Katie Kloboves – 8th Grade Pre-algebra

Introduction

Unit: Linear Equations and the Coordinate Plane

Description: Students will be taught the academic vocabulary that relates to the components of a linear equation and the process of graphing the equation on the coordinate plane. They will then be introduced to the method of solving these equations by combining like terms to isolate the variable and creating a visual representation of the equation on the coordinate grid. They will also be able to identify characteristics of the line, including if the slope is positive or negative. We will also discuss as a class, using the academic vocabulary, the application of similar triangles to the graph of a linear equation.

Importance: Students have previously learned how to simplify expressions and how to graph ordered pairs, so this topic unifies these concepts and creates a new mathematical environment in which problems can be solved. If students master solving and graphing linear equations, they can then move onto solving and graphing more than one equation, which is solving systems. Eventually, they can advance to graphing and interpreting functions which coincides with trigonometric ratios.

Grade Level: 8th grade

Course: Pre-algebra

Standards/Objectives: <u>Grade 8</u>
Grade 8 Common Core Mathematics Standards: Expressions and Equations

CCSS.Math.Content.8.EE.B.6
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; derive the equation y = mx for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b.

1. Students will be able to individually combine like terms to manipulate an equation into slope-intercept form by correctly solving 6/7 quiz exercises (Application level).

2. Students will be able to individually explain the relationship between similar triangles and why slope is constant by correctly earning 3/4 points on the extended response quiz item (Analysis level).

Grade 8 Common Core Mathematics Standards: Functions

CCSS.Math.Content.8.F.B.4
Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.

3. Students individually will be able to comprehend content vocabulary in an academic setting by correctly completing 14/16 quiz exercises. (Comprehension level).

4. Students will be able to individually describe their graphed linear equations (intercepts, positive/negative slope) with 80% accuracy on 5 quiz exercises and earning 8/10 points on the essay question. (Evaluation level).

Table of Specifications:

Content	**Application Objective 1**	**Analysis Objective 2**	**Comprehension Objective 3**	**Evaluation Objective 4**	**Total**
Linear Equations and the Coordinate Plane	7 items Item numbers: 7, 9, 14, 23-25, 29	1 item Item numbers: 28	16 items Item numbers: 1-6, 10, 11, 13, 15-17, 19-22	6 items Item numbers: 8, 12, 18, 26, 27, 30	30 items

Pre-assessment Plan:

Approach: At the start of the unit, I will give out a quiz that includes solving single and multivariable equations, graphing ordered pairs, and determining slope. There will also be a small vocabulary activity where the students will be asked to give their own definitions for the words listed and draw a corresponding image. These are the main topics that will be covered in the unit.

Explanation: This exercise allows me to determine the class's overall level of comprehension of the material. Since each student receives their own individual quiz, I can assess whether a student needs extra help, or if others already have a deep understanding of the material. Since the quiz not only asks students to use computation and problem-solving, but also define the vocabulary verbally and pictorially, this engages all types of learners. Even if a student cannot think of the definition of a word, they may be able to draw it.

Execution: After "grading" the quizzes, I can arrange the papers in order of scoring. Then, I can do a quick statistical analysis to see which major topics need the most attention. For example, if

I discover that 17/22 students gave an incorrect definition of intercept, I will know that most likely the material has never been covered and adjust my instruction to thoroughly cover that concept. Also, I can loosely arrange a seating chart from the scores so that students with different knowledge bases sit across from each other. This way they will be partners in the upcoming activities. As the class goes on, I can adjust the partners when necessary.

Formative Assessment Plan:

Approach: Following the section of solving equations, I will hand out an exit slip that requires the students to rate certain concepts on a scale of 1-5, where 5 is mastery and 1 is little to no understanding.

Explanation: The exit slip is a way to judge how well the material is being comprehended without taking up too much class time. Also, the students do not feel pressured to “nod and smile” during this exercise and can honestly rate themselves on how comfortable they feel with each concept.

Execution: After collecting the exit slips I will make a quick scatterplot to discern which concepts have been mastered by the majority of the students and those that need more review. If 60% of students marked a 4 or 5 for a concept, I will only give a brief overview in the next lecture. However, if for the concept of manipulating an equation the predominant rating is a 1 or 2, I will revisit that topic next lesson and give more examples. Depending on the feedback, I may revisit the topic using an alternate approach such as using a sequential format for solving.

