# Graphing Calculators
# Essential Tools for Investigating and Active Learning in Every Secondary Mathematics Class

Madison High School

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# Common Canned Foods

Direct Variations

| Canned Food | US Measurement | Metric Measurement |
|---|---|---|
| Crabmeat | 6 oz | 170 g |
| Soup | 5 oz | 142 g |
| Black Beans | 15 oz | 425 g |
| Pineapple | 20 oz | 567 g |
| Stew | 10.75 oz | 304 g |
| Pumpkin | 40 oz | 1130 g |
| Green Chiles | 4.35 oz | 120 g |
| Tomatoes | 102 oz | |
| Sundried Tomatoes | | 980 g |

- Place the measurement for ounces in L1 and the corresponding measurement for grams in L2.
- Create a scatter plot of the data in L1 (x axis) and L2 (y axis). Set an appropriate window.
- Describe any patterns you see in your graph.
- Trace along the graph and describe how the x and y values are related.
- Create a list L3 that represents the quotient of L2/L1. What does this number mean?
- Return to the graph and trace along the graph. How does the number you saw in L3 related to the value in each ordered pair?
- Return to the lists and describe how you can create the value in L2 from the value in L1. How can you create the value in L1 from the value in L2?

- If x is the number of ounces, then describe how you can find the corresponding number of grams (y). y=_____

- Enter this equation in y1 in your graphing calculator. What happens when this line is graphed against the data?

- Trace along the graph of your equation. Predict the number of grams in the can of tomatoes that weighs 102 oz. Predict the number of ounces in the can of sundried tomatoes that weights 980 grams.

- Create a table of values for x and y. Predict the number of grams in the can of tomatoes that weighs 102 oz. Predict the number of ounces in the can of sundried tomatoes that weights 980 grams.

- Write several sentences that describes what you learned about approximating values with a graph, a table, and a graph of an equation. Describe which way you prefer and describe why.

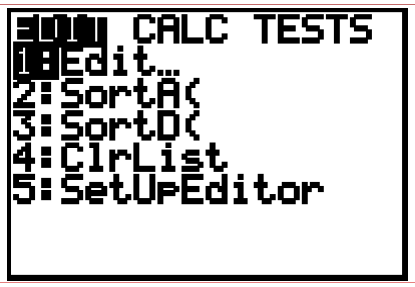
# TI-84

Home

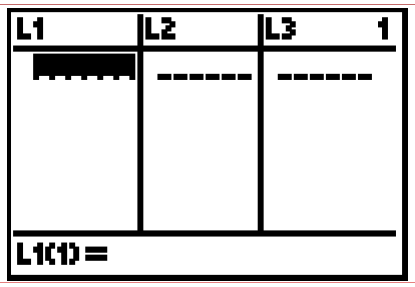
# Making a ScatterPlot

From the home screen press the STAT key to get the menu for statistics

Select choice 1. Edit

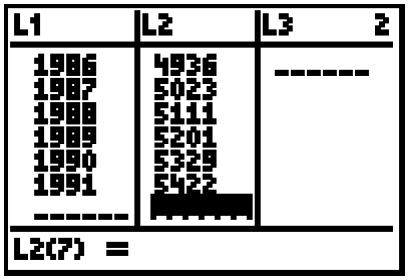



If this is your first time for the activity you will need to enter data for the x values under L1 and the data for the y values under L2.




Enter the data in the columns labeled L1 and L2.

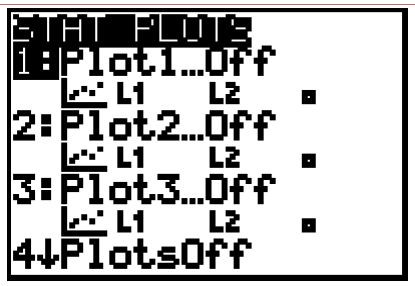
| Year | Population in Millions |
|---|---|
| 1986 | 4936 |
| 1987 | 5023 |
| 1988 | 5111 |
| 1989 | 5201 |
| 1990 | 5329 |
| 1991 | 5422 |

