

2002 National Teacher Training Institute

Grades 9-12

Rise over Run

Master Teacher

Rachel W. Edwards

Time Allotment

Two 50-minute classes

Overview






The activities presented in this lesson will help students define the slope of the line, find the slope between any two points on the line, and allow them to name other areas where the slope is used. By doing the various activities on certain Web sites and viewing the video, the students will understand why the slope is defined as the rise over the run. In subsequent lessons they will use the concept of the slope to determine equations of lines.

Subject Matter

Mathematics

Learning Objectives

Students will be able to:

-  describe the meaning of slope
-  investigate horizontal and vertical slopes
-  determine the sign of the slope
-  find the slope given two points
-  calculate the slope using the equation

South Carolina Standards

(These Algebra Standards for grades 9-12 are available online at http://www.myschools.com/offices/cso/Standards_Page.htm.)

I. Understand patterns, relations, and functions.

IB. Understand relations and functions and select, convert flexibly among, and use various representations for them.

IB2. Represent relationships among quantities using concrete models, tables, graphs, diagrams, verbal descriptions, equations, and inequalities including representations involving computer algebra systems, spreadsheets, and graphing calculators.

Media Components

Video

Algebra: In Simplest Terms, Lesson 10: “Linear Relations”

Web Sites

ExploreMath.com (http://www.exploremath.com/activities/Activity_page.cfm?ActivityID=45) features highly interactive math activities for students and educators defining a line with two points activity.

Graph Skills: Unit Four (<http://syllabus.syr.edu/cid/graph/Unit4a.html>). This site shows the student how to calculate the slope from a graph and the equation.

Materials

Per student:

rulers, pencil, paper
graph paper
copies of worksheet for each student
color pencils (optional)
graphic calculators (optional)
Activity 1: Warm-Up “Rise over Run”
Activity 2: “Ramp and Similar Triangles”
Activity 3: “Roof”
Activity 4: “Road Sign”
Activity 5: “Finding the Slope”
overhead projector
overhead transparencies

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Prep for Teachers

- ✍ Bookmark the Web Sites on the computers for the students.
- ✍ Run off copies of the activity sheets from the Web Sites.
- ✍ Make overhead transparencies for Activity Sheets 1, 2, 3 and 4.
- ✍ Go to the Web page: *Graph Skills: Unit Four* (<http://syllabus.syr.edu/cid/graph/Unit4a.html>) and review the information there.
- ✍ Before conducting this lesson, be sure to read to familiarize yourself with the “Defining a Line with Two Points” activity on <http://www.exploremath.com/activities/ActivityPage.cfm?ActivityID=45>. Verify that the activity plays correctly on all the computers in the lab. Bookmark the activity page for your students. If you like, make copies of the worksheet for each student.
- ✍ Cue the video.

Introductory Activity

Step 1: Warm-up Activity. Explain to the students that in another lesson (Order of Things on page ?), they learned how to plot points on the coordinate plane and that they will now use that knowledge to plot points on a plane in a straight line. After the video, tell the students that they will be asked to write a brief definition of the slope.

Step 2: Provide students with a **Focus for Media Interaction** by asking them to raise their hands if they already have an idea of how to find the slope of a line. Tell them to listen for a relationship that shows how the slope is used in other areas of the curriculum. Explain that Mr. Garfinkle, the presenter in the video, will give them the meaning of the slope of the line. The presenter is seated at

desk and on the screen is a coordinate graph. START the video when Mr. Garfinkle says, “that making eyeball estimate from a graph isn’t very precise.” STOP the video when Mr. Garfinkle says, “Now we are halfway toward the equation of our whole speed relationship.”

Step 3: Have students get out a sheet of paper and tell them to write the definition of the slope and describe the steps in calculating the slope.

Learning Activities

Step 1: Break students up into small groups of two or three. Give each group a sheet of paper, a ruler and Activity Sheet 1: Warm-Up. Instruct the students to draw a right triangle with a horizontal leg of 12 cm and a vertical leg of 1 cm. Explain to the students that in order for buildings to be handicap accessible they must have an entrance ramp. The triangle represents a scale model of the steepest ramp allowed by law.

