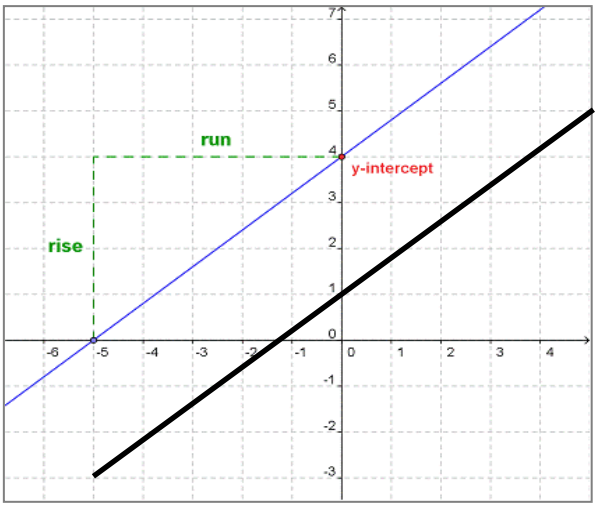
Mind Stretch

Slippery Slope

1. What is the slope of this line?



$$\frac{\text{rise}}{\text{run}} = \frac{4-0}{0--5} = \frac{0-4}{-5-0} = \frac{4}{5}$$

Slope can also be expressed as:

$$\frac{\text{Change in y}}{\text{Change in x}} \text{ or } \frac{y_2 - y_1}{x_2 - x_1}$$

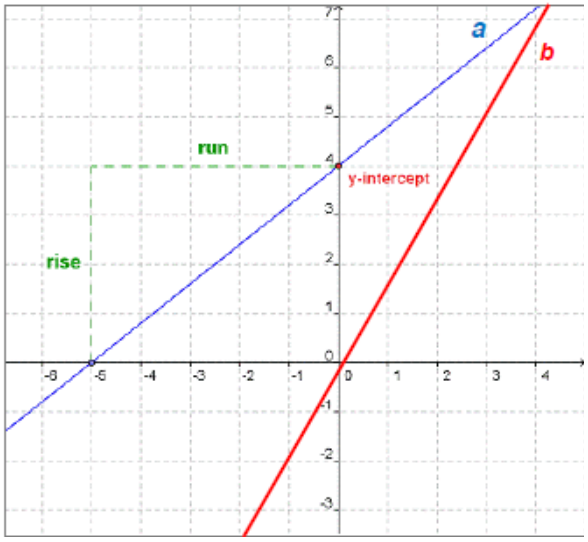
2. Draw a different line with the same slope.

The black line is one example. Any line that is parallel to the blue line (i.e., has a slope of $\frac{4}{5}$) is correct.

3. Look at **line b**. The slope of **line b** is:

a) steeper than the slope of **line a**
b) equal to the slope of **line a**
c) less steep than the slope of **line a**

I know this because….



The slope of line b ($\frac{5}{3}$) is greater than the slope of line a ($\frac{4}{5}$). Students may also say the line b is rising faster than line a.

[1] **Inspiration for Task**: The *Slippery Slope* Workout and Final Stretch have been adapted from Illustrative Mathematics materials, particularly the Slopes Between Points on a Line task, accessed on 5/1/2014, and is licensed by Illustrative Mathematics under CC BY-NC-SA 4.0. The *Slippery Slope* challenge question has been adapted from Georgia Department of Education's Common Core Georgia Performance Standards Framework, Unit 5 What's My Line task accessed on January 23, 2014. According to the Bureau of Labor Statistics, the average wage for a fast food worker in 2012 was $8.84 per hour. We have revised this average slightly to make numbers more approachable for students.

