# **UNIT 2 – GRAPHING AND WRITING LINEAR EQUATIONS**

## Part A: Video Tutorial Section

Video 1 and 2:

<u>https://www.youtube.com/watch?v=bdgg88slT6c</u> (Graphing Slope of Parallel and Perpendicular Lines) <u>https://www.youtube.com/watch?v=K-Ir0VMIIhA</u> (More Examples of Graphing Slope of Parallel and Perpendicular Lines)

Video 3 and 4:

<u>https://www.youtube.com/watch?v=xyVJZKu7Euw</u> (Graphing Linear Equations in Slope Intercept Form) <u>https://www.youtube.com/watch?v=ruTcNEIXdzQ</u> (More Examples of Graphing Linear Equations in Slope Intercept Form)

Video 5 and 6:

<u>https://www.youtube.com/watch?v=eSx-Uzbjc68</u> (Writing Equations in Slope Intercept Form) <u>https://www.youtube.com/watch?v=L\_5tE1vUsyc</u> (More Examples of Writing Equations in Slope Intercept Form)

Video 7 and 8:

<u>https://www.youtube.com/results?search\_query=graphing+linear+equations+in+standard+form</u> (Graphing Linear Equations in Standard form)

<u>https://www.youtube.com/watch?v=Sge6dbJuej8</u> (More Examples of Graphing Linear Equations in Standard form)

Video 9 and 10:

https://www.youtube.com/watch?v=eSx-Uzbjc68 (Writing Equations in Point-Slope Form)

<u>https://www.youtube.com/watch?v=XG9m9HnixTg</u> (More Examples of Writing Equations in Point-Slope Form)

## Part B : Vocabulary, Hints and Explanations

This unit contains many basic concepts that will be required in order to build on additional concepts.

linear equation	•	an equation whose graph is a line		
	•	the points on the line are the solutions of the equation.		
<mark>slope</mark>	•	rate of change between any two points on a line.		
	•	it measures the <i>steepness</i> of a line.		
	•	it is the change in y (RISE), to the change in x (RUN) between any		
		<mark>two points on the line.</mark>		
<mark>parallel lines</mark>	•	two different line in the same plane that never intersect are		
		parallel lines		
<mark>perpendicular lines</mark>	•	two lines in the same plane that intersect to form right angles are		
		perpendicular lines		
<mark>x-intercept</mark>	•	the x coordinate of the point where the line crosses the x-axis. It		
		<mark>occurs when y = 0</mark>		
<mark>y-intercept</mark>	•	the y-coordinate of the point where the line crosses the y-axis. It		
		occurs when x= 0		
slope intercept form	•	a linear equation written in the form y = mx+b.		
	•	The slope of the line is <i>m</i> and the y-intercept of the line is b		
<mark>standard form</mark>	•	ax + by = c		
point-slope form	•	a linear equation written in the form $y - y_1 = m(x - x_1)$		

## **Important Vocabulary Students Need to Understand!**

## **Linear Equation**

1) Students often struggle to understand that linear equations have multiple solutions.

<u>Hint:</u> Remind the student that he solved "in/out" problems in earlier grades. His teacher may have used the equation box in which the numeral was input, solved, and an output was created.

Ex: If my equation was: \_\_\_\_\_ + 2

"input" 3, my "output" is 5

2) Students benefit from creating a table that allows the student to "see" the process

Ex.

X-value	Equation $y = -2x + 1$	Solution = Y-value	Ordered Pair
-1	y=-2(-1) + 1	3	(-1,3)
0	y= -2(0) + 1	1	(0,1)
2	y= -2(2) + 1	-3	(2,-3)

<u>Hint:</u> If a student struggles to recall which comes first (x or y), remind the student it's alphabetical order.

## **Graphing a Linear Equation:**

1) A student may struggle to plot lines on a graph. In earlier grades, they plotted only positive coordinates.

<u>Hint:</u> Begin with a number line that includes zero, positive and negative points to represent the X-axis. Students should be familiar with this number line. Encourage students to create the number line independently as much as possible.

Transfer that to the graph as the X-axis.

Use the mnemonic "Y to the sky" to help students understand where to plot the Y-axis. Instruct the student to think of a thermometer with positive and negative numbers running up and down.

Once a student has created his own graph, begin plotting points by reminding the student that the coordinates are in alphabetical order.... (X,Y). If y goes to the sky, the student must plot the X-coordinate first.

## Slope of a Line:

Slope is the rate of change between any two point on a line. It is a measure of steepness of the line. Slope may be positive or negative.

Change in Y

Slope= -----

Change in X

<u>Hint:</u> Again the mnemonic "Y to the sky" may help students remember to plot the change in Y over the change in X

Another sayings to use is "rise over run".

A student may struggle to use two points for a negative slope, because the slope does not "rise". a mnemonic to use is "negatives bring me down" to remind the student that the slope is "falling" not rising if it is a negative slope.