Approach: After we have covered graphing linear equations, I will assign several homework problems, but allow class time to solve them. These problems will focus on manipulating equations into slope intercept form and graphing the equations. This assignment synthesizes all the concepts taught previously and also tests students’ acquisition of vocabulary and usage.

Explanation: Often when students go home to work on these problems, they get outside help where the student does not do the work, or they receive no help at all. This creates an inaccurate assessment when going over homework problems the next day and even collecting the papers for review. Having the students complete the problems in class gives them time to ask me questions directly, and gives a more accurate view of where the students stand. If I can figure out why they struggle (kinesthetic, interpersonal, etc) then I can modify my instruction.

Execution: I’ll have students get into groups of 2-3 students, and monitor the progress of each group. As they work, I will listen to the conversations and observe the facial expressions and body language of the students. This way I will get a feel for how well the students have mastered the material, and if there are any concepts I may need to reteach. For example, if several groups struggle with identifying the characteristics of a line on a graph they have drawn, I will plan a lesson the next day that highlights that material. However, instead of lecturing again, I will have students get into groups of 4 and give them an equation to graph and determine its characteristics. Each student will then present a characteristic to the class.

Summative Assessment Plan:

Component	Possible Points	Weight
Attendance	10 points	5%
Homework (effort based)	20 points	10%
Quiz (first 3 sections)	30 points	15%
Quiz (last 4 sections)	30 points	15%
Lab Activity (group work)	20 points	10%
Linear Equation Performance Presentation	30 points	15%
Unit Test	60 points	30%
Total	**200 points**	**100%**

Grading Scale:

80-100%	**A**
60-79%	**B**
40-59%	**C**
20-39%	**D**
0-19%	**F**

<u>Alternative Assessment Plan</u>

Alternate Form: A student has Down syndrome and works much slower than other students, even with comprehension of the material. I will give that student a slightly shortened version of the test that only eliminates problems associated with objectives that have already been tested. Thus, the student will be able to finish the majority of the test in the time allotted (with extra time) but will still be assessed on the same content as the rest of the class.

Alternate Administration: A student has ADHD and becomes distracted by noise and movement. I will have that student take the test in another room, supervised by an adult, so that the distractions will be limited and the student can focus on the assessment.

Alternate Modification: A student is on an IEP due to a minor cognitive disability, so that student will receive a test with the different forms of an equation written at the top. The different forms will not be labeled, so the student must be able to identify which equation corresponds with which form. The rest of the test will remain the same and thus test the same objectives, but the student will not be tested on remembering those forms.

Selected Response

Matching (1 point each; Objective 3)

Match each term with the correct statement. Not every answer will be used.

1) _C_Slope
2) _E_Rational
3) _B_Intercept
4) _F_ Like terms
5) _D_Slope intercept form
6) _A_Standard form

A) Ax + By + C = 0
B) $y - y_1 = m(x - x_1)$
C) gradient of a line
D) y = mx + b
E) can be written in the form $\frac{a}{b}$
F) terms that can be combined when simplifying or solving an equation
G) the point at which a line intersects an axis
H) the point at which two lines meet

Multiple Choice (2 points each; Objectives 1, 3, and 4)

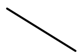
Choose the best answer for each of the following questions.

7) What is the first mathematical property you would use to simplify this equation: $2(3x + 4) - 2y = 7$
   a) Distributive property
   b) Commutative Property
   c) Associative Property
   d) Addition

8) Which line has a positive slope?

a) 

b)

c) 

d)

9) If you simplify $\frac{3}{2}(x + 2y) - 4x = 10$ into standard form, you get which of the following?

a) $-\frac{3}{2}x + 3y = -7$

b) $-\frac{5}{2}x + 3y = 10$

c) $-\frac{5}{2}x - 2 = 7y$

d) can’t be simplified

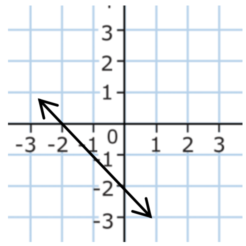
10) The problem $3(x + 2) = 3x + 6$ demonstrates which mathematical property?

a) Additive Inverse
b) Associative
c) Commutative
d) Distributive

11) In the equation for slope-intercept, $y = mx + b$, what aspect of the graph does m represent?

a) Constant
b) Slope
c) Variable
d) Y-Intercept

12) Given this graph, what could be a possible equation for the line shown?