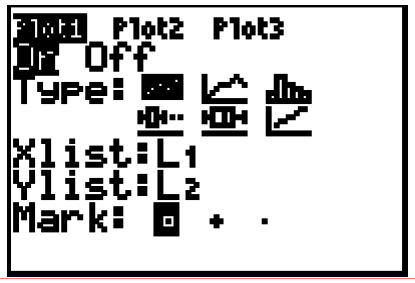
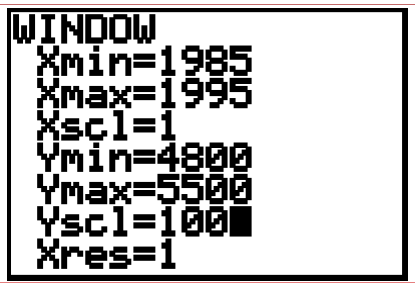
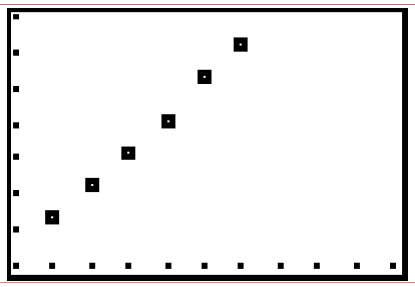



To set up the scatterplot select STATPLOT (2nd Y=)

Select choice 1. Plot 1 and set up the window as indicated:

ON

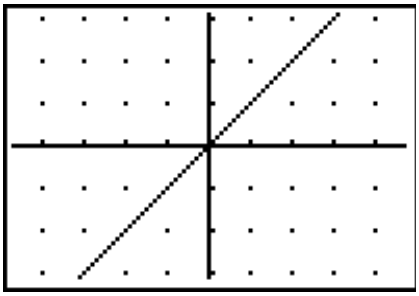
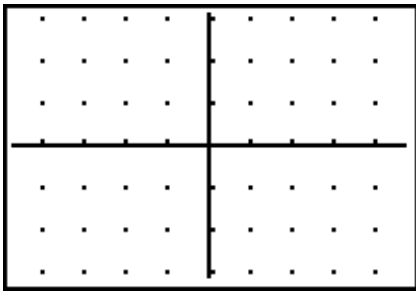
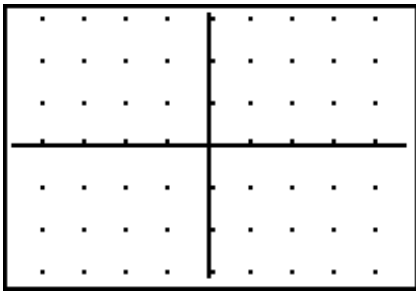


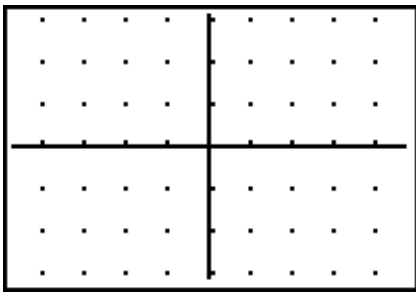
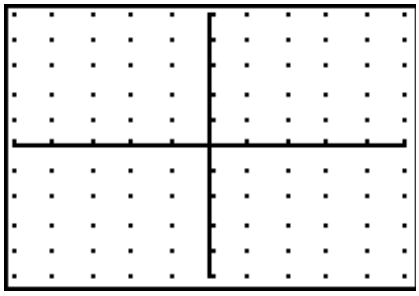
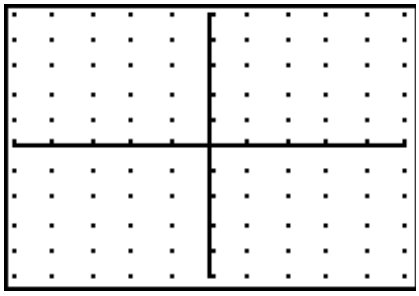
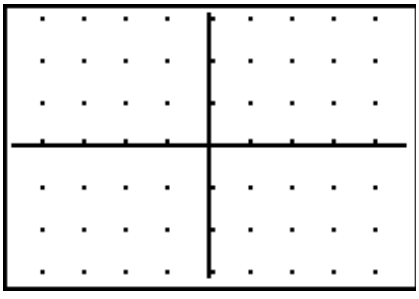
| | |
|---|---|
| ScatterPlot<br>L1<br>L2<br>Box |  |
| The next step would be to select an appropriate window for the data.<br><br>Press WINDOW.<br><br>In this case the window at the right would be appropriate. |  |
| We are now ready to look at a scatterplot. Press GRAPH. |  |
| How to fit a regression line to this data. | |

