The Best Cell Phone Plan

Overview – Activity ID: 8932

Students will compare two cell phone plans and determine which plan is better for a specific situation. They will utilize both tables and graphs to make their decisions. For this activity, students need prior experience writing linear models.

Math Concepts

- Linear functions
- Graphing
- Tables
- Patterns

Materials

- TI-34 MultiView™
- Graph paper
- Pencil
- Straightedge

Activity

Begin with a discussion about what makes a function or a relation linear.

What does the term linear *mean? Can you give an example of a linear function?*

Students' answers will vary, but anticipate some saying "anything that looks like a line on a graph" or "a relationship that changes at the same rate." Be prepared to review one-to-one and constant rate of change (slope).

One definition of linear *includes the condition that the graph of a linear function will always be a line. Consider the following example:*

You join a CD club, and each CD costs $9.95 plus a $3.50 shipping and handling fee. How many CDs could you purchase with $60? Let's create a table of values, graph the values, and then discuss what we see.

Use the table (transparency included at the end of this activity) to work this example in class with the students. Have them calculate the total cost, including shipping and handling, for each quantity.

Is this a linear function? How many CDs could be purchased with $60? What about with $90?

The students should be able to interpret the table and see that five CDs could be purchased with $60 and that eight CDs could be purchased with $90. Now, have them graph the function to help them visualize whether or not it is linear, using the graph transparency at the end of this activity. Discuss the domain and how only whole numbers can be used in a real-life situation. For example, you cannot buy 5.5 CDs.

Now we know the function is linear. We can see its graph and see that it's a line, plus we can interpret the data to see that the total cost is increasing by a constant rate of $9.95 per additional CD. Since it's a linear function, we can easily write a linear model for the cost of various numbers of CDs: (shipping) + (cost per CD)(# of CDs) = total cost.

$$3.50 + 9.95x = \text{total cost, where } x = \#\text{ of CDs}$$

©2008 Texas Instruments Incorporated

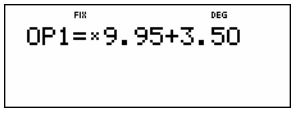
The Best Cell Phone Plan

Show the class how to utilize the Data feature of the TI-34 MultiView™ to generate the cost for each quantity, using a formula.

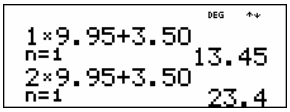
Now, how can we find the cost of 7 CDs? What about 22? It's easy using the TI-34 MultiView. We can simply store a series of operations, then calculate the cost for specific numbers of CDs.

Follow these steps:

1. Press [2nd] [set op1], then [×] 9 .95 [+] 3.50 [enter] to store the series of operations.
2. The screen should show this:



3. Press [2nd] [quit] to return to the home screen.
4. Now press 1 [op1], 2 [op1], etc., to see the cost of one and two CDs, respectively.
5. The screen should show this:



Show the students how to use the Mode feature to adjust the number of decimal places shown, as appropriate.

Another helpful feature of the TI-34 MultiView is the ability to change the number of decimal places shown. For example, when you deal with money, it makes sense to display two places after the decimal. Be aware that the calculator will display all outputs with two decimals until you change the mode again. Let's do that now.

Show the students an example using two different cell phone plans now that they've seen the procedure.

Your parents have agreed to get you a new cell phone plan since you continually go over the limit on your current plan. The first plan costs $34.95 per month plus $15.00 for every 100 minutes. The second option is a plan with unlimited minutes, but it costs $79.95 per month. If you use 400 minutes per month, which plan is better for you?

Follow these steps:

1. Press [mode] ▼ ▼ ▶ ▶ ▶ to tell the calculator to display two places after the decimal.
2. The screen should show this:

3. Press [enter] to select.
4. Now press [2nd] [quit] to return to the home screen.
5. Press 3 [op1], 4 [op1], etc., to see all answers shown with two places after the decimal.

The Best Cell Phone Plan

Note: Hundred-minute increments are used for ease of calculation and calculator entry. Students should understand that each minute actually costs $0.15 in the above example.

Use the Store Operations feature of the TI-34 MultiView to generate the cost of the first plan per 100 minutes.

Similar to the way we found the cost of the different numbers of CDs, we need to find the cost of the first cell phone plan when different numbers of minutes are used.

The linear model would be (flat rate) + (cost per 100 min) (# of 100-min increments) = total cost.

So the equation would be 34.95 + 15x = total cost, when x = number of 100-minute increments.

