Lesson Title: Similar Triangles and Slope   Course: Common Core Mathematics 8

Date: _____   Teacher(s): _____   Start/end times: _____

Lesson Objective(s): *What mathematical skill(s) and understanding(s) will be developed? Which Mathematical Practices do you expect students to engage in during the lesson?*

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.

MP1: Make sense of problems and persevere in solving them.
MP4: Model with mathematics.
MP5: Use appropriate tools strategically.
MP6: Attend to precision.
MP7: Look for and make use of structure.
MP8: Look for and express regularity in repeated reasoning.

Lesson Launch Notes: *Exactly how will you use the first five minutes of the lesson?*

Display the picture of the man skiing down a mountain. Have students independently answer the following questions: **(Look for evidence of MP7.)**
    a. Describe the picture.
    b. How do you think the picture is related to slope?
    c. What would make it easier to determine the slope?

Lesson Closure Notes: *Exactly what summary activity, questions, and discussion will close the lesson and provide a foreshadowing of tomorrow? List the questions.*

1. What would be the equation to the line formed in the Creating your own Line and Triangles activity?
2. Describe the slope of similar triangles.
3. Below draw a line with a negative slope and label 5 points and draw one set of similar triangles.

Lesson Tasks, Problems, and Activities (attach resource sheets): *What specific activities, investigations, problems, questions, or tasks will students be working on during the lesson? Be sure to indicate strategic connections to appropriate mathematical practices.*

1. Discuss as a class the answers to the three warm-up questions. Students should recognize that slope is the steepness of a line that can be expressed as a number, but it is necessary to have a grid to give measurements so that we can come up with that number.
2. Discuss how students can see the coordinate plane as the grid mathematicians use to find slope.
3. Place the students in pairs and give them the line on a coordinate plane (included) and the Slope Activity questions (included). Have students work through the activity and then share as a class. **(MP5,MP7, MP8)**
    Discuss as a class the characteristics of congruent figures: congruent angles and sides with the same shape.
    Discuss as a class the many ways of thinking about slope beginning with referring back to the triangles.
    Consider having the students copy down the ratio explanation: Ratio:
    $$\frac{\text{vertical side length}}{\text{horizontal side length}} = \frac{\text{change in } y}{\text{change in } x} = \text{slope}$$
4. Distribute the resource sheet on comparing slide and slope steepness. Assign students to pairs. Partner A will examine the picture of the slide and partner B will examine the picture of the ski slope. Have pairs answer the questions, labeling the figures and answering the questions. **(MP1, MP6)**
5. As a class, discuss how the slopes are the same and the triangles that were created were similar because their slopes were the same.
6. In pairs, have students use their original coordinate plane to draw the next line using the criteria on the Creating your own Line and Triangles Activity resource sheet. As an extension consider having students create a line using the slope of their choice and show how the triangles are similar. **(MP4, MP7)**

7. As a class, have students share solutions.
8. Distribute the closure exit ticket, collect and grade.

Evidence of Success: *What exactly do I expect students to be able to do by the end of the lesson, and how will I measure student mastery? That is, deliberate consideration of what performances will convince you (and any outside observer) that your students have developed a deepened (and conceptual) understanding.*

Monitoring students as they are labeling the slide and ski slope and checking with students as they are finding and simplifying the slope and naming the shape formed. Checking the equations for the slide, slope and line. Closure Questions Exit Ticket will provide a means for the teacher to assess student understanding.

Notes and Nuances: *Vocabulary, connections, common mistakes, typical misconceptions, etc.*

Vocabulary: slope, change in *y*, change in *x*, rise, run, similar triangles, constant, coordinate plane

Common mistakes: In the warm-up, students may think because the man is skiing down that makes the slope of the line negative. In the Slide vs. Ski Slope Activity, students may need help labeling the 3000 feet on the ski slope and understanding that it is the change in elevation. There are a lot of numbers and students have to distinguish which ones to use and when.