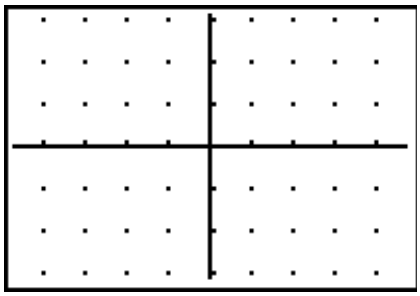
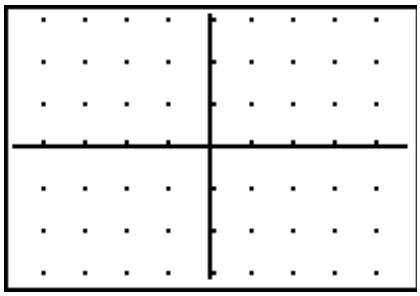
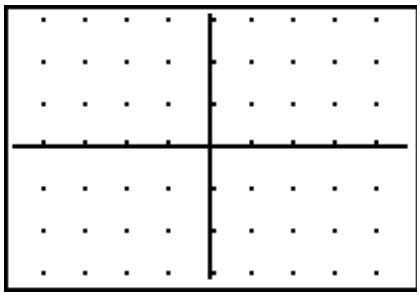
# Studying the Graphical Effects of M

Directions: In this lesson you will study how the coefficient of the x term effects the graph of the line. The first entry has been completed for you.

Part I: Complete the table and then answer questions 1-7 on your answer document

| Problem | Function | Value of slope "m" | What is the graphical meaning of the slope? | Is the graph steeper, flatter, or the same as the graph of y = x? | Sketch of the graph Trace along the graph and label two coordinates on the graph. The window is a zoom 6. Integer window with xscl=yscl =10 |
|---|---|---|---|---|---|
| 1 | y = x or y = 1x | 1 | For every change of 1 in the vertical direction y the x changes by 1. | |  |
| 2 | y = 2x | | | |  |
| 3 | y = 3x | | | |  |

| | | | | | |
|---|---|---|---|---|---|
| 4 | y = (3/2)x | | | |  |
| 5 | y = (5/2)x | | | |  |
| 6 | y = -x or<br>y = -1x | | | |  |
| 7 | y = -2x | | | |  |

| | | | | | |
|---|---|---|---|---|---|
| 8 | y = -3x | | | |  |
| 9 | y = -1.5x | | | |  |
| 10 | y = -2.5x | | | |  |

1. What point does every graph have in common? (_____, _____)
2. Graphs 1-5 are different from graphs 6-10. When the m, the coefficient of x, is positive which way does the line point?

_____

When m, the coefficient of x, is negative which way does the line point?

_____

4. When m is positive which two quadrants does the line appear?

_____

When m is negative which two quadrants does the line appear?

_____

5. As the m value, the coefficient of x, got larger how did the line change?

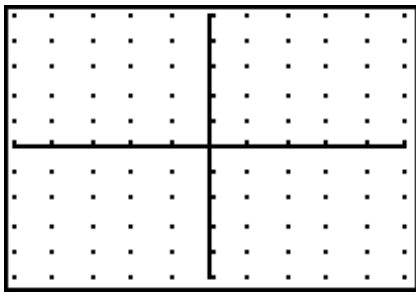
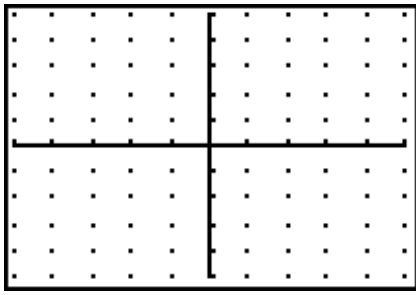
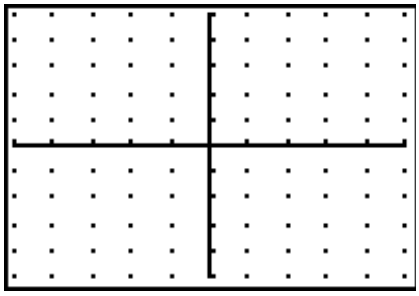
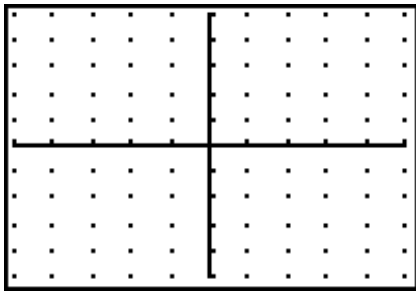
_____

