

Slope-2-Slope

Reporting Category Equations and Inequalities

Topic Investigating slope of horizontal and vertical lines and graphing a line

Primary SOL A.6 The student will graph linear equations and linear inequalities in two variables, including

- determining the slope of a line when given an equation of the line, the graph of the line, or two points on the line. Slope will be described as rate of change and will be positive, negative, zero, or undefined; and
- writing the equation of a line when given the graph of the line, two points on the line, or the slope and a point on the line.

Related SOL A.7d

Materials

- Scissors
- Slope-2-Slope Squares Puzzle (attached)
- Graphing calculators (optional)
- Graph paper (optional)

Vocabulary

horizontal line form, point-slope form, rate of change, slope, slope-intercept form, standard form, vertical line form, x-intercept, y-intercept (A.6)

Student/Teacher Actions (what students and teachers should be doing to facilitate learning)

Before engaging in this activity, students should have completed the “Slippery Slope” activity to develop an intuitive formula for slope. The teacher should extend student definitions to a variety of plausible, contextual situations, including determining the slope of a line when given the coordinates of two points on the line, the equation of the line, or the graph of the line.

1. Discuss positive and negative slope. Ask students what effect the slope has on the graph of the line.
2. Have students experiment with the slopes of horizontal and vertical lines. Direct them to generalize their findings. Ask about equations for the x - and y -axes.
3. Have students graph explicit equations, and discuss the transformation(s) necessary to produce the image graph from the parent graph, $y = x$. Have students describe the graph in terms of the slope and the intercepts. Discuss ways to determine the slope and the intercepts when given only the equation. Reinforce the general coordinates of the intercepts $(x, 0)$ and $(0, y)$ by reviewing the equations of the x - and y -axes. Then, reverse the process, and demonstrate how to graph, using transformations, slope and y -intercept, and the x - and y -intercepts.
4. Distribute scissors and copies of the Slope-2-Slope Squares Puzzle, and have students complete it individually or in small groups.

Assessment

- **Questions**

- Write the equation of a line that has an undefined slope.
- Write the equation of a line that has a zero slope.
- Write the equation of a line that has a negative slope and a positive y -intercept.
- Write the equation of a line that has a positive slope and a positive x -intercept.
- What is the equation for the x -axis?
- What is the equation for the y -axis?

- **Journal/Writing Prompts**

- Explain why the graph of a horizontal line does not have an x -intercept. Describe how you know this from the equation.
- Explain why the graph of a vertical line does not have a y -intercept. Describe how you know this from the equation.

- **Other**

- Have students create a design on graph paper, using at least 10 lines. Have them write the equations of the lines, including the start and stop points for each line. Alternatively, have students program their designs, using software or graphing calculators.

Extensions and Connections (for all students)

- Have students identify a given slope from a variety of lines drawn on 1-inch-grid graph paper.
- Have students work in groups to create their own 3 x 3 square with questions and answers in order to practice writing equations of lines. Have the groups exchange their 3 x 3 squares with other groups and solve.
- Have students work in groups to create a 4 x 4 square with questions and answers in order to practice writing equations of lines. Have the groups exchange their 4 x 4 squares with other groups and solve.

Strategies for Differentiation

- Encourage use of graph paper, graphing calculators, and white boards with grids for students to see the slope and intercepts.
- Have kinesthetic learners use their arms to illustrate slopes—positive, negative, undefined, and zero. This can be extended to estimating slopes like 2 versus $\frac{1}{4}$.

Slope-2-Slope Squares Puzzle

Standard form to slope-intercept form...and back again!

- Cut the squares apart on the dotted lines.
- Match equations in standard form to equations in slope-intercept form by placing them adjacent to each other.
- You should get a new 3 x 3 square.

	$y = 4$		$y = -2x + 5$		$2x + y = 4$	
$2 - 2x - y = 4$		$3x + 4y = 24$	$9 - x = 4$	$2x - 3y = 8$	$9 = 4z - xz$ $3x$	$4x - 2y = 8$
	$2x - y = -7$		$y = 1/3x - 3$		$x - y = 6$	
	$3y = x + 4$		$y = 2/3x - 12$		$x - y = 11$	
$6 - 3x - 9 = 4$		$3x + 4y = 20$	$4z = 27 - 3y - 4x$	$y = x$	$z = 4 + xz$ $2x$	$2x - 3y = 36$
	$x - 3y = 9$		$3y = x + 12$		$y = 2/3x - 8/3$	
	$y = x$		$4x - 4y = -1$		$x - y = 0$	
$5 + xz/2 = 4$		$y = 2x - 4$	$5 + xz = 4z$	$y = 3/2x - 3$	$0t = 4z + 4x$	$y = 3x$
	$y = 1/3x + 4$		$y = -3/4x + 5$		$y = 4$	

Solution to 3 x 3 puzzle.

	$y = 7/2x + 5$			$y = 3x$			$3x + 4y = 24$	
$y = 1/3x + 4$		$y = x$	$0 = y - x$		$y = 4$	$y = 4$		$2x - y = -7$
	$y = 2x - 4$			$4x + 2y = 10$			$y = -2x - 2$	
	$4x - 2y = 8$			$y = -2x + 5$			$2x + y = -2$	
$2x + y = 4$		$x - y = 6$	$9 - x = y$		$2x - 3y = 8$	$5/8 - x/2 = y$		$x - y = 11$
	$3x - 2y = 6$			$y = 1/3x - 3$			$2x - 3y = 36$	
	$y = 3/2x - 3$			$x - 3y = 9$			$y = 2/3x - 12$	
$4x - 4y = -1$		$y = -3/4x + 5$	$3x + 4y = 20$		$y = 4/3x - 9$	$4x - 3y = 27$		$y = x$
	$2y = 7x + 5$			$3y = x + 4$			$3y = x + 12$	