Resources: *What materials or resources are essential for students to successfully complete the lesson tasks or activities?*	**Homework:** *Exactly what follow-up homework tasks, problems, and/or exercises will be assigned upon the completion of the lesson?*
Picture of person skiing, warm up resource sheet, transparency coordinate plane (not included) Ruler Line on coordinate plane and slope activity questions Slides vs. Ski Slopes pictures and resource sheet	1. If the slide was as tall as the mountain which do you think would have a higher difficulty rating? Justify your answer. 2. Give students 4 graphs with different lines and similar triangles already drawn on them and points labeled. Have students find the ratio of the vertical side length to the horizontal side length and then simplify. 3. Have students explain how the ratio relates to slope.

Lesson Reflections: *How do you know that you were effective? What questions, connected to the lesson standards/objectives and evidence of success, will you use to reflect on the effectiveness of this lesson?*

Are students able to find the slope of a line from multiple points?
Are students able to draw congruent and similar triangles to using the vertical length of the side vs. the horizontal length of the side? Are students able to identify that similar triangles have the same slope?
Are students able to derive the equation from a line through the origin and intercepting the vertical axis at *b*?

1) Describe the picture. _____

_____

_____

2) How do you think the picture is related to slope? _____

_____

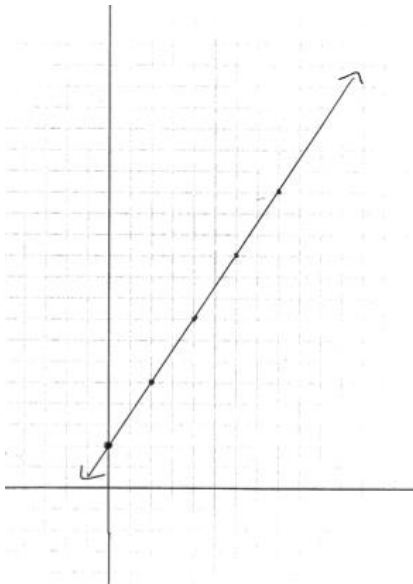_____

3) What would make it easier to determine the slope? _____

_____

_____

Slope Activity

1) Find the slope of the line. _____

2) Label the points.

3) Connect the vertices (0,2), (0,5), and (2,5).

4) Name the geometric figure formed by connecting the vertices. _____

5) Connect the vertices (4,8), (4,11), and (6,11).

6) Name the geometric figure formed by connecting the vertices. _____

7) How do the 2 figures formed compare to each other? _____
_____

8) Use the other given points to create 2 more identical figures.

HCPSS Secondary Mathematics Office (v2); adapted from: Leinwand, S. (2009). *Accessible mathematics*: *10 instructional shifts that raise student achievement*. Portsmouth, NH*:* Heinemann.

5

Lesson Title: Similar Triangles and Slope   Course: Common Core Mathematics 8

Date: _____   Teacher(s): _____   Start/end times: _____

<p style="text-align:center">Slides vs. Ski Slopes</p>

Types of ski slopes vary depending on the steepness, difficulty and specific location. The different types of slopes are green, blue, red and black, increasing with difficulty from green to black. As well, there are different difficulties of slides. Lets compare the steepness of the slide with the steepness of the mountain. The slide above is 10 feet from the base of the slide to the top and 15 feet from the base of the slide to the end. The skiers are let off their lift at an elevation of 12,300 feet and have skied to an elevation of 10,300 feet at the bottom of the picture and are 3,000 feet away from an imaginary line that extends from the top of the mountain to its base. The lift starts at an elevation of 4,000 feet to go up the mountain, which is where the ski slope ends.

For each of the figures above, find the steepness (slope). Make sure to simplify your slope (if possible).

_____

Follow-Up Questions:

1) What shape was formed when you labeled the slide? _____

2) What shape was formed when you labeled the ski slope? _____

3) The slope of the slide is _____ and the ski slope is _____.

4) The simplified slope of the slide is _____ and the ski slope is _____.

5) If the slope were classified as a red slope based on its steepness, how would you classify the slide given the four different types of classifications given above? _____

6) How do the shapes compare from questions one and two? _____
_____

Creating your own Line and Triangles Activity

Directions:

1) Draw a line that starts at the point (0, -10), goes through the *x*-axis and has a slope of $\frac{2}{3}$.

2) Label 6 points.

3) Connect the vertices (0, -10), (0, -6), and (6, -6).

4) Name the geometric figure formed by connecting the vertices. _____

5) Connect the vertices (3, -8), (3, -2), and (12, -2).

