# MATH NEWS

Grade 8, Module 4, Topic C

LAFAYETTE PARISH SCHOOL SYSTEM

# 8th Grade Math

*Module 4: Linear Equations*

**Math Parent Letter**

This document is created to give parents and students a better understanding of the math concepts found in Eureka Math (© 2013 Common Core, Inc.) that is also posted as the Engage New York material which is taught in the classroom. Module 4 of Eureka Math (Engage New York) builds on ratios, rates, and unit rates to formally define proportional relationships and the constant of proportionality.

## Focus Area Topic C:

*Slope and Equations of Lines*

In Topic C, students first encounter slope by interpreting the unit rate of a graph. Students learn that slope can be determined using any two distinct points on a line. Students derive y = mx and y = mx + b for linear equations. Students generate graphs of linear equations in two variables by completing a table, then using information about slope and y-intercept. Students learn how to write equations of lines given slope and a point, and how to write an equation given two points. Students learn that multiple forms of an equation can define the same line.

**Words to Know:**

**Unit Rate -** the numeric value of a rate; a rate indicates how many units of one quantity there are for every 1 unit of the second quantity.

**Slope -** slope is a number that describes the “steepness” or “slant” of a line. It is the constant rate of change.

**Slope Formula -** $m = \frac{rise}{run}$ , $m = \frac{difference\ in\ y-values}{difference\ in\ x-values}$,

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

**Slope Intercept Form -** y = mx + b where m is slope and b is the y-intercept

**y-intercept -** the point where graph intersects y-axis, (0, b); the initial value of the relation.

**x-intercept -** the point where the graph intersects x-axis, (x, 0)

**The Slope of a Non-Vertical Line**

Students know slope is a number that describes the steepness or slant of a line. Please note, lines that are left-to-right inclining are said to have positive slope, and lines that are left-to-right declining are said to have negative slope. To determine which lines have the steeper slope, students compare absolute values of the slopes.

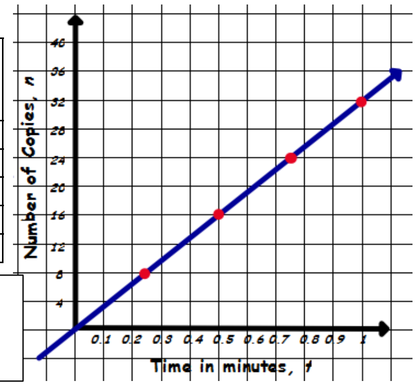
## Focus Area Topic C:

*Slope and Equations of Lines*

**Interpret the Unit Rate as the Slope of a Graph**
**Example:**

A copy machine makes copies at a constant rate. The machine can make 80 copies in $2\frac{1}{2}$ minutes. How many copies can the machine make each minute; that is, what is the unit rate of the copy machine?

| *t* time in minutes | Linear equation: n = 32t | *n* number of copies |
|---|---|---|
| 0 | n = 32(0) | 0 |
| 0.25 | n = 32(0.25) | 8 |
| 0.5 | n = 32(0.5) | 16 |
| 0.75 | n = 32(0.75) | 24 |
| 1 | n = 32(1) | 32 |




**Hint:** to explain the equation $\frac{80}{2\frac{1}{2}} = \frac{80}{\frac{5}{2}} = 80 \cdot \frac{2}{5} = 32$

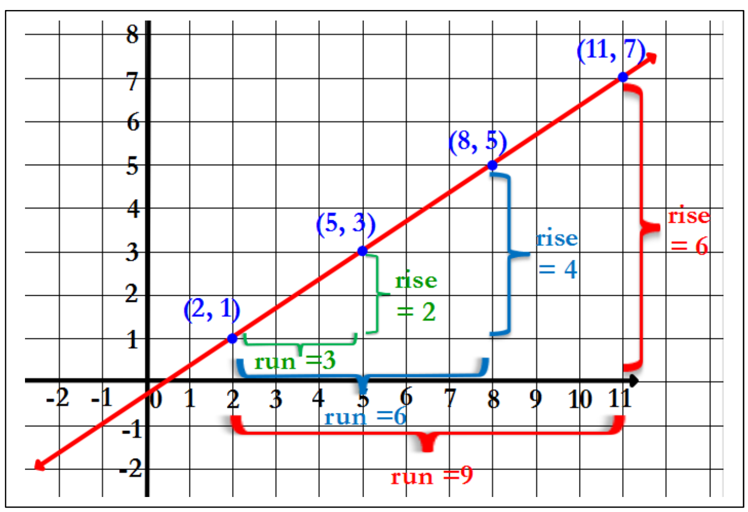
***Refer to table and/or graph and identify the output, n, when t = 1. The unit rate is 32 copies per 1 minute.***

**The Computation of the Slope of a Line**

Students use similar triangles to explain why the slope *m* is the same between any two distinct points on a non-vertical line in the coordinate plane. Students can also use the slope formula to compute the slope of a non-vertical line.

