# The Variables of Renting

Activity Overview

In this activity, students will identify what a variable is, construct a table of values, graph the ordered pairs from the table, and use the TI-84 Plus to graph the equation.

Topic: Algebraic Thinking

- Writing number sentences
- Using variables to represent changing quantities
- Creating ordered pairs, tables, and graphs

Teacher Preparation and Notes

- Students should be familiar with ordered pairs and graphing ordered pairs.
- For more connection to the scenario used in this activity, students can set the calculator to always display two decimal places by pressing MODE, use the arrow keys to highlight the number 2 to the right of the word Float and press ENTER.
- Before beginning the activity, students should turn off all plots and functions.
- **To download the student worksheet, go to education.ti.com/exchange/vor**
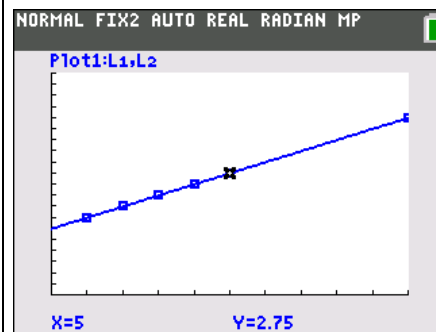
This activity utilizes MathPrint™ functionality and includes screen captures taken from the TI-84 Plus C Silver Edition. It is also appropriate for use with the TI-83 Plus, TI-84 Plus, and TI-84 Plus Silver Edition but slight variances may be found within the directions.

Compatible Devices:

- TI-84 Plus Family
- TI-84 Plus C Silver Edition

Associated Materials:

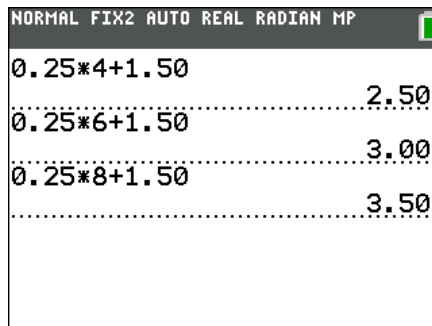- Variables_Of_Renting_Student.pdf
- Variables_Of_Renting_Student.doc

Tech Tips:

- Access free tutorials at http://education.ti.com/calculators/pd/US/Online-Learning/Tutorials
- Any required calculator files can be distributed to students via handheld-to-handheld transfer.

Part 1 – Number Sentences

In the first part of this lesson, students will look at the rental scenario using number sentences. Students first insert a specific number of hours to find the total cost of the rental.

Questions 1–2

Students can type the number sentence on the home screen of the TI-84 Plus. For the first example, students will press [0] [.] [2] [5] [×] [4] [+] [1] [.] [5] [0] [ENTER]. In future entries, they can either retype the equation or you can press [2nd] [ENTRY] and then just change the number of hours.

Questions 3–6

These questions are to help students identify what part of their number sentence is variable and to represent the changing quantity with a variable. Students may have had previous experience with variables or even with symbols (a box or triangle) that represented the changing quantity.
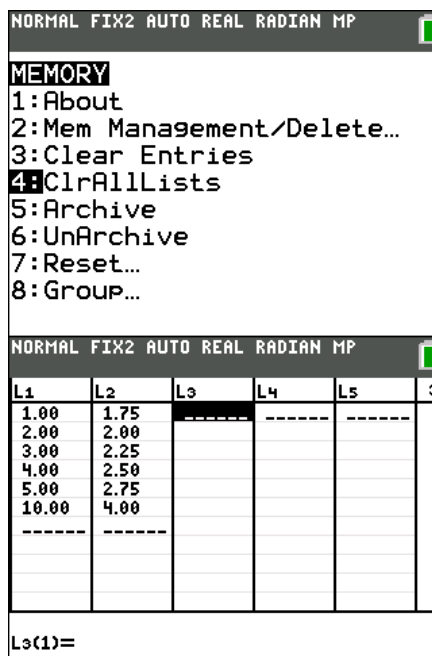
Part 2 – Creating a Graph

Next, students will explore the data in the form of a scatter plot.