6) Name the geometric figure formed by connecting the vertices. _____

7) How do the 2 figures formed compare to each other? _____

_____

If we use the Slope Intercept formula $y = mx + b$ where *m* is our slope and *b* is our y intercept (starting point) come up with an equation for the slide and ski slope. Refer to the information below both pictures if you need help.

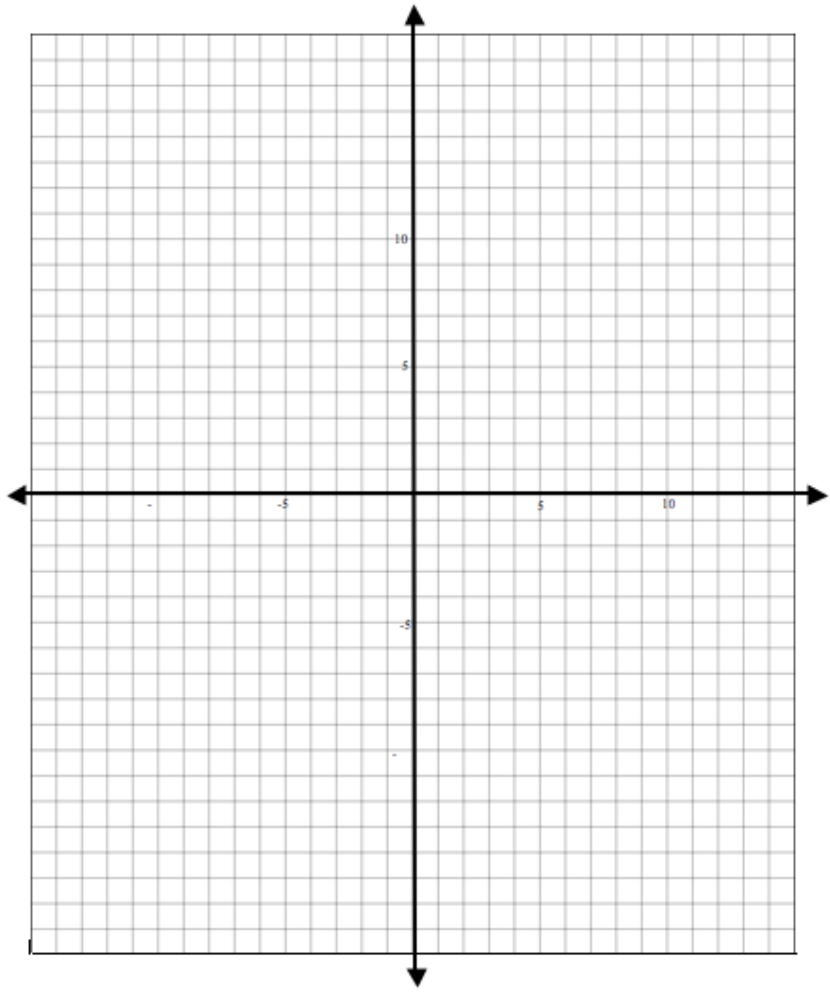8) Equation for slide: _____   9) Equation for ski slope: _____

Closure

1) What would be the equation to the line formed in the Creating your own Line and Triangles activity?

_____

2) Describe the slope of similar triangles. _____

3) Below draw a line with a negative slope and label 5 points and draw one set of similar triangles.

Answer Key
Skiing Warm Up

1) Describe the picture. *A man skiing down a slope at a high speed because the snow coming up from the back of his skies, clouds in the back ground, he is wearing a blue jacket, he has a backpack, there are other mountains in the background, he looks like he is at a high elevation.*

2) How do you think the picture is related to slope? *Angle he is skiing down, the direction he is going in, his body angle and position, the steepness of the slope*

3) What would make it easier to determine the slope? *A grid/ coordinate plane, measurements*

Slope Activity

1) Find the slope of the line. $\dfrac{3}{2}$

2) Label the points.
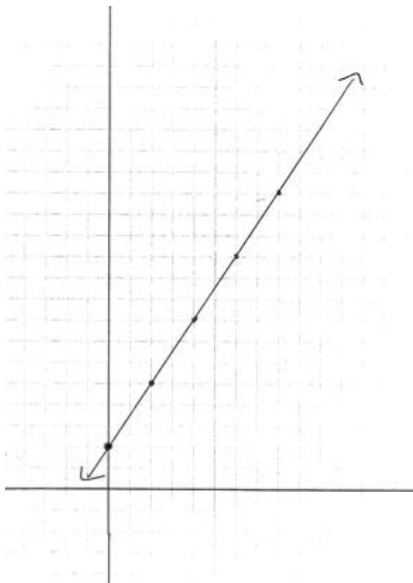
3) Connect the vertices (0,2), (0,5), and (2,5).