6. As the m value, the coefficient of x, got smaller negatively, how did the line change?

_____

7. Predict how the line will change if the slope, m, is between 0 and 1.

Enter several equation in your calculator and verify your prediction. Complete the table below for four examples

| Problem | Function | Value of slope "m" | What is the graphical meaning of the slope? | Is the graph steeper, flatter, or the same as the graph of y = x? | Sketch of the graph Trace along the graph and label two coordinates on the graph. |
|---|---|---|---|---|---|
| 11 | | | For every change of y in the vertical direction the x changes by 1. | |  |
| 12 | | | | |  |
| 13 | | | | |  |
| 14 | | | | |  |

8. How did the line change as the slope, m, got closer to zero?

_____

_____

9. Predict how the line will change if the slope, m, is 0.

_____

_____

As the value of m changed, did the location of the y-intercept ever change? Explain._____

_____

10. Study the coordinates you labeled on each graph. How do these coordinates reflect the equation the lines represents?

_____

11. Write a sentence that describes your understanding of the value of m in graphing the equation.

_____

_____

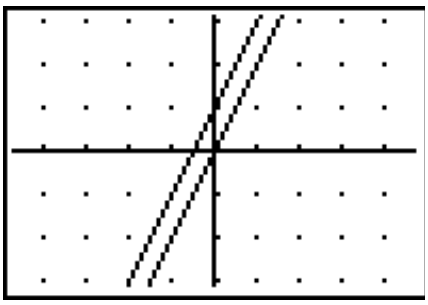
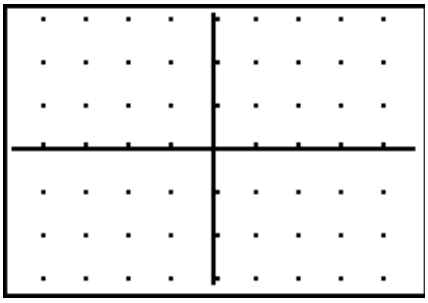
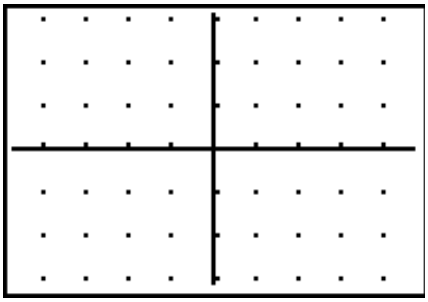
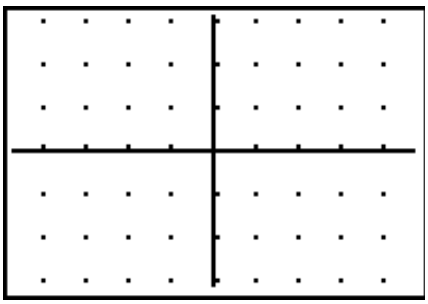
12. For each of the following, write an equation of a line that fits the characteristics. Verify your answer with the calculator.

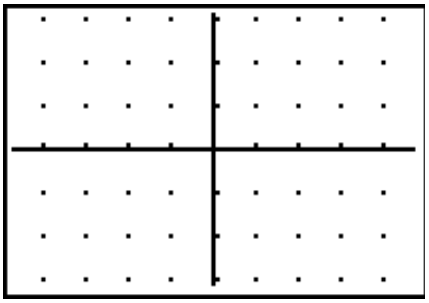
| Condition to be met | Equation | Example of a coordinate on this line |
|---|---|---|
| A line steeper than $y = 3x$. | | |
| A line flatter than $y = -(1/2)x$. | | |
| A line that lies between the graphs of $y = 1.5x$ and $y = (1/2)x$. | | |

# Studying the Graphical Effects of b

Directions: In this lesson you will study how the constant term *a* effects the graph of the line. The first entry has been completed for you.

