 5$

c. a line with slope −1 and that goes through the point (−2, −4)

d. a line with slope 4/3 and that goes through the point (4, 6)



7. The tables of values give a list of points for four linear functions, or for four lines. Determine the equation of each, in slope-intercept form.

a.

x	0	10	20	30	40	50	60
y	16	12	8	4	0	−4	−8

b.

x	−15	−10	−5	0	5	10	20
y	−9	−5	−1	3	7	11	15

c.

x	−24	−20	−16	−12	−8	−4	0
y	−12	−11	−10	−9	−8	−7	−6

Puzzle Corner

a. Determine the value of a so that the line $y = ax + 3$ goes through the point (2, −2).

b. Determine the value of b so that the line $y = 2x + b$ goes through the point (−6, −3).