Discuss the results with the students, reminding them that each *x* represents 100 units. For example, 100 minutes costs $49.95, 200 minutes costs $64.95, etc. Again, only whole numbers can be used in a real-life situation, as it is unrealistic to purchase 130.6 minutes. It's possible, but not realistic.

Now, discuss the second scenario with the students.

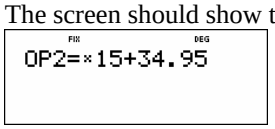
The second plan your parents are considering costs $99.95 per month regardless of number of minutes used. We don't really need to create a table of values for this plan, since it always costs $99.95.

Now, let's answer the question. Which plan is better if you use 400 minutes per month? Explain.

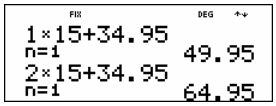
Students should be able to conclude that if they use 400 minutes per month, the cost of the first plan is slightly lower. To see at what point the second plan becomes more cost-effective, simply have the students calculate the cost when $x = 4$ and when $x = 5$.

Follow these steps:

1. Press [2nd] [set op2], then [×] 15 [+] 34.95 [enter] to store the series of operations.
2. The screen should show this:



3. Press [2nd] [quit] to return to the home screen.
4. Now press 1 [op2] , 2 [op2] , etc., to see the cost of 100 and 200 minutes, respectively.
5. The screen should show this:



The Best Cell Phone Plan

Name _____

Date _____

Laney and her parents have been at odds over her cell phone bill each month. They are unhappy with her because she goes over her allotted number of minutes, and she is also displeased because the plan is so limited. Laney has agreed to stick within the allowed number of minutes, provided she can have a new phone and a new and improved plan with more minutes. Her parents agree, but they want her to research the plans and then let them know which plan she thinks would be best. Here is what she found:

Option 1: Vertical Communications
cost of new phone: included
monthly fee: $24.95
cost per 100 minutes: $16.00

Option 2: Sprite Wireless
cost of new phone: included
monthly fee: $12.95
cost per 100 minutes: $18.00

Directions: Answer the following questions, using the Stored Operations feature of the TI-34 MultiView™. Hint: Let the variable represent 100-minute increments, then use [op1] for Vertical Communications and [op2] for Sprite Wireless.