Part I: Complete the table and then answer questions 1-7 on your answer document

| Problem | Function | Value of b | What is the graphical meaning of the b value? | Sketch of the graph<br>Trace along the graph and label two coordinates on the graph. Each window is a zoom 8. Integer window with xscl=yscl=10 |
|---|---|---|---|---|
| 1 | y = 2x +10 | 10 | |  |
| | and | and | | |
| | y = 2x | 0 | | |
| 2 | y = 2x +20 | | |  |
| 3 | y = 2x - 10 | | |  |
| 4 | y = 2x - 20 | | |  |

| | | | | |
|---|---|---|---|---|
| 5 | y = 2x - 2 | | |  |

1. What do all graphs have in common?

_____

2. How are the graphs different from each other?

_____

3. If b is positive how does it affect the graph?

_____

4. If b is negative how does it affect the graph?How does b affect the tilt or slope of the line?

_____

5. As the value of b gets larger how does it affect the graph?

_____

6. As the value of b gets smaller and closer to zero, how does it affect the graph?

_____

7. As the value of b gets smaller (more negative), how does it affect the graph?

_____

8. If you want to make a line pass through the origin (0,0), what should the equation look like?

_____

Create an equation with the following conditions. After you write the equation graph the equation and confirm that the slope is correct and then give an example of a coordinate on this line.

| Condition to be met | Equation | Example of a coordinate on this line |
|---|---|---|
| A line with a slope of 3 that passes through the y intercept of 5. | | |
| A line with a negative 2 slope that passes through the y intercept of -10. | | |
| A line that has negative slope and a negative y intercept. | | |
| A line that has positive slope and a negative y intercept. | | |

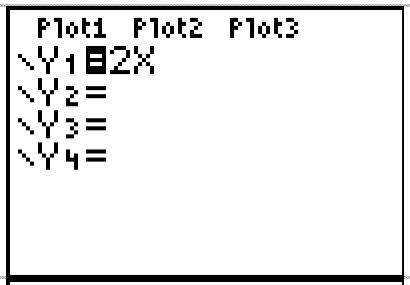
# Guess My Rule

Home

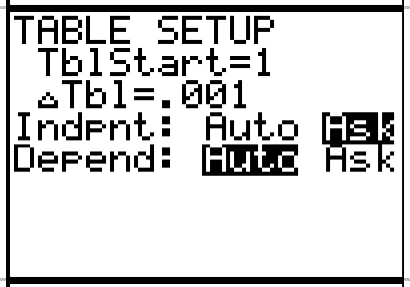
In this activity you will set up the overhead graphing calculator and use it as with a classroom discussion. Students will see an x-y table and step by step you will add numbers to the table. Students will look for pattern in the numbers. The goal is for the students to be able to guess the rule associated with the pattern.

## Set Up Calculator

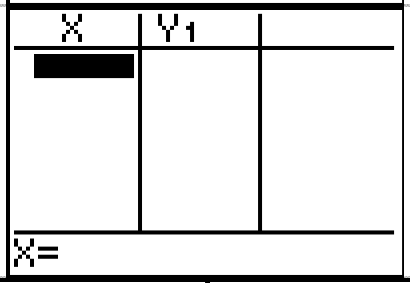
Press Y=. Store an equation in one of the y= slots.



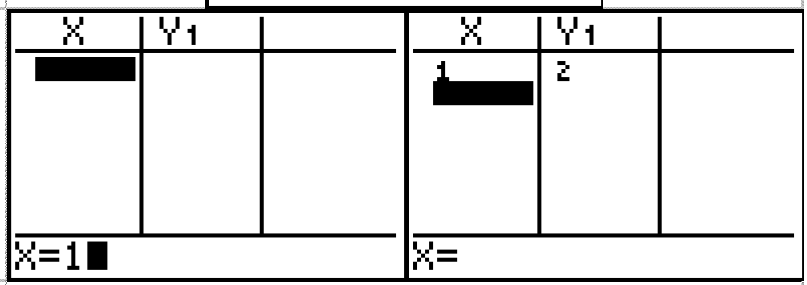

Press 2nd (Window) TblSet. Set the Indpnt to ASK. *It does not matter what the TblStart or ΔTbl is set on.*




Press 2nd (GRAPH) TABLE and you should see an x-y table on the screen with the cursor in the x column waiting for you to enter a number.