4) Name the geometric figure formed by connecting the vertices. ***Right Triangle***

5) Connect the vertices (4,8), (4,11), and (6,11).

6) Name the geometric figure formed by connecting the vertices. ***Right Triangle***

7) How do the 2 figures formed compare to each other? ***Congruent triangles***

8) Use the other given points to create 2 more identical figures.

Slide vs. Ski Slope Activity

1) What shape was formed when you labeled the slide? ***Right Triangle***

2) What shape was formed when you labeled the ski slope? ***Right Triangle***

3) The slope of the slide is $\dfrac{10}{15}$ and the ski slope is $\dfrac{2000}{3000}$.

4) The simplified slope of the slide is $\dfrac{2}{3}$ and the ski slope is $\dfrac{2}{3}$.

5) If the slope were classified as a red slope based on its steepness, how would you classify the slide given the four different types of classifications given above? ***red***

6) How do the shapes compare from questions one and two? ***Similar triangles***

Creating your own Line and Triangles Activity

Directions:

1) Draw a line that starts at the point (0, -10), goes through the *x*-axis and has a slope of $\dfrac{2}{3}$.

2) Label 6 points.
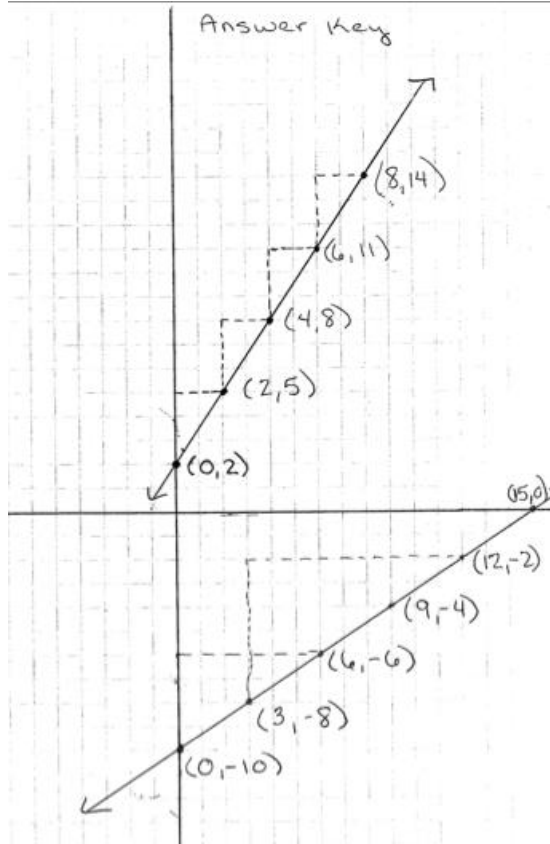
3) Connect the vertices (0, -10), (0, -6), and (6, -6).

4) Name the geometric figure formed by connecting the vertices. ***Right Triangle***

5) Connect the vertices (3, -8), (3, -2), and (12, -2).

6) Name the geometric figure formed by connecting the vertices. ***Right Triangle***

7) How do the 2 figures formed compare to each other? ***Similar Figures***

If we use the Slope Intercept formula $y = mx + b$ where *m* is our slope and *b* is our y intercept (starting point) come up with an equation for the slide and ski slope. Refer to the information below both pictures if you need help.

8) Equation for slide: $y = \dfrac{2}{3}x$　　　　9) Equation for ski slope: $y = \dfrac{2}{3}x + 4{,}000$

Closure

1) What would be the equation to the line formed in the Creating your own Line and Triangles activity?

$y = \dfrac{2}{3}x - 10$

2) Describe the slope of similar triangles. ***It is the same.***