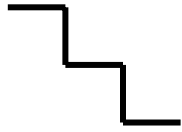


<b>LessonTitle: Slopes of Stairs</b>		<b>Pre 6.7</b>
<b>Utah State Core Standard and Indicators</b> Algebra Content Standard 2 Process Standards 1-5		
<b>Summary</b>		
In these lessons, students receive hands on experience with the slope of a linear graph. They build a set of stairs from poster board and record their stairs on a coordinate grid.. Then they record and analyze the data about the different rise and run measurements. They predict which slope ratios will produce the highest slope. Then they and graph and compare the slopes of the different groups' stairs. If desired, they move on to examining the slope intercept form of line.		
<b>Enduring Understanding</b>	<b>Essential Questions</b>	
The slope of a line on a graph tells the story of how two variables in a mathematical story are changing in relationship to each other.	What part of a graph's story does the slope of a line tell?	
<b>Skill Focus</b>	<b>Vocabulary Focus</b>	
<ul style="list-style-type: none"> <li>Building and analyzing slope</li> </ul>	coordinate plane, ordered pairs, slope, rise, run	
<b>Assessment</b>		
Students write a "Show All You Know" assessment about $y = mx + b$ equations. They should be sure to answer all the essential questions and include numeric data, equations, graphs and stories. Evaluate using a teacher/class created rubric.		
<b>Materials:</b> Graphing Calculators, Computers, LCD projector, graph paper.		
<b>Launch ideas:</b> "Talk about slopes of skateboard ramps, roller coasters, and ski mountains."		
<b>Explore</b> "Students will get to build a staircase, and measure stairs around the school to find the slopes of different objects."		
<b>Summarize ideas:</b> "Be sure students are understanding what the slope of a line tells us and how to find the slope, even if you don't use the technical terms for finding rise and run."		
<b>Apply</b>		

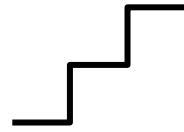
**Directions:**

As part of Pre 6.7, you may wish to examine and incorporate the "slope" activities from Exploring Algebra with Geometer's Sketchpad, pages 37-44.

- 1) Have student groups each build a set of stairs. See the directions below. If desired, have each group use a different rise/run. Then you can compare the steepness of the stairs.
- 2) Discuss ski slopes and how the steepness might be talked about. Relate discussion to the rise and run of the previously constructed stairs. Then transfer to a math context and say that we also talk about steepness of lines in graphs. Draw a simple graph as you tell the story of making \$5 for 1 hour worked, \$10 for 2 hrs, etc. What would happen to the steepness of the line if you got \$7 per hour instead. Yes, it would be steeper. The slope ratios are 5/1 and 7/1. The equations for how much money you make would be  $y = 5x$  (what is  $x$ ?) and  $y = 7x$ .

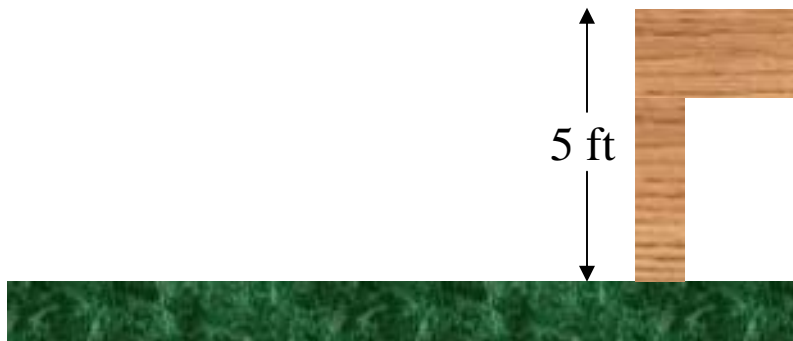


## *Making a Set of Stairs*



### Given Information:

- You need to make a set of stairs for a deck that is 5 feet above the ground. Each step has a run of 8 inches and a rise of 6 inches.
- The scale to be used is 3" = 1'.
- Make a set of stairs using the poster board as your lumber.



## Pre 6.7 Slopes of Stairs, Ramps, Mountains

Each group of student is responsible for measuring the rise and the run of a set of stairs or a ramp found in the school.

- If you are measuring a stair all you need to measure is the rise and the run of one stair step.

$$\text{Rise} = \frac{\quad}{\text{run} = \quad}$$

- If you are doing a ramp, you will need to create a step on the ramp with a rise and run.

1) Stairs or ramp measured \_\_\_\_\_ Rise = \_\_\_\_\_ Run = \_\_\_\_\_

2) Draw your stair step on the graph below. Then draw the line from 0 to the height points. This line shows the steepness of the slope of your set of stairs or your ramp.

3) For each step you climb, you move up

\_\_\_\_\_ cm and forward \_\_\_\_\_ cm.

