

### Activity Overview

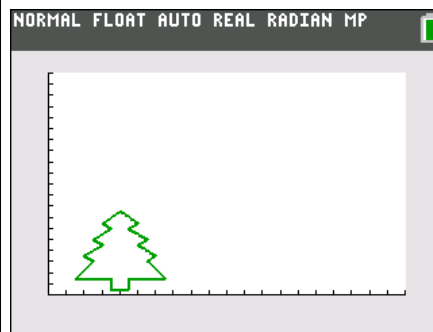
In this activity, students will discover how pictures formed by graphing ordered pairs can be stretched (and shrunk) by multiplying (and dividing) the coordinates.

### Topic: Geometry & Measurements

- Ordered pairs, graphing ordered pairs
- Dilations

### Teacher Preparation and Notes

- Prior to this activity, students should have had some experience with coordinate graphing and understand the difference between  $x$ - and  $y$ -axes and how to list an ordered pair
- Copies of the tree (page 7 of this document) and the student worksheet should be provided to students.
- **To download the data lists and student worksheet, go to [education.ti.com/exchange/cbme](http://education.ti.com/exchange/cbme)**



**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:

- Changing\_Before\_My\_Eyes\_Student.pdf
- Changing\_Before\_My\_Eyes.doc
- L1.8xl, L2.8xl

#### 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.

Before beginning the activity, the lists, L1 and L2 need to be transferred to the students' calculators or students need to store the numbers given on the worksheet into list L1 and L2.

If you choose to have students store the numbers manually, they need to press **[STAT]** **[ENTER]** to access the List Editor. Students should enter the  $x$ -coordinates in order into L1 and the  $y$ -coordinates in order into L2.

NORMAL FLOAT AUTO REAL RADIAN MP					
L1	L2	L3	L4	L5	1
8	15	-----	-----	-----	
6	13				
7	12				
5	10				
6	9				
4	7				
5	6				
3	3				
7	3				
7	1				
9	1				

L1={8,6,7,5,6,4,5,3,7,7,9,9}

### Part 1 – Creating the Original Image

In this lesson, students will identify coordinate pairs and graph them on the TI-84 Plus to explore the transformation of an image.

#### Question 1

Students will need to identify and record the coordinates of the points marked on the graph.

#### Questions 2–4

Have students think about how they could transform the graph based on changes they could make to the  $x$ -coordinates and/or the  $y$ -coordinates. You can use the original graph as a transparency to plot some modified points for students to see what happens.

#### Question 5

After students have discussed what they think will happen with modifications, have them enter the original lists into L1 and L2.











To enter the lists, press **[STAT]** and select **1:Edit....** If there are already values in L1 or L2, move to the top of the list and press **[CLEAR]** **[ENTER]** to empty the list before starting.

**Note:** Lists L1 and L2 are provided if you would prefer to send the lists to students using the unit-to-unit link cable. (or TI-Connect).

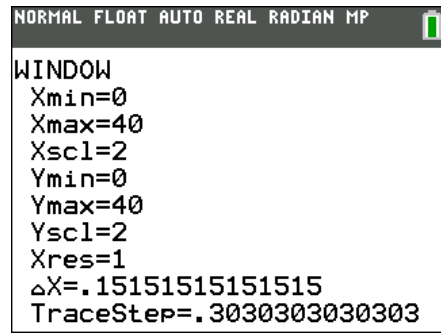
To setup the STAT PLOT press **[2nd]** **[STAT PLOT]** and configure as shown.

NORMAL FLOAT AUTO REAL RADIAN MP					
L1	L2	L3	L4	L5	1
8	15	-----	-----	-----	
6	13				
7	12				
5	10				
6	9				
4	7				
5	6				
3	3				
7	3				
7	1				
9	1				

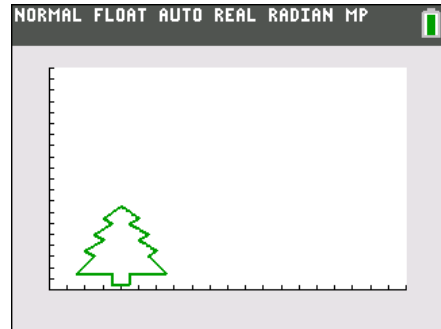
L1(1)=8

NORMAL FLOAT AUTO REAL RADIAN MP					
PRESS $\leftarrow$ TO SELECT AN OPTION					
Plot1	Plot2	Plot3			
On	Off				
Type:					
Xlist:	L1				
Ylist:	L2				
Mark:					
Color:	GREEN				

A suggested window is shown at the right. This is chosen because you will be doubling both the  $x$ -coordinates and the  $y$ -coordinates. Other windows can be used if the class decides on something different.



Press **GRAPH** to view the tree.



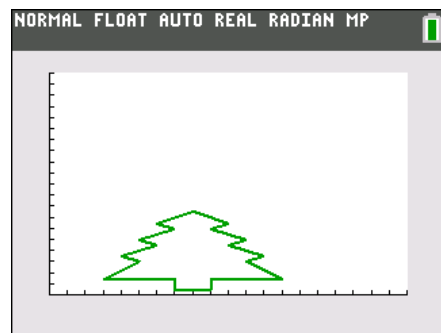
**Part 2 – Changing  $x$ -values**

After graphing the original image, students will begin by changing the  $x$ -values of the coordinate pairs. Students make predictions about the dilation and then graph to confirm.