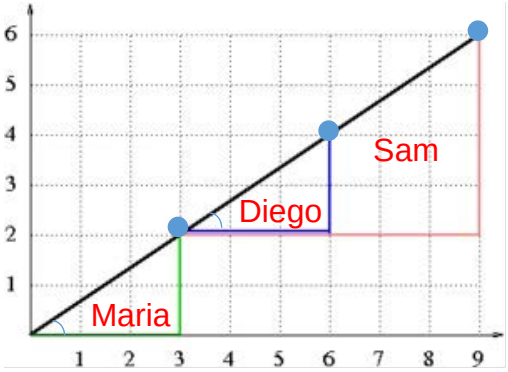
This work was supported by grant number #DRL-1020393 from the National Science Foundation and grant number 2012-8075 from the William and Flora Hewlett Foundation.

Workout

Slippery Slope

Maria, Sam, and Diego are computing the slope between pairs of points on the line in this drawing.

- Maria finds the slope between the points (0, 0) and (3, 2).
- Sam finds the slope between the points (3, 2) and (9, 6).
- Diego finds the slope between the points (3, 2) and (6, 4).



They have each drawn a triangle to help with their calculations.

1. Which student has drawn which triangle? Write the student's name inside their triangle. (See graph above)

2. Finish the slope calculation for **each** student. Please show your work.

Maria: $\frac{2-0}{3-0}=\frac{2}{3}$ Sam: $\frac{6-2}{9-3}=\frac{4}{6}=\frac{2}{3}$ Diego: $\frac{4-2}{6-3}=\frac{2}{3}$

3. Are the slope triangles that each student drew similar to each other? How do you know?

All 3 slope triangles are similar. Diego and Maria's triangles are identical (congruent), and Sam's triangle is scaled up by a factor of 2 – **both** the base and the height are twice that of Diego's triangle. Therefore the ratio of the height to the base is equal for all three triangles (i.e., the ratios are proportional) which means the triangles are similar.

[1] **Inspiration for Task**: The *Slippery Slope* Workout and Final Stretch have been adapted from Illustrative Mathematics materials, particularly the Slopes Between Points on a Line task, accessed on 5/1/2014, and is licensed by Illustrative Mathematics under CC BY-NC-SA 4.0. The *Slippery Slope* challenge question has been adapted from Georgia Department of Education's Common Core Georgia Performance Standards Framework, Unit 5 What's My Line task accessed on January 23, 2014. According to the Bureau of Labor Statistics, the average wage for a fast food worker in 2012 was $8.84 per hour. We have revised this average slightly to make numbers more approachable for students.

This work was supported by grant number #DRL-1020393 from the National Science Foundation and grant number 2012-8075 from the William and Flora Hewlett Foundation.

4. If all three triangles are similar to each other, what must be true about the angles on the left side of each triangle (i.e., the angles marked with a "◝ "? Why?

Since the triangles are similar, corresponding angles must be identical (congruent) meaning the angles have the same (equal) measures.

5. The slope triangle that includes the points (3,2) and (9,6) is much larger than the other two triangles. Explain why the slope, calculated using this triangle, must be the same as the slope calculated using the other two triangles?

Since the triangles are similar, the ratio of the altitude (height) : base (length) of the two triangles are equal (i.e., the sides are proportional). This can also be shown mathematically as: $\frac{2}{3}\cdot\frac{2}{2}=\frac{4}{6}$. Multiplying by $\frac{2}{2}$ is the same as multiplying by 1 so the two ratios are equal. [**Note:** Beware of students saying the **ratio** of the sides of the larger triangle is two times the smaller or that we multiplied the smaller ratio by 2. This is incorrect because we multiplied by $\frac{2}{2}$ or 1. Therefore the ratios are equivalent and, the ratios are proportional!]

6. If you drew a slope triangle between *any* two points on the line and used that slope triangle to calculate the slope, how would that slope compare to the slopes you calculated above? Why?

The slope should always be the same along the same line since any slope triangle along that line will be similar to the slope triangles that are shown. You know this because the angles of all the slope triangles will have equal measures.

Check Your Pulse

Compare your answers with a partner. Discuss where you agree or disagree.

1. In a few words, explain what part(s) were difficult for you?

Circle the thumb that best describes how you are feeling:

?	I have lots of questions, I need help.	Almost got it, but need practice.	Got it. I can explain this to a classmate.

