Math Objectives

- Students will compute unit rates.
- Students will find linear equations using unit rates to represent proportional relationships.
- Students will examine ordered pairs to confirm that linear equations represent proportional relationships.
- Students will examine entries in function tables to confirm linear equations represent proportional relationships.
- Represent proportional relationships by equations (CCSS).
- Model with mathematics (CCSS Mathematical Practice).
- Use appropriate tools strategically (CCSS Mathematical Practice).

Vocabulary

- ordered pair
- unit rate
- linear relationship
- proportional relationship

About the Lesson

- This lesson involves finding a linear equation and confirming the equation represents a proportional relationship with numeric values in ordered pairs or in functions tables.
- As a result, students will:
  - Find the linear relationship given a proportional situation.
  - Find ordered pairs on the linear equation.
  - Find numeric value that fit the proportional situation.

TI-Nspire™ Navigator™ System

- Send and collect a file.
- Use Screen Capture to monitor student work and generate class discussions.
- Use Live Presenter for students to demonstrate and explain their work.
- Use Quick Poll to assess students' understanding and generate class discussions.

Equations from Unit Rates
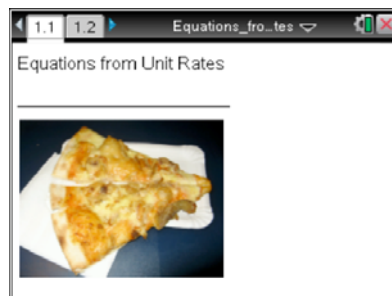
TI-Nspire™ Technology Skills:

- Download a TI-Nspire document
- Open a document
- Move between pages
- Grab and drag a point

Tech Tips:

- Make sure the font size on your TI-Nspire handhelds is set to Medium.
- You can hide the function entry line by pressing `ctrl` `G`.

Lesson Files:
Student Activity
Equations_from_Unit_Rates_Student.pdf
Equations_from_Unit_Rates_Student.doc

TI-Nspire document
Equations_from_Unit_Rates.tns

Visit www.mathnspired.com for lesson updates and tech tip videos.

Discussion Points and Possible Answers

Move to page 1.2.

In this activity, you will find the linear equation for a proportional situation and you will find ordered pairs from the graph of the linear equation. Your group will also create and present a story about a proportional situation and use technology to provide mathematical representations for the story to the rest of the class.
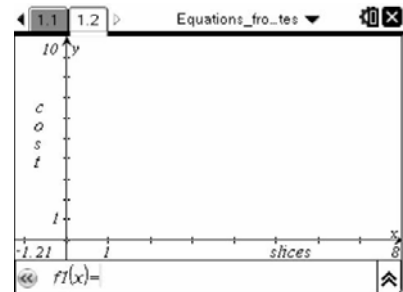
1. Suppose you can buy two pieces of pizza for $2.50. Compute the unit rate, and use that to see how much x slices would cost. Write the expression for the cost of x slices.

    Answer: The unit rate can be found as 2.50/2 = 1.25 dollars per slice, so x slices will cost 1.25x dollars.

2. Enter your expression in the entry line for f1(x). If the entry line is not visible, press ⌈ctrl⌉ ⌈G⌉. Press ⌈enter⌉ to graph the equation.
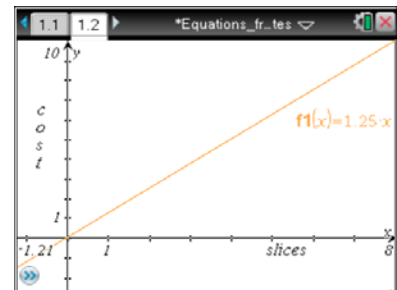
3. Describe the graph of the equation. What is the slope for your graph?

    Sample Answer: The line passes through the origin**.** The slope of this line is 1.25, the unit rate.

4. Identify some points this line passes through. Use the Trace tool of TI-Nspire in order to display numerical values based upon the equation. Describe how these values fit the proportional situation.

    Reminder: In order to trace the graph, press ⌈menu⌉ and select Trace. Next select Graph Trace. Press ⌈enter⌉ to mark points from Trace.
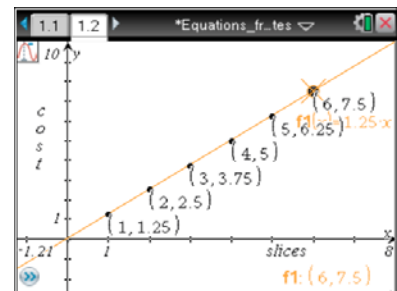
    Sample Answers: The equation produces a line that passes through the origin. The Trace function provides several ordered pairs, like (1,1.25), (2, 2.5), (3, 3.75) that the line passes through. In each of these ordered pairs, the ratio of the y-values to x-values is equal to the unit rate. In this situation, the unit rate is 1.25.