Another difficulty a student may have is keeping the ordered pairs in sequence. I have often had the student select a pair to use first and place the y-coordinate as the numerator and the x-coordinate as the denominator. Then make the subtraction sign and place the second pair of coordinates in the same manner.

A line that rises has a positive slope.

A line that falls has a negative slope.

A horizontal line has a slope of 0.

A vertical line has an undefined slope.

**<u>Hint:</u>** Tell students to think of riding a bike. It takes positive energy to ride uphill (a rise). It takes negative energy to ride down hill (fall). It takes a steady zero energy to coast along in a straight line. If you are riding vertical you are in trouble! You will become "undefined".

## Slope of parallel and perpendicular lines:

Parallel Lines: two different line in the same plane that never intersect are parallel lines.

Hint: the two letter Ls in the word parallel are parallel.

Parallel lines have the same slope.

To identify parallel lines, you find the slope of each line using two coordinate points and find the slope using the formula:

Change in Y Slope= -----Change in X

Encourage a student to use the formula and not guess by looking at lines that appear "pretty close"!

**Perpendicular Lines:** two lines in the same plane that intersect to form right angles are perpendicular lines.

Lines are perpendicular if the product (the result of multiplying) of the slopes = -1

This can also be referred to as the negative reciprocal.

Ex: a line with a slope of -2/3 is perpendicular to a line with a slope of 3/2

#### Intercepts: where a line meets an axis

X-intercept: is the x-coordinate of a point where the line crosses the x-axis. The y-coordinate will be zero

Ex: (2,0) (-8,0) (27,0)

Y-intercept: is the y-coordinate of a point where the line crosses the y-axis (students will NEED to understand this in order to solve the equation of a line!)

Ex: (0,2) (0,-8) (0,27)

**Equation of a line/ slope-intercept form:** the equation of a line is a representation of any two points (x, y) that will be represented on the line on a graph

A student MUST understand the equation of a line as:

## y = mx + b

In this equation the student must understand that m=the slope and b=the y intercept

If the student is creating a table, he should "plug in" a zero for the x-coordinate and will then find the y-intercept.

## **Graphing Linear Equations in Slope-Intercept Form**

To begin to understand graphing in slope-intercept form the student is given the equation of the line.

Ex: y = 2/3x + 4

The student identifies the y-intercept as 4 and plots the point (0,4) on the y-axis.

The student then identifies the slope as 2/3 or Up 2, Over 3 (rise over run)

The student may plot more points as needed based upon "up 2, over 3" and draw the line or may use the two points to draw the line on the graph.

Ex: y = -4/5x + 3

The student identifies the y-intercept as 3 and plots the point (0,3) on the y-axis.

The student identifies the slope as -4/5 (remember "negatives bring me down") or Down 4, Over 5

The student may plot more points with down 4, over 5 or may use two points to draw the line on the graph.

## Standard Form: (See video 4)

The standard form of a linear equation means that the equation is written in a manner that a student is "used to seeing" but with two variables ( x and y).

Standard form of a non-linear equation might be:

In linear form the equation is represented by two variables.

2x + 3y = 5

The student needs to write the standard form of the equation into the slope-intercept form in order to graph the equation. This means that the student needs to change the given equation into

## y = mx + b

**<u>Hint:</u>** In standard form, the student may benefit from circling the y and making a "railroad" problem in order to create an equation that solves for y.

Ex: 2x + 3y = 6 (circle the 3y)

3y = -2x + 6 (subtract 2x from each side of the equation)

3y = -2x + 6 (divide the equation by 3)

#### Writing the Equation for a Line in Slope-intercept Form:

#### y = mx + b

The student uses the graph to find the y-intercept (point where the line crosses the y-axis) and the slope. Recall:

Change in Y Slope= -----Change in X

OR slope = rise over run (see slope of a line subsection for details)

#### Writing the Equation for a Line in Point-Slope Form: (See video 5)

In point-slope form the student may use <u>one point and the slope</u> to complete the equation if given one point and the slope.

Y-  $y_1$  (from the given ordered pair) = m (the slope given) ( $x - x_1$  (from the given ordered pair) )

Ex: The student is given the ordered pair (1, 2) and the slope m = -4

Y - 2 = -4 (x - 1)

The student may then solve this for slope-intercept form by:

Y - 2 = -4 (x - 1) Y - 2 = -4x + 4 (distribute) Y = -4x + 2 (solve for y)

In point-slope form the student may use <u>two points</u> to complete the equation, if given two points.

The student will use the same formula:

Y-  $y_1$  (from the given ordered pair) = m (the slope given) (x – x <sub>1</sub>)(from the given ordered pair) )

But will need to recall how to find the slope using:

Change in Y Slope= -----Change in X

(see subsection on slope)