[1] **Inspiration for Task**: The *Slippery Slope* Workout and Final Stretch have been adapted from Illustrative Mathematics materials, particularly the Slopes Between Points on a Line task, accessed on 5/1/2014, and is licensed by Illustrative Mathematics under CC BY-NC-SA 4.0. The *Slippery Slope* challenge question has been adapted from Georgia Department of Education's Common Core Georgia Performance Standards Framework, Unit 5 What's My Line task accessed on January 23, 2014. According to the Bureau of Labor Statistics, the average wage for a fast food worker in 2012 was $8.84 per hour. We have revised this average slightly to make numbers more approachable for students.

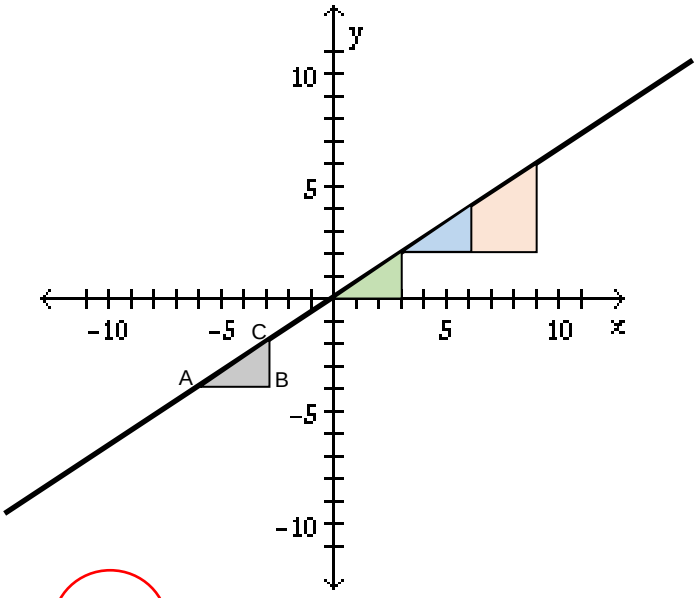
This work was supported by grant number #DRL-1020393 from the National Science Foundation and grant number 2012-8075 from the William and Flora Hewlett Foundation.

Final Lift

Slippery Slope

Abby draws a triangle (*Triangle ABC*) like the triangles drawn by Maria, Diego and Sam. She ends up with a different slope.

point a (-6,-4)
point b (-3,-2)
change in x = -6 – 3 = -9
change in y = -4 – -2 = -6
slope = -9 ÷ -6 = -1.5



1. Is Abby's work correct? YES NO

2. Explain why you think she is correct or incorrect. Provide as much evidence as possible to support your answer.

Abby did several things wrong: First, she subtracted -6 – 3 rather than -6 – -3. -6 – -3 is -3 (not -9). Second -4 – -2 is -2 rather than -6. Abby also divided the change in x by the change in y. Slope is defined as the change in y divided by the change in x. In this case the slope is $\frac{2}{3}$. Finally, Abby concluded the slope was negative, but the slope clearly rises from left to right and it so must be a positive number.

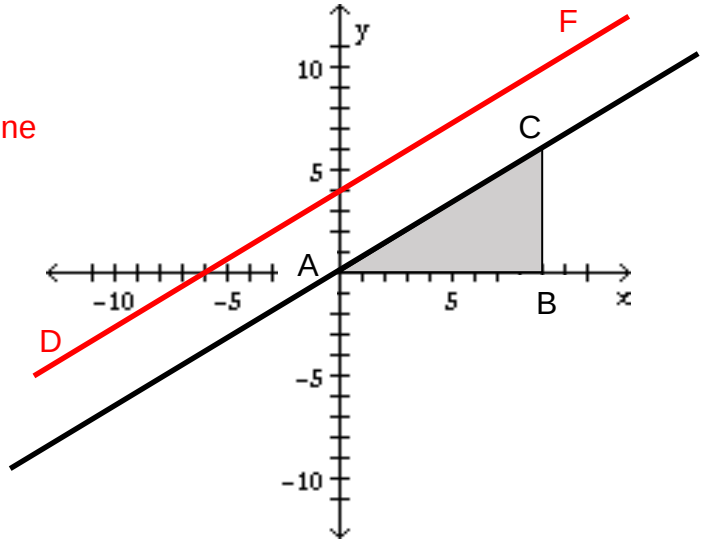
[1] **Inspiration for Task**: The *Slippery Slope* Workout and Final Stretch have been adapted from Illustrative Mathematics materials, particularly the Slopes Between Points on a Line task, accessed on 5/1/2014, and is licensed by Illustrative Mathematics under CC BY-NC-SA 4.0. The *Slippery Slope* challenge question has been adapted from Georgia Department of Education's Common Core Georgia Performance Standards Framework, Unit 5 What's My Line task accessed on January 23, 2014. According to the Bureau of Labor Statistics, the average wage for a fast food worker in 2012 was $8.84 per hour. We have revised this average slightly to make numbers more approachable for students.