Enter any x value and press ENTER. The calculator will place the value in the x column and give you the value for the y based on the equation your entered in Y1.



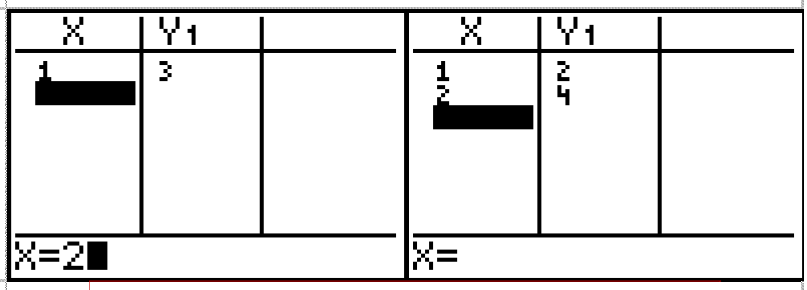

The students can be asked questions about the relationship of 2 to 1.

- How can you make 1 become a 2?
- Is there more than one way to make 1 become a 2?
- How much more is 2 than 1?

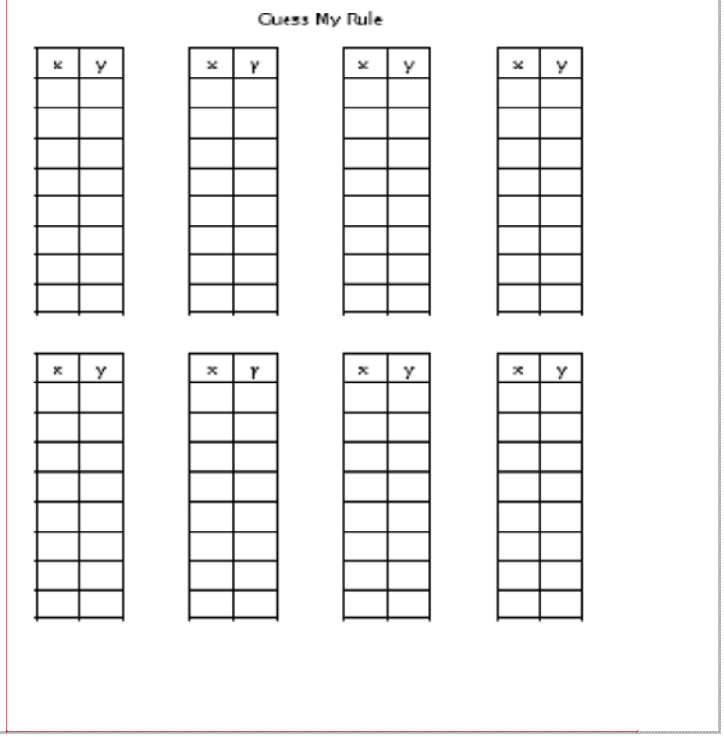
- What rule will make the 1 become a 2?

After students have given several possibilities enter a second number in the x list.

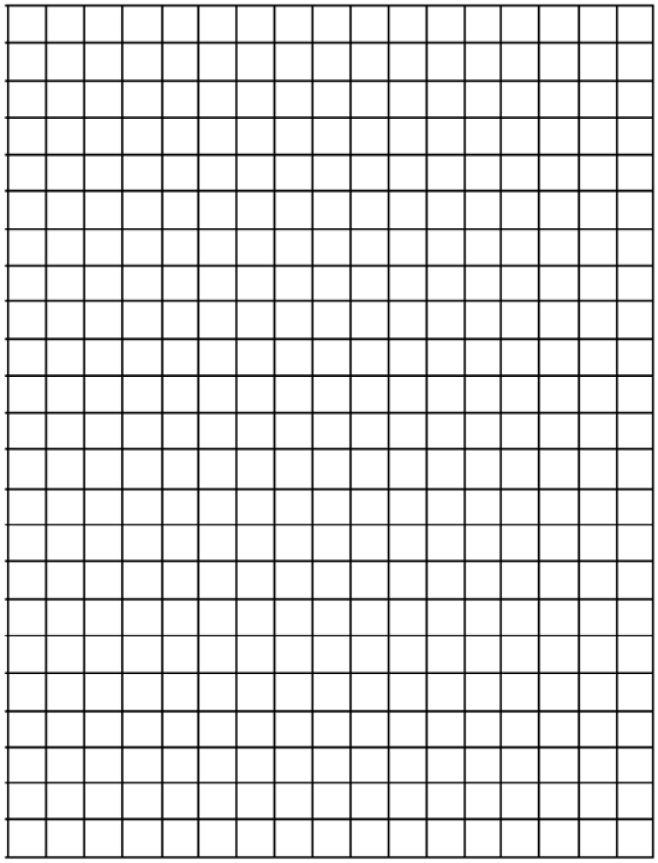
Ask students to think again about a function rule that would make the 1 into a 2.