5. Use Function Table option of TI-Nspire in order to display numerical values based upon the equation. Explain what the values pairs represent in the situation. Reminder: In order to display function table, press [ctrl] [T].
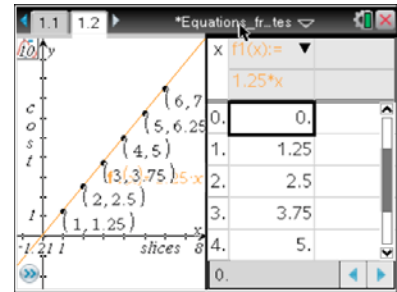
    Answer: The values in the function table correspond to values in the ordered pairs. The values in the function table are proportional. In each of these rows of the function table, except the row with x=0, the ratio of the *y*-values to the corresponding *x*-values are equal the unit rate. In this situation, the unit rate is 1.25.

6. Your group will now create a real-life story that represents a proportional situation. In this story you cannot use the unit rate to describe the situation, but you can use the ratio of two variables. You can then use the ratio to analyze the relationship between the two variables. Record your story in the space below.

Sample Stories:

This example is a proportional story: Erin uses six scoops of ice and two cups of fruit juice to make one large serving of one of her smoothies. How much ice will she need to make three large smoothies?

This example is not a proportional story: Mike starts the year with $500 in his bank account. He adds $100 every two weeks when he gets paid. How much will he have after 10 weeks?

Tech Tip: When students open a new document, they will be asked whether they want to save current document or not. If you do not plan on collecting these documents, students can choose No to continue. In order to open a new document while another document is open, press [⌂on] to go to the Home Screen. Then select New Document. The current document will not be saved so press [tab] to move to No. Press [enter] and select Add Graphs. (Keystrokes: [⌂on] [1] [tab] [enter] [2]).
To change Window Settings, select **MENU > Window/Zoom > Window Settings**. Each problem will require unique window settings.

Teacher Tip: Help the students to adjust the window settings to values appropriate for their problem. Move about the classroom to examine each group's created problem or selected problem selection.

7. Find an equation that describes the relationship in your story. Record your equation. Is this a proportional situation? Explain.

    Sample Answers: Answers will vary. If it is a proportional story setting, the equation will be in the form $y = kx$, where k is the unit rate.

8. Enter your equation into f1 in the entry line. Press `enter` to graph the equation. Describe the graph of the equation. What is the slope for your equation? Explain.

    Sample Answers: Answers will vary. If it is a proportional story setting, the graph produces a line that passes through the origin with a slope equal to the unit rate for the problem.

9. Use either the Trace tool or the Function Table of TI-Nspire in order to display ordered pairs based upon the equation. List at least four ordered pairs of values based on your equation.

    Sample Answers: Answers will vary.

10. Describe how these ordered pairs fit the story.

    Sample Answers: Answers will vary. For all of the proportional situations, the equations will be in the form $y = kx$, where the slope k is equal to the unit rate. The graph of the equation will be a line that passes through the origin. The Trace function provides several ordered pairs that the line passes through. The ordered pairs are proportional, that is each x-value can be changed into the y-value by multiplying by the unit rate for each situation. The same can be said for the values shown in the function table.

> **TI-Nspire Navigator Opportunity:** *Live Presenter*
> **See Note 2 at the end of this lesson.**

Wrap Up

Upon completion of the discussion, the teacher should ensure that students are able to understand:

*   How to find a unit rate given in a proportional situation to use in the linear equation.

*   How to determine a linear equation for a given proportional situation.

*   How to confirm that the representations provide some matching ordered pairs.

Assessment

TI-Nspire Navigator Opportunity: Quick Poll
See Note 3 at the end of the document.

TI-Nspire Navigator

Note 1

Name of Feature: Screen Capture

Use Screen Capture to project students' screens as they are entering their linear equations, displaying function tables, and tracing points for the problem selected or created. Make sure the window settings have reasonable values for the problem setting.

Note 2

Name of Feature: Live Presenter

Have groups present their proportional situations and the associated equations and numerical values. Use Live Presenter to allow all of the class to see how linear equations, traced values, and function tables have represented the proportional situations. Group members will share their findings.

Note 3

Name of Feature: Quick Poll

Use Quick Poll. Choose the Yes/No option and pose the following questions:

Are you confident that you can:

- create a new document with a Graphs page?

- determine a unit rate for a proportional situation?

- determine an equation for a proportional situation?

- confirm your equation fits the situation with numerical values using the Trace option?

- confirm your equation fits the situation with numerical values found in the Function Table?

- describe the relationships of the linear equations and the numerical values from the Trace and Function Table options?