3-2: Linear Equations

A **linear equation** is an equation that models a linear function (a straight line).

Activity 1: With your partner, identify/illustrate the meaning of the words in the word-bank. You may use the graph provided to show their meaning.

"a" x-intercept: where the line crosses the x-axis. (y=0)

"b" y-intercept: where the line crosses the y-axis. (x=0)

solution(s): points on the line

"m" slope: $\frac{\text{rise}}{\text{run}}$

WORD-BANK

x-intercept,	solution(s)
y-intercept,	slope

Identify the following:

x-intercept: (2,0)

y-intercept: (0,-2) = (0,b)

FIVE solutions: (3,1)

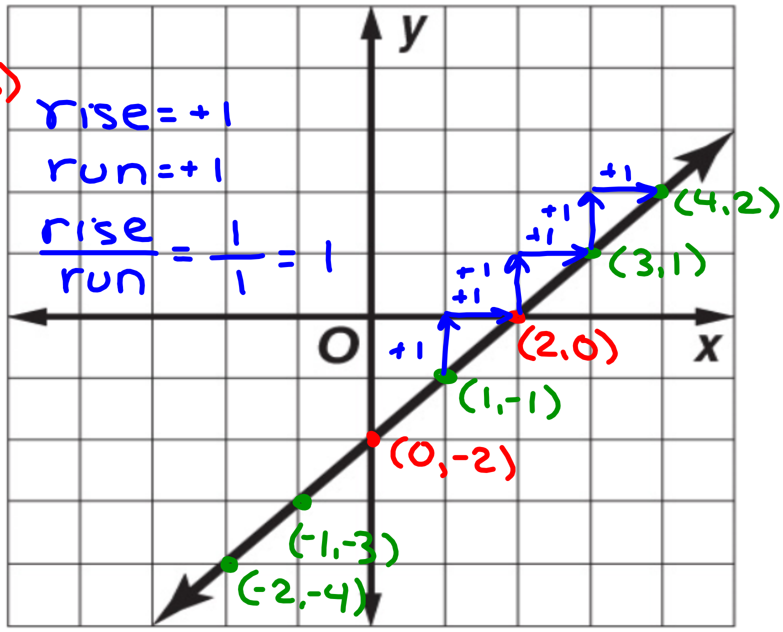
(4,2)

(-1,-3)

(1,-1)

(-2,-4)

the slope: 1 "m"



Write the equation of the line in the graph above in slope-intercept form $\boxed{(y = mx + b)}$.

$y = 1x - 2$ or $y = x - 2$

The "x" and "y" are retained in the formula.

We replace "m" with the value of the slope and "b" with the value of the y-intercept.

$y = mx + b \rightarrow$ slope-intercept form

Determine whether each equation is a linear equation (could the equation be written in the form of y = mx + b ?). Write *yes* or *no*.

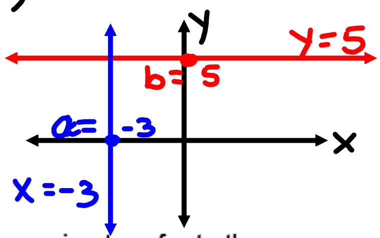
1. $6x + y = 10$
$-6x \quad -6x$
$y = -6x + 10$
yes

2. $y = 2 - 3x$
$y = -3x + 2$
yes

3. $y = 3x^2 + 1$
no → not linear
(x^2)

4. $y = 5$
$y = b$
horizontal

5. $x = -3$
$x = a$
vertical



In grade 8 you referred to straight lines as linear equations. We are now going to refer to them as linear functions and begin using function notation.

Equation → **Function Notation** linear function

y = 3x – 8 f(x) = 3x – 8

$y = mx + b$
linear equation

As you can see, we changed "y" to" f(x)", it is read as "f of x".

g(x) = g of x
h(x) = h of x

Also the x variable is called the domain and the the f(x) is called the range.

Example 1: f(x) and y mean the same thing.

$\boxed{\text{For } f(x) = -4x + 7, \text{ find } f(2)}$ → means y = –4x + 7, plug in 2 for x and calculate the y value.

PEMDAS.

f(2) = –4(2) + 7
-8 + 7
f(2) = –1

In other words, when x = 2, y = -1.

For f(x) = 2x – 3, find f(-1) + f(2) → means find f(-1), then find (f(2), then add together

= [2(-1) – 3] + [2(2) – 3]
-2 - 3 4 - 3
= [-5] + [1]
-5 + 1
= -4

3-2 Functions

Find Function Values Equations that are functions can be written in a form called **function notation**. For example, $y = 2x - 1$ can be written as $f(x) = 2x - 1$. In the function, x represents the elements of the domain, and $f(x)$ represents the elements of the range. Suppose you want to find the value in the range that corresponds to the element 2 in the domain. This is written $f(2)$ and is read "f of 2." The value of $f(2)$ is found by substituting 2 for x in the equation.

Example: If $f(x) = 3x - 4$, find each value.

a. $f(3)$

$f(3) = 3(3) - 4$	Replace x with 3.
$= 9 - 4$	Multiply.
$f(3) = 5$	Simplify.

b. $f(-2)$

$f(-2) = 3(-2) - 4$	Replace x with -2.
$= -6 - 4$	Multiply.
$f(-2) = -10$	Simplify.

Table:

x	$y \to f(x)$
3	5
-2	-10

Exercises

If $f(x) = 2x - 4$ and $g(x) = x^2 - 4x$, find each value.

PEMDAS

1. $f(4) = 2x - 4$
$= 2(4) - 4$
$= 8 - 4$
$f(4) = 4$

2. $g(2)$

3. $f(-5)$

4. $g(-3) = x^2 - 4x$
$= (-3)^2 - 4(-3)$
$= 9 + 12$
$g(-3) = 21$

5. $f(0)$

6. $g(0)$

7. $f(3) - 1$

8. $f(k + 1) = 2x - 4$
$f(k+1) = 2(k+1) - 4$
$= 2k + 2 - 4$
$f(k+1) = 2k - 2$

9. $g(2n) = x^2 - 4x$
$g(2n) = (2n)^2 - 4(2n)$
$g(2n) = 4n^2 - 8n$

10. $f(3x)$

11. $f(2) + 3$
$f(2) = 2x - 4$
$= 2(2) - 4$
$= 4 - 4$
$f(2) = 0$
$f(2) + 3 = 0 + 3 = 3$

12. $g(-4)$