

Activity 6

Finding Function Rules from Sequences

John Neral

CALCULATORS: Casio: *fx-9860G* • Casio: *fx-9750G Plus*

Teaching Notes/Lesson Plan /Answers to the Problems

Objective

The participant will demonstrate the ability to input a set of data into the STAT application and determine the function for the data. Participants will use the Casio *fx-9860* to input the data and effectively communicate the similar or different characteristics in a sequence by examining the visual and data representations of the graphs.

Getting Started

Within the NCTM Standards, students are expected to have a clear understanding of patterns and functions. While this standard begins in early elementary school with constructing patterns, more sophisticated patterns and representations are presented as the students progress through elementary, middle, and high school. For some students, their first exposure to using a graphing calculator is in middle school. This is a beginner's activity to help the participant get more acquainted with the Casio calculator and begin to learn and gain a greater understanding of functions and their graphs.

Activity Notes

Write this basic numerical sequence on the board: 2, 4, 6, 8, ... By examining this sequence, students should be able to determine that the next number in this pattern is 10 because the next number is found by adding 2 to the previous term.

Explain that to derive a formula for this pattern, one might determine that since the next number is found by adding two to the previous term, the rule would be " $2X$ " where X = the number of the term in the sequence. To put this rule into a function formula, one could say that $Y = 2X$ where X is the number of the term in the sequence and Y is the output or the number in the sequence. Then have them examine the sequences shown on the Student Worksheet and determine the rule for each sequence.

3, 5, 7, 9, ...	Rule: ($Y = 2X + 1$)
4, 8, 12, 16, ...	Rule: ($Y = 4X$)
20, 15, 10, 5, ...	Rule: ($Y = -5X + 25$)

Extension

Rather than being given the data set and then determining the function rule, have students write a function rule and then determine five data points for that function. Then have them input the function rule into the Table application, set the range for the specific data points they wish to find, and then record those points on a separate sheet of paper.

For the classroom, have students develop arithmetic and geometric patterns and write them on index cards. Then, have students exchange their index cards with other members of the class, input those sequences into the STAT application and determine the function rule.

Answers

- $Y = 0.5X^2 + 0.5X$
- $Y = 6X - 1$
- $Y = X^2 + 2X + 1$
- $Y = 3.5X - 4$
- $Y = 15X + 20$

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Calculator Notes

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To Access the STAT Application:

- From the Main Menu, move the cursor to the **STAT** icon and press **EXE**.
- Input data into List 1 and List 2. (As a general rule when working with functions, input the independent (input) data in List 1 and the dependent (output) data in List 2.)
- Press **F1** to graph the data. (**GRPH**)
- Press **F1** again to graph the data in Graph 1. (**GPH1**)
- Once the data points have been displayed, press **F1(CALC)** to calculate the data.
- Decide what kind of data is being displayed. Since the data is linear, press **F2 (X)**.
- Examine the data for the Linear Regression.
- If needed, press **F5** to copy that formula into the **GRAPH** application, press **EXE** to paste the function into the Graph Editor window. Then, press **F6** to Draw the line for the graph.

To Access the GRAPH Editor Application:

- From the Main Menu move the icon over **GRAPH** and press **EXE**.
- Once you have entered a function into the Graph Editor window, press **F6** to draw and **Shift-F3** to adjust the View Window.

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Student Worksheet:

Look at this basic numerical sequence: 2, 4, 6, 8, ... By examining this sequence, one should be able to determine that the next number in this pattern is 10 because the next number is found by adding 2 to the previous term.

To derive a formula for this pattern, one might determine that since the next number is found by adding two to the previous term, the rule would be "2X" where X = the number of the term in the sequence. To put this rule into a function formula, one could say that $Y = 2X$ where X is the number of the term in the sequence and Y is the output or the number in the sequence.

Now, examine the following sequences and determine the rule for each sequence.

- 3, 5, 7, 9, ... _____
 4, 8, 12, 16, ... _____
 20, 15, 10, 5, ... _____

It might be difficult for you to derive the formula or function rule for a given pattern. One way in which you can derive the formula is to input the data into the STAT application.

- Using the first sequence, access the STAT application and in List 1, input the term numbers (1, 2, 3, 4).
- Then, input the numbers in the sequence in List 2. (3, 5, 7, 9).
- On the soft menu, press **F1** for Graph (GRPH) and then **F1** again for Graph 1 (GPH1). A series of dots will appear on a line.
- Press the **F1** key to Calculate (Calc) the formula. Since the data appears to be linear, press **F2** for X (which is the symbol for a linear representation).
- The next screen will show a Linear Regression formula in the form of $y = ax + b$.
- Substitute the values of the variables into the linear regression to determine the formula $Y = 2X + 1$.

Now, use the STAT application to input the next two sequences from the example to determine the function formula. All of these sequences are linear and will thus fit the linear regression formula given on the calculator. (Note: In any true representation, the r and r^2 values will equal 1. If you choose a regression and you don't get a value of 1 for r and r^2 , then you must choose another type of regression as that one is not correct.)

Problems:

For each problem, input the following data into the STAT application and determine the function rule for each set. Each set of data represents the output. Remember to input the term number in List 1 (ex: 1, 2, 3, 4, ...) and the output (the numbers given in the problem) in List 2.

1. 1, 3, 6, 10, 15, ... _____
2. 5, 11, 17, 23, 29, ... _____
3. 4, 9, 16, 25, 36, ... _____
4. -0.5, 3, 6.5, 10, 13.5, ... _____
5. 35, 50, 65, 80, 95, ... _____