Written as a slope ratio (rise/run)

\_\_\_\_\_

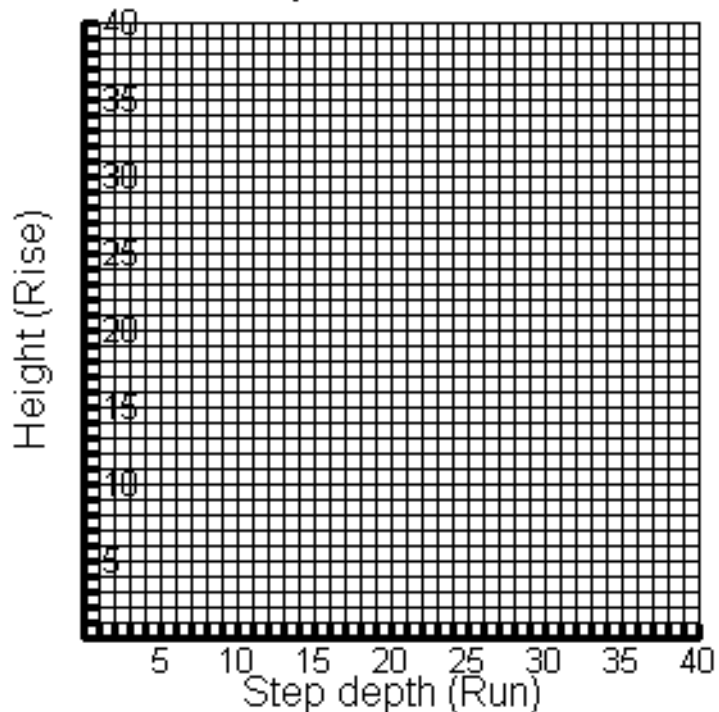
4) Compare the different slopes below.

Predict which ratio will create the steepest slope. \_\_\_\_\_

Explain your answer.

How can we find out for sure which slope is the steepest?

### Slopes of Stairs



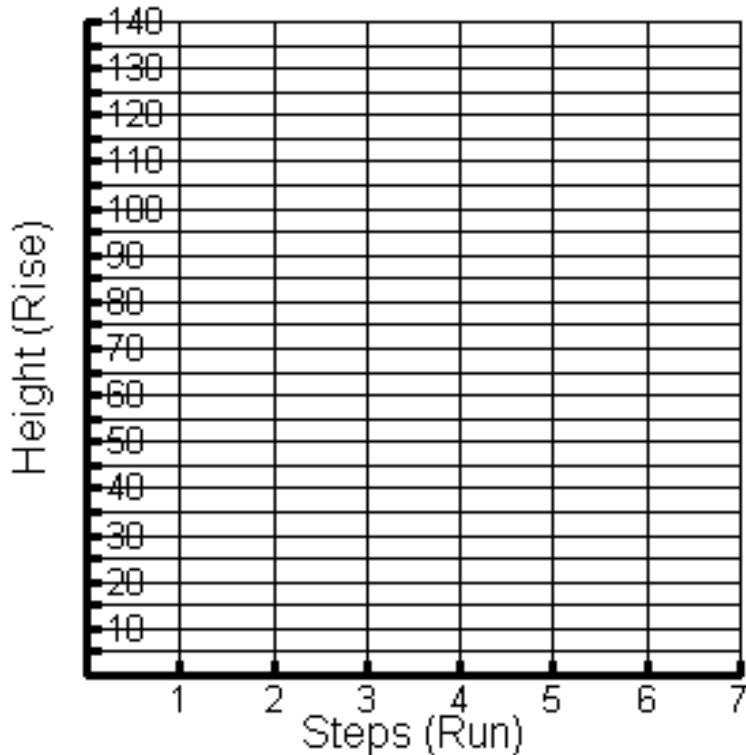
Stairs measured	Slope ratios		Stairs measured	Slope ratios		Stairs measured	Slope ratios	

We will now create a larger graph of your stairs. Instead of using the centimeter measurement as the run, we will measure the run as the steps you take and the rise of each of those steps.

## Slopes of Stairs

5) Create a table of numbers for you moving up the stairs or ramp. Now draw yourself moving up the stairs, actually draw the steps in.

x(step)	y (height)
1	_____ (your rise)
2	_____
3	_____
4	_____
5	_____
6	_____



Connect the height points to show the slope.

6a) Write the rise/run for 1 step? \_\_\_\_\_

b) Write the rise/run for 3 steps \_\_\_\_\_ Reduced slope \_\_\_\_\_

c) Write the rise/run for 5 steps \_\_\_\_\_ Reduced slope \_\_\_\_\_

d) What do you notice? Explain.

For every step you take you are rising \_\_\_\_\_ cm. What is the formula for finding how high you'd be if you climbed x steps using your slope.  $y = \underline{\hspace{2cm}}$

6) How high would you be if you climbed 50 steps or sections of a ramp? \_\_\_\_\_

7) Write a story about 3 people hiking a mountain trail. How do you think the +20 or -10 would fit into the story?

One person's hike uses your equation.  $y = \underline{\hspace{1cm}}x$  (fill in your slope)

Another person's hike uses this equation  $y = \underline{\hspace{1cm}}x + 20$  (fill in your slope)

The third person's hike uses this equation  $y = \underline{\hspace{1cm}}x - 10$  (fill in your slope)