Students can record the values in a chart at their desks.



As an extension students could also be asked to graph the data as they collect it.



# Which Way Do I Have to Walk?

Lesson Objective: In this activity students will be using the CBR along with the TI-84 to observe the effects of moving away from the CBR, toward the CBR, and not moving at all.

Materials Needed:
1 CBR (Calculator Based Ranger
1 overhead TI84 Calculator or TI84
1 overhead projector
handout for students

Activity: Students will create three types of graphs.

Trial 1:
- Students will stand a minimum of .5 meters from the CBR but not more than 1 meter.
- Students will walk slowly, but steadily, away from the CBR for 15 seconds.
- Students will record a copy of the graph that is produced on the screen.
- Samples can be repeated if necessary.

Trial 2:
- Students will stand about 5 meters from the CBR.
- Students will walk toward the CBR at a slow but steady speed.
- Students will record a copy of the graph that is produced on the screen.
- Samples can be repeated if necessary.

Trial 3:
- Students will stand about 2 meters from the CBR.
- Students will stand still during the data collecting.
- Students will record a copy of the graph that is produced on the screen.
- Samples can be repeated if necessary.

Follow Up: Discussion will take place about the three graphs and students will be asked to think about:
- Why does the plot on Trial 1 go up as it moves from left to right? (Use words "time" and "distance" in your explanation.)
- Why does the plot on Trial 2 appear to be moving downward? (Use words "time" and "distance" in your explanation.)

- Why is the plot on Trial 3 a flat line? (Use words "time" and "distance" in your explanation.)
- Write a short paragraph summing up how the direction in which you move affects the plot of your distance from the CBR with respect to time?

Extension of Activity:

- Combine the three graphs into one graph
- First have the students predict what a graph would look like if a student starts close to the CBR, walk away slowly but steadily, for 3 seconds, STOP for 3 seconds, and then walk toward the CBR slowly and steadily. They should first draw a picture and then support why they have drawn their particular picture.
- Check the graph by doing the motion with the students.
- Have students think about other graphs.
- When have they seen a graph that goes UP?
- When have they seen a graph that goes DOWN?
- When have they seen a graph that is horizontal?

# Recursive Sequences

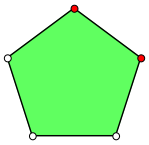


Figure 1

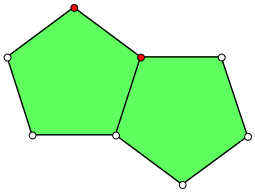


Figure 2

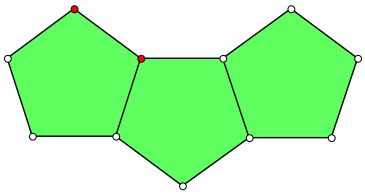


Figure 3

Consider the sequence of pentagons where each side equals 1 unit and the area of each pentagon is 1.73 square units.

Complete the table for five figures.

| Figure Number | Perimeter | Number of Toothpicks | Area |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |

- Write a recursive routine for the perimeter.
- Write a recursive routine for the area of the pentagons.
- Write a recursive routine for the number of toothpicks.
- Find the perimeter of Figure 10.
- Which figure has a perimeter of 47?
- Which figure has an area of at least 34 square units.
- Find the number of toothpicks needed for Figure 12.
- Which figure contains 53 toothpicks?