

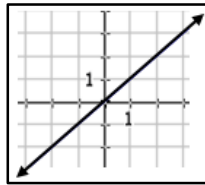
# Unit 3 - Linear Functions - Study Guide



## Translating the Parent Function

Parent function:  $y = x$

- the number after the x (the y-intercept) moves the function **UP** or **DOWN**
- the number before the x (the slope) makes the line **STEEPER** (bigger than 1) or **LESS STEEP** (less than 1)
- If the number before the x is **NEGATIVE**, the line will **DECREASE**



EX:  $y = -2x + 1$  will move the parent function 1 unit up, make it steeper, and will be decreasing

## Different Forms of a Line

Slope-Intercept:  $y = mx + b$

$m$  = slope and  $b$  = y-intercept

Standard:  $ax + by = c$

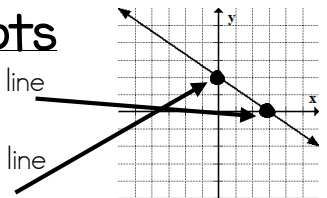
$a$ ,  $b$  and  $c$  are constants

Point-Slope:  $y - y_1 = m(x - x_1)$

$(x_1, y_1)$  is a point and  $m$  = slope

## Intercepts

- x-intercept**: the point where the line crosses the x-axis (when  $y = 0$ )
- y-intercept**: the point where the line crosses the y-axis (when  $x = 0$ )



EX:  $2x + 3y = 6$

## Steps to Graphing Lines

- Write in slope-intercept form
- identify the slope and y-intercept
- plot the y-intercept on the y-axis
- use the formula slope =  $\frac{\text{rise}}{\text{run}}$  to generate more points (+ up or right, - down or left)

When graphing, make sure:

- To plot **at least** 3 points
- To connect your line with a **straightedge**
- To draw **arrows** on both ends of your line
- That your line **covers the entire graph**
- To **label**

The x-intercept is:

$$2x + 3(0) = 6$$

$$2x = 6$$

$$x = 3$$

The y-intercept is:

$$2(0) + 3y = 6$$

$$3y = 6$$

$$y = 2$$

## Slope/Average Rate of Change

To find the average rate of change you need **TWO POINTS**

The steepness of a line

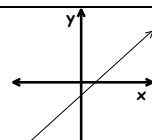
$$m = \frac{\text{y change}}{\text{x change}}$$

OR

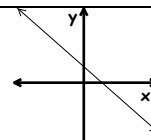
$$m = \frac{\text{rise}}{\text{run}}$$

$$\text{OR } m = \frac{\Delta y}{\Delta x}$$

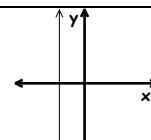
$$\text{OR } m = \frac{y_2 - y_1}{x_2 - x_1}$$



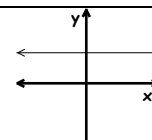
Positive



Negative



Undefined



Zero

EX: Find the slope of the line  $f(x) = \frac{1}{2}x - 7$ .  $m = \frac{1}{2}$

When in doubt, make a TABLE

EX: Find the slope of a line that passes through the points  $f(-2) = 5$  and  $f(4) = -1$ .

$$\begin{array}{l|l} x & -2 & 4 \\ \hline y & 5 & -1 \end{array} \quad \frac{\text{y change}}{\text{x change}} = \frac{-6}{6} = -1$$

## Finding the Equation of a Line

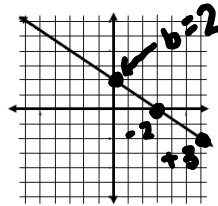
Find two points

Find their slope ( $m$ )

Find the y-intercept ( $b$ )

Write the equation in slope-intercept form

EXAMPLE ABOVE:  $y = -\frac{2}{3}x + 2$

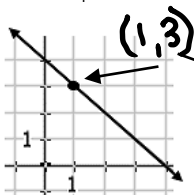


## Is it a solution?

A point is a solution to a linear function if:

- It lies on the graph
- When it is substituted into the equation, it makes a **TRUE** statement
- If it appears in the table of values

EX: The point (1, 3) is a solution to:



AND

x	y
-2	12
0	6
2	0
4	-6

AND

$y = -2x + 5$  ...because

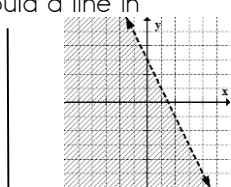
$$3 = -2(1) + 5$$

$$3 = -2 + 5$$

$$3 = 3 \text{ TRUE!!! } \odot$$

## Graphing Linear Inequalities

1. Graph points like you would a line in  $y = mx + b$  form
2. Determine if the line is **solid** ( $\geq$  or  $\leq$ ) or **dashed** ( $>$  or  $<$ )
3. Shade **above** the line  $>$  or  $\geq$
4. Shade **below** the line  $<$  or  $\leq$



EX:  $y < -2x + 3$   
< means dashed  
and shade below

## Interpreting Solutions to Inequalities

- a point **IS** a solution if: it is in the shaded area or if it is on a **SOLID** line
- a point **IS NOT** a solution if: it is **NOT** in the shaded area or if it is on a **DASHED** line

## Translating Words into Algebra

- four less than twice x is y  $\rightarrow y = 2x - 4$
- y is equivalent to the sum of half of x and three  $\rightarrow y = \frac{1}{2}x + 3$
- the difference of x and y is 7  $\rightarrow x - y = 7$
- y is triple the sum of x and 2  $\rightarrow y = 3(x + 2)$

## Arithmetic Sequences

$$a_n = a_1 + (n - 1)d$$

- d is the common **difference**
- $a_1$  is the **first term** in the sequence
- $a_n$  is the **n<sup>th</sup>** term in the sequence
- n is a positive integer

EXAMPLE: The third term in an arithmetic sequence is 7 and the sixth term is 19.  
What is an equation that can be used to find the n<sup>th</sup> term?

MAKE A TABLE!!!

Term	0	1	2	3	4	5	6
Value	-5	-1	3	7	11	15	19

- common difference/slope is 4
- first term is -1
- y-intercept is -5

Using the **formula** on the reference sheet:

$$a_n = a_1 + (n - 1)d$$

$$a_n = -1 + (n - 1)4$$

Using **slope-intercept form**:

$$y = mx + b$$

$$a_n = 4n - 5$$

## Writing a Line in Slope-Intercept Form

Is just like solving an equation only simpler

1. Distribute
2. Sort (move y terms to one side)
3. Make sure it is in  $y = mx + b$  form

EX:

$$4(x - 1) + 2y = 10 \quad \text{distribute}$$

$$4x - 4 + 2y = 10 \quad \text{sort}$$

$$2y = -4x + 4 + 10 \quad \text{combine like terms}$$

$$2y = -4x + 14 \quad \text{divide by 2 to get y alone}$$

$$y = -2x + 7$$

## Solving for "y"

EX: Write  $3x + 4y = 20$  in slope-intercept form.

$$3x + 4y = 20$$

sort

$$4y = -\frac{3x}{4} + \frac{20}{4}$$

divide all terms by 4

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