1. If Laney used 300 minutes a month, what would Vertical Communications cost?

2. For 300 minutes a month, what would Sprite Wireless cost?

3. Which plan would be better if Laney used 300 minutes per month?

4. If she used 500 minutes per month, which plan would be better? Explain.

5. Which plan should Laney choose if she uses 700 minutes per month? Explain.

6. At what point do the two plans cost the same? What is that cost?

©2008Texas Instruments Incorporated

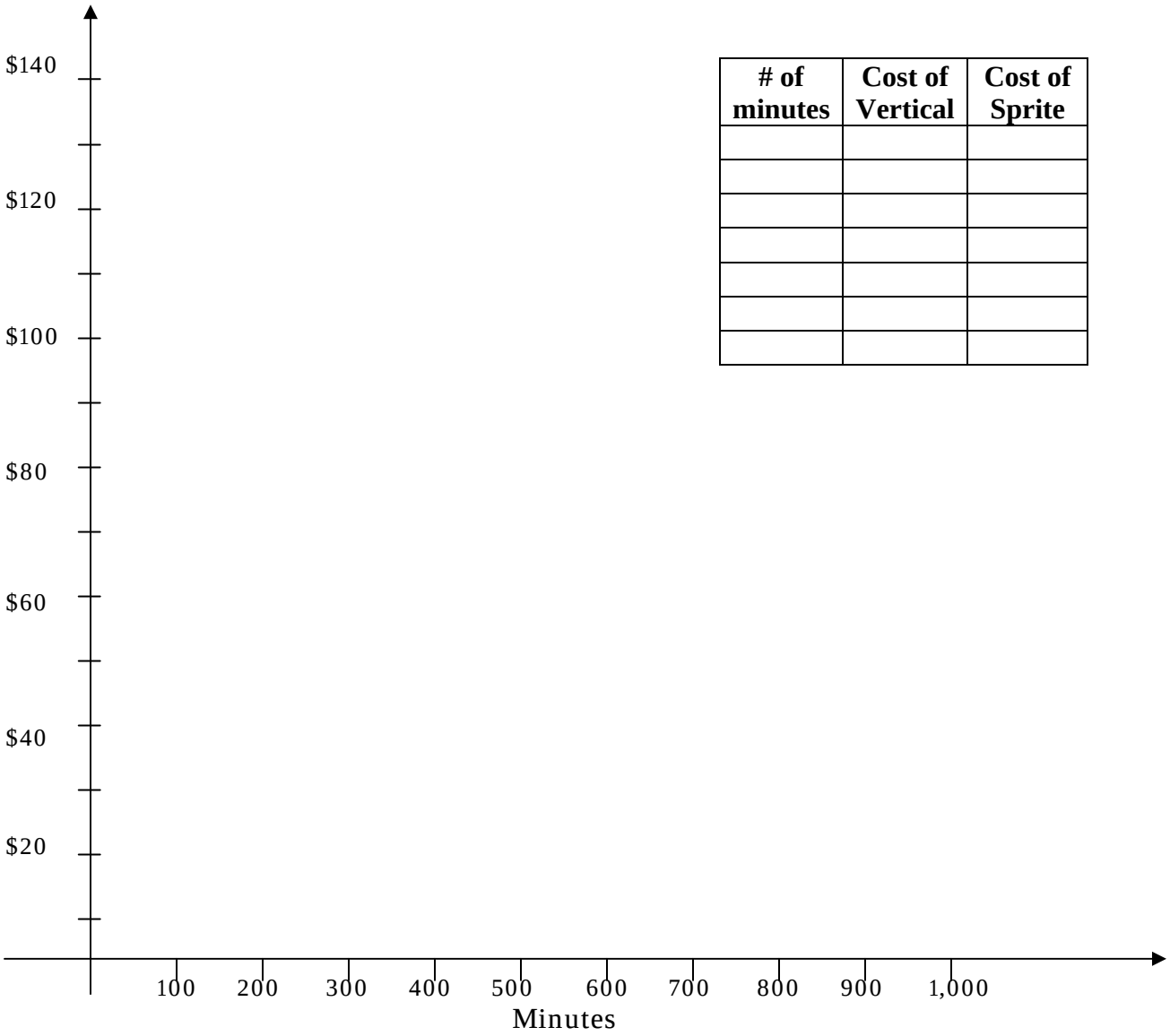
The Best Cell Phone Plan

Name _____

Date _____

7. Use the data from your calculator to complete the table below, and then graph the Vertical Communications and Sprite Wireless plans.

# of minutes	Cost of Vertical	Cost of Sprite



8. What does "n = " in your calculator represent?

9. Consider your personal cell phone usage. Explain which of the two plans above would be better for you. Discuss how you used the graph above to help you determine the better plan.

©2008 Texas Instruments Incorporated

The Best Cell Phone Plan

Answer Key

1. If Laney used 300 minutes a month, what would Vertical Communications cost?

   $72.95

2. For 300 minutes a month, what would Sprite Wireless cost?

   $66.95

3. Which plan would be better if Laney used 300 minutes per month?

   Sprite Wireless

4. If she used 500 minutes per month, which plan would be better? Explain.

   Vertical Communications would cost $104.95, and Sprite Wireless would cost $102.95. Sprite Wireless would be better by a small amount.

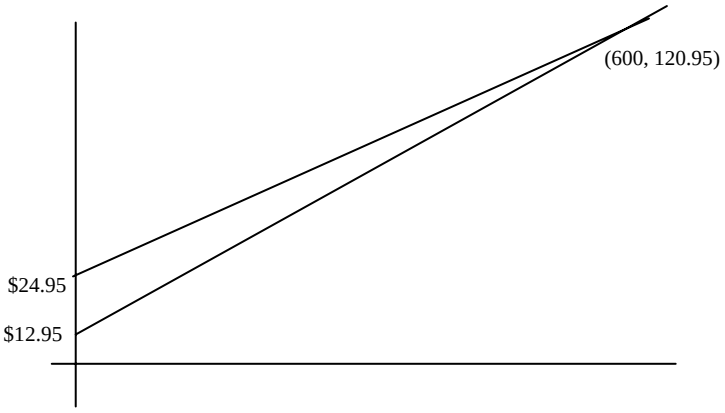
5. Which plan should Laney choose if she uses 700 minutes per month? Explain.

   Vertical Communications is the better plan for using 700 minutes per month. It costs $136.95, and Sprite Wireless costs $138.95.

6. At what point do the two plans cost the same? What is that cost?

   At 600 minutes per month, the plans both cost $120.95.

