

The Submarine

Reporting Category Equations and Inequalities

Topic Investigating slope as rate of change

Primary SOL A.6a 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.

Related SOL A.7f

Materials

- Graphing calculators (optional)
- Graph paper (optional)

Vocabulary

slope, rate of change, constant (A.6)

function, dependent variable (A.7)

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

1. Introduce the following situation: “A submarine cruising at 195 meters beneath the surface of the ocean begins to ascend at 12 meters per minute.” Have students describe verbally, algebraically, and graphically a function relating the submarine’s depth and the length of time it has been rising. Ask how long it will take the submarine to reach the surface, and have them explain their answers.
2. Tell students to suppose the submarine, starting at its original depth of 195 meters, must reach the surface 5 minutes sooner than before. Have them describe how this change in length of time will change the function and the graph of the original situation. Have them state the new function and explain how they determined it.

Assessment

• Questions

- A submarine at the surface of the sea descends to 195 meters below the surface at a rate of 15 meters per minute. How long will it take the submarine to descend to that depth? How does the word *descend* relate to the rate of change? What information is necessary to compute the rate of change?
- You release a helium balloon attached to 500 feet of string on a windless day. The balloon climbs upward at a rate of 7 feet per second. You release the balloon at time $t = 0$. What is the slope of the linear model for this situation? After 30 seconds, will you run out of string? Why, or why not?

• Journal/Writing Prompts

- Explain to a pen pal who has not studied this process how to find the rate of change.

- **Other**
 - Have students create a children’s story that involves a rate of change.

Extensions and Connections (for all students)

- Relate this activity to an angle and slope format.
- Have students investigate the takeoff procedures of an airplane and describe their findings as they relate to the rate of change.

Strategies for Differentiation

- Encourage students to use graph paper and pictorial representations of these problems.
- Provide ELL students with visuals or further vocabulary explanations.
- Set up the t-chart and coordinate plane, and label the axes for students to use to complete this activity.