Questions 6–9

Move to the top of L1. The entry line should read “L1 = {8, 6, 7, 5, 6, 4...”. To double the  $x$ -values, press **2nd** **[LIST]** **1** **×** **2** **ENTER**.

After you have doubled the  $x$ -values, press **GRAPH** to see the dilated graph.



**Part 3 – Changing  $y$ -values**

Next, students will change the  $y$ -values of the image and see what happens. Before doing this, they will need to return L1 ( $x$ -values) to the original amounts. Move the cursor to the top of L1 again and divide L1 by 2.

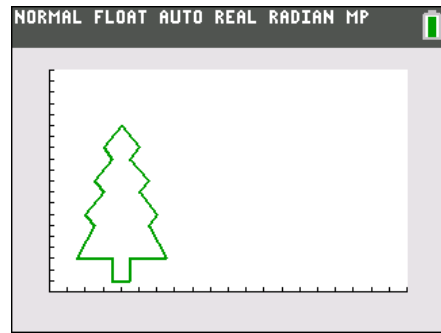
Questions 10–12

Move to the top of L2. The entry line should read “L2 = {15, 13, 12, 10...”. To double the  $y$ -values, press **2nd** **[LIST]** **2** **×** **2** **ENTER**.

After students have discussed what they think will happen, press **[GRAPH]** to see the dilated figure.

Questions 13–14

You can let students continue to modify the lists and explore what happens with each type of modification. If they multiply by something less than 1, what happens?



**Solutions – student worksheet**

**Part 1**

1. Write the coordinates all of points on the original tree.

**Answer:** (8, 15), (6, 13), (7, 12), (5, 10), (6, 9), (4, 7), (5, 6), (3, 3), (7, 3), (7, 1), (9, 1), (9, 3), (13, 3), (11,6), (12, 7), (10, 9), (11, 10), (9, 12), (10, 13), (8, 15)

2. How do you think we can make the tree taller?

**Answers will vary. Check students' answers.**  
**Answers should reflect multiplying the y-values by a number greater than 1.**

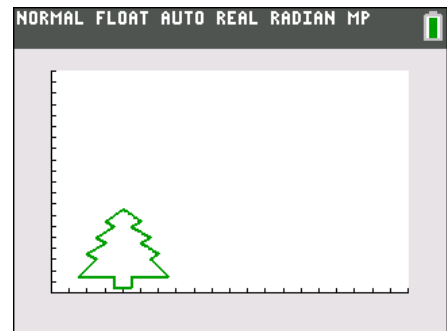
3. How do you think we can make the tree shorter?

**Answers will vary. Check students' answers.**  
**Answers should reflect multiplying the y-values by a number between 0 and 1.**

4. What do you think would happen if we doubled all the x-coordinates?

**Answer will vary. Students should indicate that doubling the x-values will make the tree wider.**

5. Draw the tree as best you can at the right. **Answer:**



**Part 2**

6. First, let's change the x-values by doubling all the numbers. To do this, press **[STAT]** and select **1:Edit...**, and then move to the top of L1. Then, press **[2nd] [LIST] [1]** to select L1, **[x] [2]** to multiply by 2, and **[ENTER]** to execute the command. How did all the values in the list change?

**Answer: Students should indicate that all the x-values doubled.**

7. Predict how the graph of the tree will change.

**Answer: Predictions will vary. Students should state that the tree will be wider than before.**

9. If your prediction in Question 7 was not correct, how did the graph change?

**Answers will vary.**

### Part 3

10. Predict how the graph of the tree will change.

**Answer: Predictions will vary. Students should state that the tree will be taller than before.**

12. If your prediction in Question 10 was not correct, how did the graph change? **Answers will vary.**

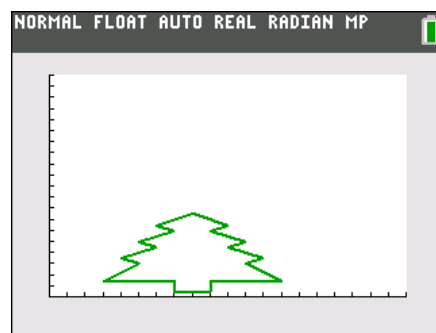
13. If you divide the original lists by 2, what do you predict will happen?

**Answer: Students should realize that the graph would be half as tall and half as wide.**

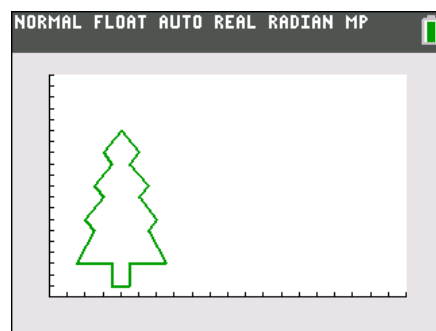
14. How would you make the tree both taller and wider?

**Answer: Multiply each list by something greater than 1 at the same time.**

8. Press **[GRAPH]** to see the new tree. Draw it at the right. **Answer:**



11. Press **[GRAPH]** to see the new tree. Draw it at the right. **Answer:**





Graph of Original Tree