This work was supported by grant number #DRL-1020393 from the National Science Foundation and grant number 2012-8075 from the William and Flora Hewlett Foundation.

Challenge

3. **Using a ruler**, draw a line **parallel** to Line AC. Label this new line **Line DF**. Draw a new slope triangle so that the hypotenuse of the new slope triangle is on **Line DF**. Label this new ***Triangle DEF***.

One possible line is shown here. Any line With a slope of $\frac{2}{3}$ is correct.



4. Use ***Triangle DEF*** to calculate the slope of **Line DF**. Please show your work.

Slope of **Line DF =** $\frac{2}{3}$

5. Are the triangles ABC and DEF similar to each other? How do you know?

The ratio of the sides of triangle ABC is equal to the ratio of corresponding sides of triangle DEF, therefore the two triangles are similar.

[1] **Inspiration for Task**: The *Slippery Slope* Workout and Final Stretch have been adapted from Illustrative Mathematics materials, particularly the Slopes Between Points on a Line task, accessed on 5/1/2014, and is licensed by Illustrative Mathematics under CC BY-NC-SA 4.0. The *Slippery Slope* challenge question has been adapted from Georgia Department of Education's Common Core Georgia Performance Standards Framework, Unit 5 What's My Line task accessed on January 23, 2014. According to the Bureau of Labor Statistics, the average wage for a fast food worker in 2012 was $8.84 per hour. We have revised this average slightly to make numbers more approachable for students.

This work was supported by grant number #DRL-1020393 from the National Science Foundation and grant number 2012-8075 from the William and Flora Hewlett Foundation.

6. If triangle ABC is similar to triangle DEF, what must be true about angle A and angle D? Why?

If the two triangles are similar, corresponding angles are equal. Therefore the measure of angle A must equal the measure of angle D.

7. The slope of Line AC is (Circle one of the choices below):

less than the slope of Line DF

the same as the slope of Line DF

greater than the slope of Line DF?

Explain why you circled the answer above

The corresponding sides of similar triangles are proportional so the change in y divided by the change in x must be the same in both triangles. Also, if the slope triangle DEF is placed so that angle D is on the y axis, this angle will have the same measure as angle A (corresponding angles of similar triangles have the same measure) so the slope of both lines must be the same.

Students may also realize that corresponding angles of parallel lines cut by a transversal are equal (8.G.5) so the slope of both lines must be the same

[1] **Inspiration for Task**: The *Slippery Slope* Workout and Final Stretch have been adapted from Illustrative Mathematics materials, particularly the Slopes Between Points on a Line task, accessed on 5/1/2014, and is licensed by Illustrative Mathematics under CC BY-NC-SA 4.0. The *Slippery Slope* challenge question has been adapted from Georgia Department of Education's Common Core Georgia Performance Standards Framework, Unit 5 What's My Line task accessed on January 23, 2014. According to the Bureau of Labor Statistics, the average wage for a fast food worker in 2012 was $8.84 per hour. We have revised this average slightly to make numbers more approachable for students.

This work was supported by grant number #DRL-1020393 from the National Science Foundation and grant number 2012-8075 from the William and Flora Hewlett Foundation.