Lesson 16, Part C

Interpreting Change

Overview and student objectives

Overview

In this lesson, students transition from finding slopes in direct variation situations to finding slopes with any two data points of a linear relationship. Students will begin with data points that have a difference of 1 in the independent quantity and move on to points that do not.

The scenario continues into Lesson 16, Part D, where students will focus on *y*-intercept and then generalize to a mathematical linear statement and eventually to an equation. The time allotments between the two lesson parts can be fluid, depending on where and when you hold your debriefing discussions.

Objectives

Students will understand:

- The meaning of slope in problem situations.
- Any two points on a line can be used to find the slope.

Students will be able to:

- Calculate slope from two data points in a linear relationship.

Lesson Length: 25 minutes
Prior Lesson: Lesson 16, Part B, "Comparing Rates"
Next Lesson: Lesson 16, Part D, "Where Do We Start?" (25 minutes)
Constructive Perseverance Level: 2
Theme: Personal Finance
Outcomes: N2, N8, PR1, PR3, A1, A3, A5, A6, A7
Goals: Reasoning, Communication

Suggested resources and preparation

Materials and technology

- Computer, projector, document camera

- Preview Assignment 16.C

- Student Pages for Lesson 16, Part C

- Practice Assignment 16.C

Prerequisite assumptions

Before beginning this lesson, students should:

- Be able to interpret and determine unit rates.

- Be able to graph points on a coordinate plane.

Making connections

This lesson:

- Connects back to graphing a linear relationship in Lesson 16, Part A.

- Connects forward to interpretation of *y*-intercept.

Background context

None.

Suggested instructional plan

Frame the lesson

(5 minutes)

Alternate Opener

- Ask students to brainstorm as a class any situations where they pay a rate for goods or services. Divide the responses as a class into direct variation and other linear relationships. You may want to seed the discussion with the following examples:

  o Direct variation: You pay $87 for each night you stay in a hotel on your vacation.

  o Other: You pay $19 to rent a moving van and also pay $0.59 per mile.

Framing the Lesson

- Display the first page of the Student Pages for this lesson. Ask students to respond to question 1. Refine the responses until you have an equivalent statement to "The slope in this situation describes the monthly cost (in dollars) per phone."

- Transition to the lesson activities by briefly discussing the **Objectives for the lesson**.

Lesson activities

(15 minutes)

Questions 2–4

Think-Pair-Share

- Circulate the room to check student thinking. As students finish question 4, prompt them to refine their plan (e.g., for more specificity). Once they have a good plan, encourage them to proceed to questions 5 and 6.

- When the majority of students are finished, briefly compile a class answer. Their description from question 2 should include subtraction, and their answer for question 3 should include a discussion that $30 for 3 additional phones is the same as $10 per phone.

Class Discussion

- Work with the class to formalize their descriptions from question 4. For example, a student might say, "I subtract the cost and I subtract the phones and I divide."

  o "What is being divided by what? Which is in the numerator and which is in the denominator?" Work toward:

  $$\text{Slope} = \frac{\text{Difference in Cost}}{\text{Difference in Phones}} = \frac{\text{Cost 2} - \text{Cost 1}}{\text{Phones 2} - \text{Phones 1}}$$

  You may even compare this to the earlier spreadsheet notation:

  $$\text{Slope} = \frac{\text{B2} - \text{B1}}{\text{A2} - \text{A1}}$$

  o Decide whether you wish to take this to the usual algebraic notation, although many students may have already recalled it.

  $$\text{Slope} = \frac{y_2 - y_1}{x_2 - x_1}$$

- Emphasize that subscripts, like cell numbers in spreadsheet formulas, indicate location and are not exponents.

- Emphasize the importance of the order of the points by asking:

  o "What if we subtracted in the other order (Point 3 – Point 1)?" [Answer: –30/–3 still equals $10 per phone.]

  o "What if we subtracted $\text{Slope} = \dfrac{y_2 - y_1}{x_2 - x_1}$?" [Answer: This order would give a result that indicates that the price goes down when phones are added—the order of the denominator must match the order of the numerator.]

Questions 5–7

- Question 7 is a good time to refine the vocabulary describing process.

Group Work

- The discussion of this question is also a good time to introduce the vocabulary of *independent variable* and *dependent variable*. Even if all the groups choose to provide an algebraic response, take a minute to develop a statement such as, "We can find the slope of the linear relationship by dividing the difference in the dependent quantity by the difference in the independent quantity."

- Place special emphasis on the use of the word *difference* as a device to establish a group for order of operations in the algebraic expression.

- Foreshadow work with exponential relationships by emphasizing the additive nature of the phone scenario:

  o "For every phone we add to the plan, what happens to the cost?" [Answer: We <u>add</u> $10 to the cost.]

Class Discussion

- Students may already have questions about the remainder of the cost beyond the charge for the phones. The *y*-intercept is addressed in the next lesson (Part D), so you may wish to encourage them to continue if they have completed Part C.

Wrap-up/transition

(5 minutes)

Wrap-up

- If you have not done so already, take time to introduce the use of *x* and *y* as commonly used variables used for independent and dependent quantities in a relationship.

- Have students refer back to the **Objectives for the lesson** and check the ones they recognize from the activity. Alternatively, they may check objectives throughout the lesson.

Transition

- "In the next lesson, we will combine what we know about slopes and intercepts to construct and use complete linear equations."

- "We will also extend our work with linear relationships to estimating dependent intercepts from graphs and then finding exact values."

Suggested assessment, assignments, and reflections

- Give Practice Assignment 16.C.

- Give the Preview Assignments, if any, for the lesson activities you plan to complete in the next class meeting.