Step 2: Pass out Activity 2: “Ramp and Similar Triangles.” Get the students to explain why ramps similar to these may not be suitable for handicapped access. (*Try to lead the students towards words like “rise” and “run.”*) Ask the students to find the maximum value for x allowed by law for a handicap ramp. Have students explain the methods used to get their answers. (*Explanation: Students can use ratio and proportion to solve for x . Demonstrate on the overhead how to solve for x .*)

Step 3: Ask students to name other areas where slope is important. Give each student a copy of Activity Sheet 3. Place a copy on the overhead projector. (**Note to Teacher:** Explain to students after showing the picture of a roof that most houses have roofs that are sloped. Builders use the word “pitch” to describe the slope of a roof. For example, a roof with a 5:12 pitch would rise 5 ft. for every 12 ft. of run.) Give the students time to answer the questions on the activity sheet.

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Step 4: Give the students a copy of Activity Sheet 4 and place a copy on the overhead. Explain that on mountainous roads trucks are warned of steep sections of decent. Allow time for discussion and have the students answer the questions at the bottom of the activity. Have them try and name at least two more examples where the slope concept is used in everyday life.

Step 5: Lab Activity. Review the information with the students before going to the computer lab to do “The Slope between Two Points” activity.

(The slope between two points is determined by dividing the “rise” by the “run.” “Rise” is the vertical distance between the points and “run” is the horizontal distance between the two points. Say we have two points (x_1, y_1) and (x_2, y_2) . The vertical distance is $y_2 - y_1$ and the horizontal distance is $x_2 - x_1$. Slope is usually denoted by the letter m . The formula for slope is $m = \frac{y_2 - y_1}{x_2 - x_1}$.)

Step 6: Provide student with a **Focus for Media Interaction** by telling them to use their Web browser and go to the “Defining a Line with Two Points” activity found at http://www.exploremath.com/activities/Activity___page.cfm?ActivityID=45. Click on “explorations” and follow the directions and complete the activity. After the completion of this activity, copies of the worksheet will be given to each student for later review.

Culminating Activity

Step 1: Return to computer lab. Provide students with a **Focus for Media Interaction** by telling them to go to *Graph Skills: Unit Four* (<http://syllabus.syr.edu/cid/graph/Unit4a.html>). This site shows the student how to calculate the slope from the graph and the slope formula.

Read the information and follow the examples. Click on detailed solution to the example. At the end of the exercise, click on the Additional Practice. Do practice #7 and #8. Use Activity Sheet 5 for assessment.

Cross-Curricular Extensions

Business and Marketing: Collect line graphs from the newspaper (e.g., *USA Today* or the *Wall Street Journal*) as a group and answer the following questions:

1. Does the graph show a linear relationship between two values on the x and y axis?
2. Locate two points on the graph, identify them as (x_1, y_1) and (x_2, y_2) .
3. Use the Slope equation and find the slope.
4. Explain your answer.

Community Connections

✍ Place students in groups of 3 or 4. Have the students name as many buildings as they can in the community that have access ramps for the handicap.

Student Materials

Algebra I Textbook
ruler
paper and pencil
Activity Sheets 1-5
computers
newspapers

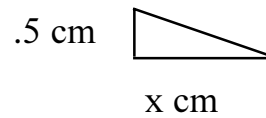
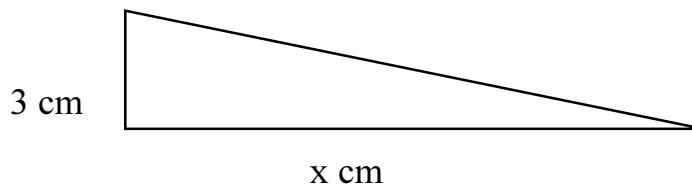
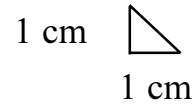
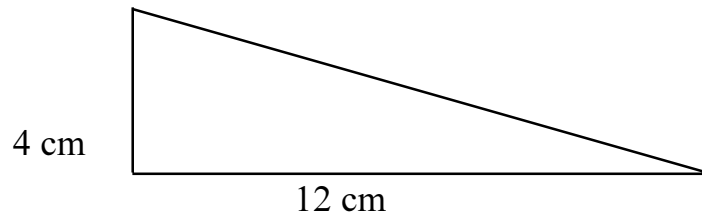
Activity Sheet 1: Warm-up “Rise and Run”

Make a right triangle with a horizontal leg of 12 cm and a vertical leg of 1 cm.