**Example:**

Calculate the slope of the line using different pairs of points.




$$slope = m = \frac{rise}{run} = \frac{2}{3} = \frac{4}{6} = \frac{6}{9}$$

These slope triangles are similar triangles, and the ratios are equivalent.

# Focus Area Topic C:

*Slope and Equations of Lines*

## Identifying Slope in Linear Equations

**Example:**

*You have* ***$20*** *in savings* at the bank. ***Each week, you add $2*** to your savings. Let y represent the total amount money you have saved at the end of x weeks. Write an equation to represent this situation and identify the slope of the equation. What does that number represent?

*slope/ rate of change* $y = 2x + 20$ *y-intercept/ initial value*

The slope is 2 and it represents how much money is saved each week

## There is Only One Line Passing Through a Given Point with a Given Slope

Students graph equations in the form of y = mx + b using information about slope and y-intercept. Students know that if they have two straight lines with the same slope and a common point that the lines are the same.

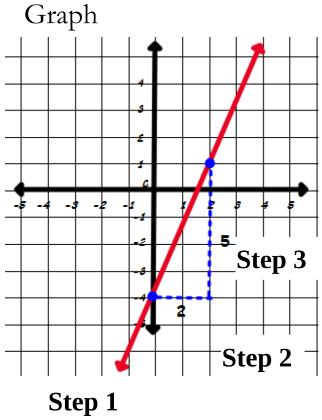
**Example:**

Graph the equation $y = \frac{5}{2}x - 4$.

a. Name the slope and the y-intercept.

$m = \frac{5}{2}$ y-intercept is (0, −4)

b. Graph




**Step 1:**
Plot y-intercept
**Step 2:**
Use slope
$\frac{rise}{run} = \frac{5}{2}$ to find another point
**Step 3:**
Plot 2nd point

## Graphing a Linear Equation Using x- and y-intercepts.

A linear equation can be graphed using two points: the x-intercept and the y-intercept. This strategy is typically used when the equation is not in slope-intercept form.

**Example:**
Graph the equation 2x + 3y = 9

**Step 1:** Replace x with zero and solve for y.

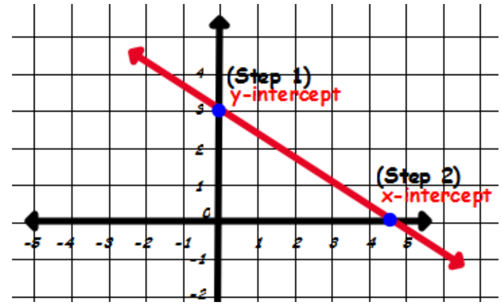
**Step 2:** Replace y with zero and solve for x.

**Step 1:**
2(**0**) + 3y = 9
3y = 9
y = 3
The y-intercept is at (0, 3)

**Step 2:**
2x + 3(**0**) = 9
2x = 9
$y = \frac{9}{2}$
The x-intercept is at (4.5, 0)

## Graphing a Linear Equation Using x- and y-intercepts.
(continued)

Step 3: Graph

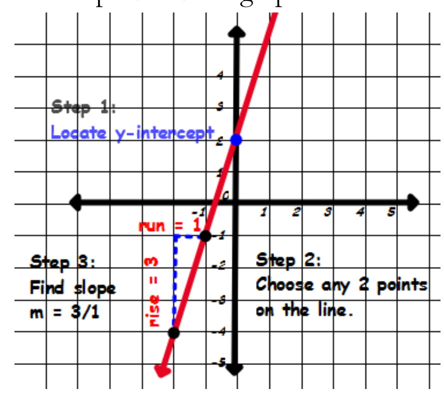



## Every Line is a Graph of a Linear Equation

Students know that any non-vertical line is the graph of a linear equation in the form of y = mx + b, where m is the slope/rate of change and b is a constant (y-intercept/initial value). Students write the equation that represents the graph of a line.

**Example:**
Write the equation that represents the line shown.

$\boldsymbol{y = mx + b}$
$\boldsymbol{y = 3x + 2}$




## Some Facts about Graphs of Linear Equations in Two Variables

Students write the equation of a line given two points or the slope and a point on the line. Students know the traditional forms of the slope formula and slope-intercept equation.

**Example**:
Write the equation for the line passing through (−1, −3) and (2, −2).

**Step 1: Find slope using slope formula.** $m = \frac{-3-(-2)}{-1-2}$

$= \frac{-1}{-3} = \frac{1}{3}$

**Step 2: Choose one of the points, let's say (2, −2). Substitute the coordinates into the slope intercept form equation.**

$$\boldsymbol{y = mx + b}$$
$$-2 = \frac{1}{3}(2) + b$$
$$-2 = \frac{2}{3} + b$$

**Step 3: Solve for b.**

$$-2 - \frac{2}{3} = \frac{2}{3} - \frac{2}{3} + b$$
$$-\frac{8}{3} = b$$

**Step 4: Use slope, m, and y-intercept, b, to write equation in slope intercept form.**

$$y = \frac{1}{3}x - \frac{8}{3}$$