a) $y = -x - 2$
b) $y = \frac{3}{5}x - 3$
c) $y = \frac{3}{5}x + 2$
d) $y = -x - 3$

13) If you plug in 0 for x in a linear equation in the form y = mx + b, what does b's value give?
a) Constant
b) Slope
c) Variable
d) Y-Intercept

14) Given $3y - \frac{3}{5}x - 3 = 5$, if you put this equation into slope-intercept form you get which of the following?
a) $y = -\frac{3}{5}x + \frac{8}{3}$
b) $y = \frac{1}{5}x + \frac{8}{3}$
c) $y = \frac{3}{5}x + \frac{2}{3}$
d) $y = -\frac{1}{5}x + \frac{2}{3}$

15) Why is the equation $4y = \frac{1}{5}x + \frac{8}{3}$ not in slope intercept form?
a) The equation is not set equal to y, but to 4y
b) The slope is in fraction form
c) The y-intercept is undefined
d) The equation is in slope-intercept form

16) The expression $4x + 2y$ cannot be simplified because
   a) The two terms have different constants
   b) The two terms have different variables
   c) They are not like terms
   d) Both b and c

True/False (1 point if true, 2 points for false: 1 point for putting false and 1 for the correct word; Objectives 3 and 4)

For each statement, decide whether it is true or false and write the full word TRUE or FALSE on the blank. If false, change the underlined portion to make it true, writing the correction on the blank following the statement.

17) _TRUE_A linear equation in standard form can be manipulated into slope-intercept form. ____________

18) _FALSE_The equation y + 2 = -4(-2x – 1) has a negative slope. __positive_

19) _FALSE_The y-intercept of a line is found by setting y equal to 0. _x-intercept_

Fill in the Blank (2 points each; Objective 3)

For the following statements, choose the correct word from the word bank to fill in the blank so that the statements are true. Some words may not be used.

Word Bank:

Constant	Distributive	Like terms	Slope	Standard Form

20) Since x and $\frac{3}{2}$x are __like terms__, they can be combined.

21) A linear equation can be found by using a point on the line and the line's _slope_.

22) In the equation 3x – 2y + 7 = 0, seven is called a __constant__.

Constructed Response

Short Answer (Objectives 1 and 4)

For the following questions, write your answer on the blank provided. (2 points each)

23) Given $2(y-1)-3\ (x-2)=13$, simplify the equation and manipulate it into slope intercept form.

$2y-3x+4=13 \rightarrow 2y=3x+9 \rightarrow y=\frac{3}{2}x+\frac{9}{2}$

24) Given $\frac{7}{12}(x-24)+y+11=13$, simplify the equation and manipulate it into slope intercept form.

$\frac{7}{12}x-14+y+11=13 \rightarrow \frac{7}{12}x-3+y=13 \rightarrow y=\frac{7}{12}x+16$

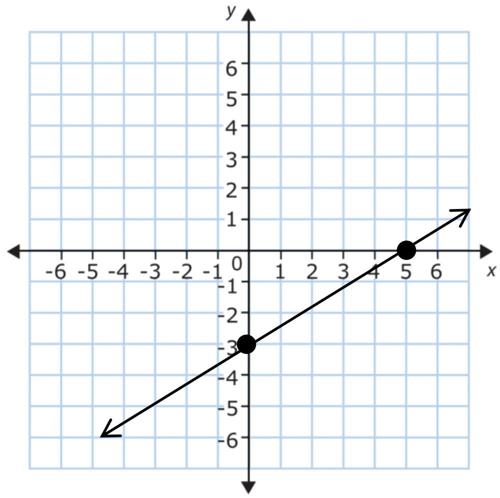
25) Put $3x+6y=6$ in slope-intercept form. Identify the slope and the y-intercept. Show your work.

$3x+6y=6 \rightarrow 6y=-3x+6 \rightarrow y=\frac{-3}{6}x+\frac{6}{6} \rightarrow y=\frac{-1}{2}x+1$

If $x=0,\ y=\frac{-1}{2}(0)+1 \rightarrow y=0+1=1$ so the y-intercept = (0, 1)

26) Graph the equation $y = \frac{3}{5}x - 3$ and identify whether the slope is positive or negative.