Activity Sheet 2: “Ramp and Similar Triangles”

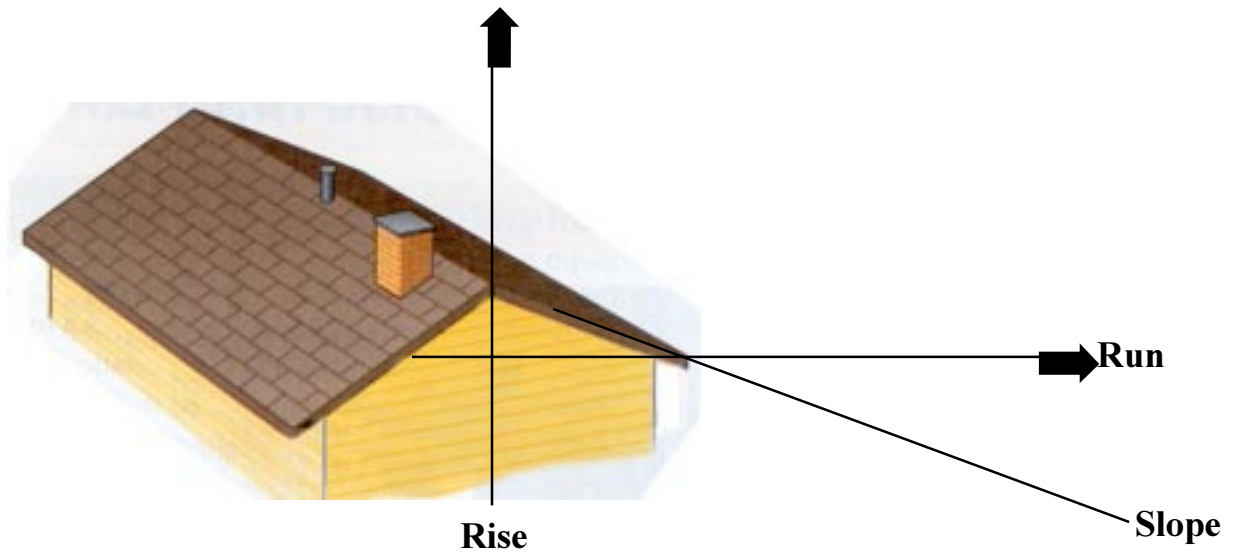
Construct on a sheet of paper:

2 similar triangles



Question – Find the maximum value for x allowed by law for a handicap ramp?
Explain the method used to get the correct answer.

Activity Sheet 3: Roof



1. Calculate the slope of the roof with the following information:
 - A. Rise is 2 feet (24 inches)
 - B. Run is 6 feet (72 inches)

2. What would the Rise be if the Slope was 4 and the Run was 14 feet?

Activity Sheet 4: Road Sign



If you were at 5,000 feet above sea level when you started downhill and at the end of the grade you were at 3,500 feet above sea level, what would the slope of the grade be assuming 1 mile = 5,282 feet?

Activity Sheet 5: “Finding the Slope”

I. Graphically plot the ordered pairs given; find the slope counting units using $\frac{\text{rise}}{\text{run}}$.

1) A(-3,4), B(2,-1)

2) M(2,-5), N(-1,-1)

3) C(2,3), D(4,3)

4) X(0,0), Y(2,4)

5) P(7,10), O(-7,10)

II. Using the slope equation: $m = \frac{y_2 - y_1}{x_2 - x_1}$ find the slope of the problems above.
Show your work.