7. Use the data from your calculator to complete the table below, and then graph the Vertical Communications and Sprite Wireless plans.



8. What does "n = " in your calculator represent? 100-minute increments

9. Consider your personal cell phone usage. Explain which of the two plans above would be better for you. Discuss how you used the graph above to help you determine the better plan.

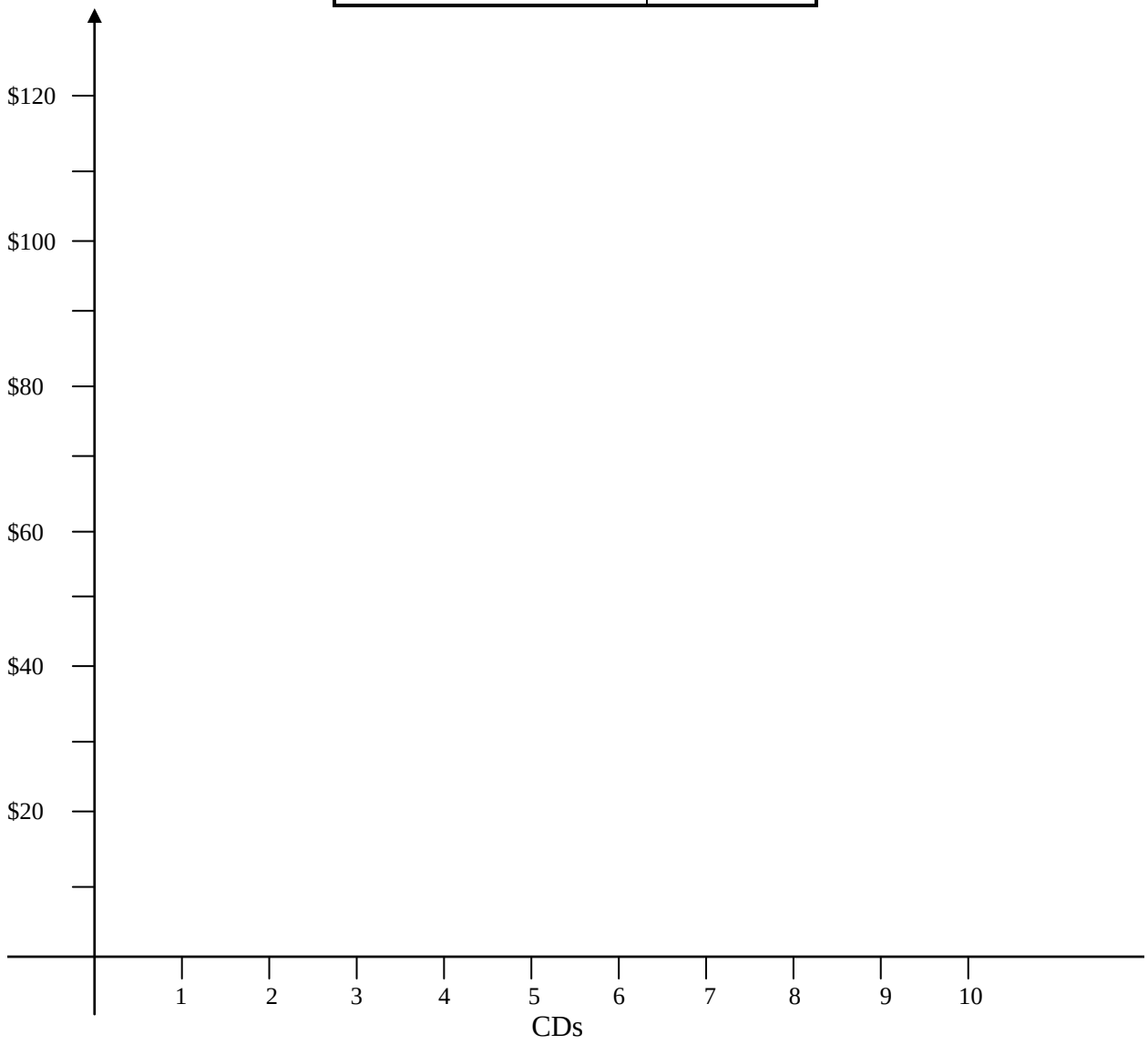
   Answers will vary.

©2008 Texas Instruments Incorporated

The Best Cell Phone Plan

Transparency

# of CDs purchased	Total cost
1	
2	
3	
4	
5	
6	
7	
8	
9	



©2008 Texas Instruments Incorporated