Question 7

First, students will write the *x*- and *y*-values as ordered pairs. They should have previous experience with ordered pairs and graphing ordered pairs. If needed, students can start out by graphing the ordered pairs on graph paper if this is something they are familiar with and more comfortable doing initially.

If needed, students can use the **ClearAllLists** command to empty L1 and L2. From the Home screen, press [2nd] [MEM] and choose option 4. Press [ENTER] to execute the command and the word Done will appear on the home screen.

Then, press [STAT], select **1:Edit…**, and enter the ordered pairs in L1 and L2. Press [ENTER] after each value to move to the next element in the list.
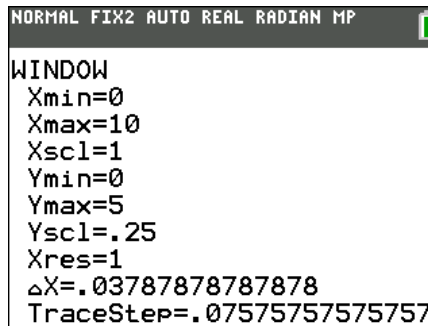
Questions 8–9

After the data is input in the lists, set up the scatter plot as shown at the right. Press [2nd] [STAT PLOT] to access the scatter plots. Move the cursor to each row and press [ENTER] on the item you need to select. To enter L1 and L2, press [2nd] [L1] or [2nd] [L2].
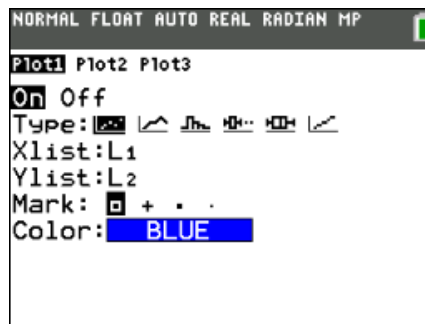
To view the graph, you will need to set an appropriate viewing window as well. Work with students to identify what will be best for viewing the data. This is a good experience to have them look at the data to determine minimum and maximum values and an appropriate scale.

After the plot is drawn, students can use a straight edge to draw a line of fit that goes through all the points.

Part 3 – Graphing the Equation

Question 10

For students to graph the equation, they can press [Y=] and then clear any equations that may be present. Then, press [0] [.] [2] [5] [×] [X,T,Θ,*n*] [+] [1] [.] [5] [0] [ENTER] To view the graph, they will then press [GRAPH]. The function along with the scatter plot will appear.
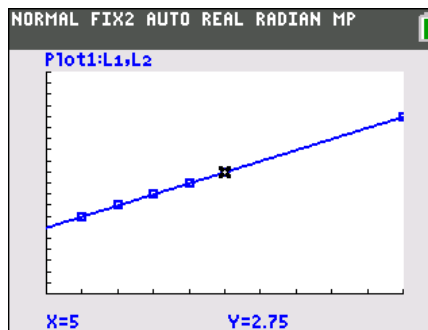
Questions 11–12

Finally, students look at the table of values to compare to the ordered pairs from earlier in the activity. Students can see how each value they had is mirrored here.

Extensions

Here are additional problems that you can assign to small groups and then have them share what they discover with the rest of the class.

1. You are going to take a taxi to the mall. The going rate is $2.00 for the first mile and 90¢ for each additional mile. How much will it cost to travel the 15 miles to the mall? Write a number sentence. How much would it cost to go to a friend's house 21 miles away?

2. You can buy a family season golf package for $350. This entitles all members of your immediate family to unlimited golf privileges from March 15 through October 15. The standard golf fees are $6.50 for juniors (through age 16) and $8.50 for adults. How often would a family of four have to golf to justify buying a season pass?

