



#9549

SLOPES: THAT'S A BIT STEEP

BENCHMARK MEDIA, 2002

Grade Levels: 9-13+

25 minutes

DESCRIPTION

Slope is the key characteristic of the linear function. Uses a variety of examples to teach how to calculate a number value of how steep a slope is. Also includes graphic representations of slopes. Pauses so viewers can calculate various slopes and ends with a review.

ACADEMIC STANDARDS

Subject Area: Mathematics

- ★ Standard: Understands and applies basic and advanced properties of the concepts of geometry
 - Benchmark: Uses synthetic (i.e., pictorial) representations and analytic (i.e., coordinate) methods to solve problems involving symmetry and transformation of figures (e.g., problems involving distance, midpoint, and slope, determination of symmetry with respect to a point or line) (See Instructional Goals #3 and 4.)
 - Benchmark: Uses geometric constructions (e.g., the parallel to a line through a given point not on the line, line segment congruent to a given line segment) to complete simple proofs, to model, and to solve mathematical and real-world problems (See Instructional Goals #3 and 4.)

INSTRUCTIONAL GOALS

1. To define horizontal and vertical lines.
2. To differentiate positive and negative slopes.
3. To show how to calculate a slope by measuring its rise and run.
4. To show how to calculate a slope by using two points on a coordinate plane.

BACKGROUND INFORMATION

Slope is the key characteristic of the linear function. It is important both for constructing its graph and for investigating its features.

VOCABULARY

- | | |
|-------------------|-------------------------|
| 1. slope | 7. rise |
| 2. horizontal | 8. run |
| 3. vertigo | 9. steep |
| 4. vertical | 10. origin |
| 5. positive slope | 11. x and y coordinates |
| 6. negative slope | 12. axes |



BEFORE SHOWING

1. Display pictures of roller coasters from different amusement parks in the country. Discuss steepness as an important factor to consider when designing a roller coaster. Consider the following facts.
 - a. The steepness of a roller coaster depends on the vertical change and the horizontal change.
 - b. A roller coaster at King's Island near Cincinnati, Ohio, reaches a speed of 64.77 mph at the base of its 141-foot drop.
2. List examples of slopes in everyday life (wheelchair ramps, ski slopes, hills, staircases, ramps used for loading trucks, road upgrades, pitch of a roof).
3. Use uncooked thin spaghetti to represent lines. Drop a handful of spaghetti onto a flat surface.
 - a. Determine how many lines were formed with a rise to the right and how many were formed with a rise to the left.
 - b. Explain that rise is used to help identify the slope of the line.
4. Pass out white boards, markers, and calculators for completing calculations that will be shown in the video.



DURING SHOWING

1. View the video more than once, with one showing uninterrupted.
2. Pause at each section that has calculations for the viewers to complete. Use white boards and calculators to find the answers.
3. Pause at the section showing the vertical post on the pier. The slope of a horizontal line is zero. Discuss what the slope of a vertical line should be.
4. Pause at the section showing the canopies outside the museum. Explain that it is difficult to see the two slopes clearly; it depends on where the observer is standing.
5. Pause at the section explaining about finding the slope by measuring the rise and run. Emphasize that it is important to find the value of the slope first. The positive or negative sign can be added later.
6. Pause at the section showing the first slope being determined by dividing 109 by 20. Explain that the video is made in Australia and they write the decimal points as a raised dot.
7. Pause at the section showing the exhibit of the skeleton of the blue whale. Clarify why the two heights were subtracted to get the actual rise.
8. Pause at the section that demonstrates how to find the slope of a line on a grid when given the coordinates of two points. Explain that the formula to use for finding the slope with points (x_1, y_1) and (x_2, y_2) is $m = (y_2 - y_1) / (x_2 - x_1)$.

AFTER SHOWING

► Discussion Items and Questions

1. What is a line that is flat called?
2. What is the slope of a horizontal line?
3. What is a line that runs up and down called?
4. What kind of slope does a line rising to the right have?

5. What kind of slope does a line rising to the left have?
6. What is the difference between rise and run?
7. How can slope expressed as a fraction be changed to a decimal?
8. What is the horizontal line on a grid called?
9. What is the vertical line on a grid called?
10. What is the point where the x-axis and y-axis meet called?
11. How can the slope of a line on a grid be found?



► **Applications and Activities**

1. Make a list of vertical and horizontal lines seen in the classroom.
2. Put a thick dictionary or other book on the desk. Put one end of a ruler on the book and the other end on the desk. Define the slope of the straight line that is formed.
3. Obtain coordinate graph paper. Draw lines passing through the following points with the specified slopes:
 - a. point (6,2) with a slope of $\frac{3}{4}$
 - b. point (-4,-5) with a slope of $-\frac{2}{3}$
 - c. point (0,0) with a slope of $\frac{5}{2}$
4. Solve several real-world situations:
 - a. A ladder is leaned up against a window eight feet above the ground so that its base is five feet away from the wall. What is the slope of the ladder?
 - b. To get to her aunt's house, Maria has to drive ten miles to the right, then turn left and drive seven more miles. What is the slope of the line formed?
 - c. When an airplane is three miles high, its projection on the ground is seven miles away from the point of departure. What is the slope of the line formed?
5. Measure the rise and run of certain incline planes and calculate the slope.
 - a. a wheelchair ramp
 - b. a slide in a park
 - c. a ramp for loading boxes into a truck
 - d. a hill
 - e. the roof of a small shed
 - f. a staircase
6. Construct a pair of coordinate axes and then draw a straight line through points with coordinates (1,3) and (2,5). Find the slope of the line.
7. Construct a pair of coordinate axes and then draw a straight line through points with coordinates (-2,3) and (3,2). Find the slope of the line.
8. The slope of a road is called the road's grade. Grades are measured in percents. Research to find what criteria determine if a warning sign needs to be posted before a hill.



RELATED RESOURCES



- [Let's Get it Straight: Linear Equations and Their Graphs: Part One #9552](#)
- [Algebra: Linear Equations #9746](#)



World Wide Web

The following Web sites complement the contents of this guide; they were selected by professionals who have experience in teaching deaf and hard of hearing students. Every effort was made to select accurate, educationally relevant, and "kid safe" sites. However, teachers should preview them before use. The U.S. Department of Education, the National Association of the Deaf, and the Captioned Media Program do not endorse the sites and are not responsible for their content.



- **GIZMOS (LINES AND LINEAR EQUATIONS)**

http://www.exploremath.com/activities/activity_list.cfm?categoryID=3

Includes interactive math activities such as slope calculation and defining a line with two points.

- **ASK DR. MATH**

http://mathforum.org/library/drmath/sets/high_lineareq.html

Contains links that answer questions about slopes. Includes information on determining slopes and interpreting slopes.

- **A REVIEW OF LINES AND SLOPES**

<http://www.ugrad.math.ubc.ca/coursedoc/math100/notes/zoo/line.html>

Uses an interactive graphic to define slope. The line can be dragged to change the rise and the run. Includes an explanation of positive and negative slopes and introduces the slope formula.