Slope: positive

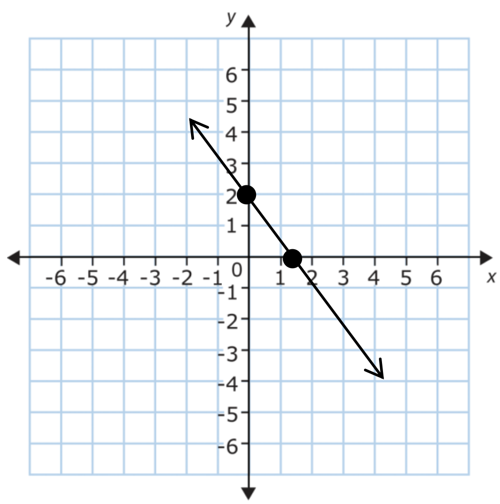


27) Graph the equation $y = \frac{-4}{3}x + 2$ and determine the x and y-intercepts. Is the slope positive or negative? Show your work.

If $x = 0,\ y = \frac{-4}{3}(0) + 2 => y = 0 + 2 = 2$ so the y-intercept = (0, 2)

If $y = 0,\ 0 = \frac{-4}{3}x + 2 => \frac{4}{3}x = 2 => x = \frac{3}{2}$ so the x-intercept = ($\frac{3}{2}$, 0)

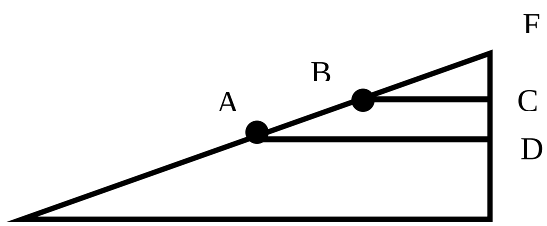
Slope: negative



<u>Extended Response</u> (Objectives 1 and 2)

The following questions require you to give a concise answer in complete sentences. Make sure to answer all parts of the question and to explain your response. (4 points each)

28) The slope of a line remains constant no matter which two points you pick to calculate it. This is based on similar triangles. Explain how this concept justifies this idea, using a visual (ie. graph, drawing) to support your explanation.
<u>When you pick any two points on a line, you can draw similar triangles intersecting those points so that the rise over the run, or slope, becomes a ratio. Since $\frac{FC}{BC} = \frac{FD}{AD}$ and so on, the rise over run ratio stays constant between any two points on the line.</u>



29) At 3:00 Polly is filling up her pool and, after 50 minutes, notices the water rises 4 inches after 25 minutes. She has 24 inches remaining to fill. She wants to catch a movie at 5:30. Will she be able to make the movie on time? Why or why not? Use a linear equation to solve.

$$y = \frac{25}{4}x + 50$$

<u>She won't be able to make the movie. When you plug in 24 for x you get 200 minutes which is 3 hours and 20 minutes. If she started at 3:00, she would finish filling the pool at 6:20 which is too late for the movie.</u>

<u>Essay</u> (Objective 4)
Respond to the following prompt in complete sentences. Your response should thoroughly answer all parts of the question. (10 points)

30) The Mathematics Standards require that students learn how to calculate slope and graph the equation of a line. Explain the importance of learning this concept and support your statement with three examples using vocabulary from the section. These examples should be detailed and contain descriptive characteristics of linear equations and their graphs.
This concept is important because we use this concept in many different fields outside of math. Being able to calculate the equation of a line allows you to predict a wide variety of outcomes. For example, you can figure out how often to mow your grass by calculating how fast the grass grows if you find your y-intercept, or the highest you will allow your grass to grow. You can also predict how large a cake you will bake when you double the ingredients because as input doubles so does the output. This creates a line with a positive slope because as your x-values increase, so do your y-values. You can also plan a gas budget using a linear equation if you know the price of gas and the gas mileage of your car.

Short Answer Rubric

0 points	**2 points**
No answer provided	Correct answer

Short Answer (Involving Calculation) Rubric

0 points	**1 point**	**2 points**
No answer provided	Correct answer, no work shown	Correct answer and work shown

Extended Response Rubric

0 points	1 point	2 points	3 points	4 points
No answer provided	Incorrect answer	Correct answer, no explanation	Correct answer, vague explanation	Correct answer, detailed and clear explanation

Essay Rubric

Category	**Below Average**	**Average**	**Proficient**	**Advanced**
Level of detail and completeness	-Importance and examples are not detailed and are incomplete	-Importance and examples are semi-complete, but with very little detail	-Importance and examples are complete with an adequate amount of detail	-Importance and examples are complete with a high level of detail and are specific to the content
Examples	-No examples given	-One example given	-Two examples given	-Three examples given