3. You get a job as a car salesman at the new Ford dealership in town. Your boss tells you that you can work by commission or salary. If you work on commission basis, you would make 1% of your sales. If you chose to work on salary, you would make $500 per week. (The average Ford sells for $21,000.) Write an equation that shows how much you would make if you worked on a commission basis and sold 1 car, 2 cars, 3 cars, n cars. At what point do you start making more money by commission?

4. Question 3 extended: A third option is offered whereby you would make 0.5% commission and $200 salary. Explain which of the three options you would choose and why. Support your opinion with a graph.

5. You have been invited to go biking in the backcountry. Claude's Classy Wheels rents mountain bikes for $4.00 an hour, but Claude insists you also rent a lock for a $1.35 flat fee for each bike rented. Write a number sentence to show how much it would cost to rent a bike for 7 hours. If you had $13.50, for how many hours could you rent the bike? What if you had $16.00? Tell how you would find this answer.

Solutions – Student Worksheet

1. If you rent the system above for 4 hours, how much will you pay? Show the number sentence you used. **Answer: 0.25 * 4 + 1.50**

2. What if you rented the system for 6 hours? For 8 hours? Write the number sentence for each case. **Answer: 0.25 * 6 + 1.50, 0.25 * 8 + 1.50**

3. Which part of your number sentence keeps changing? What does it represent? **Answer: the part after 0.25, and it represents the number of hours**

4. How could you write a math sentence about this problem using the letter *x* to hold the place for the number of hours? **Answer: 0.25*x* + 1.50**

5. Is the number of hours the only thing that changes? If not, what else changes? **Answer: the total cost changes as well**

6. Now, write a math sentence using *y* to hold the place of the total cost. **Answer: *y* = 0.25*x* + 1.50**

7. Enter the x-values in L1 and the y-values in L2 for x-values of 1, 2, 3, 4, 5, and 10. List the ordered pairs. **Answer: (1, 1.75), (2, 2.00), (3, 2.25), (4, 2.50), (5, 2.75), (10, 4.00)**

8. Set up a scatter plot as shown at the right. Then press GRAPH and draw the scatter plot you create of all the ordered pairs.

    Answer:

9. Draw a line to connect all the ordered pairs. What does this line represent?
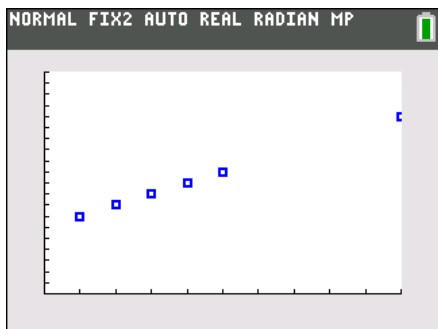
    Answer:
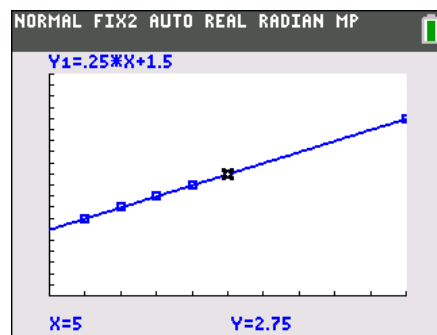
    This line represents all values of hours, not just the individual ones calculated.

10. Enter the math sentence you wrote in Question 6 into Y1 (press Y=), and then graph (press GRAPH). How does the graph of the equation compare to the line drawn in Question 9? **Answer: See the graph in Question 9 above.**

11. Look at a table of the function values. Press 2nd [TBLSET] and set up the table as shown at the right. Press 2nd [TABLE] to see the actual table of function values. How do these values compare to the list of ordered pairs from Question 7? **Answer: The values found in the table will be the same as the ordered pairs. There will, however, be more values in the table than just the 6 ordered pairs.**

12. Use the Trace feature to trace both the scatter plot and the function. Use the words continuous and discrete to describe the differences between the two. **Answer: The scatter plot is a discrete function while the equation is a continuous function. The scatter plot is discrete because you can only trace the specific values that were input in the lists, not all values along the line.**