EXPLORATIONS

Activity 5

Do You See What I See?

Students will discover how pictures formed by graphing ordered pairs can be stretched (and shrunk) by multiplying (and dividing) the coordinates.

Activity

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.

Show the transparency of the tree to the students. Ask them:

♦ *How can we make the tree taller? (By increasing the y values. For example, multiply each y value by 2.)*

♦ *How can we make the tree shorter? (By decreasing the y values. For example, divide each y value by 2.)*

♦ *What would happen if we doubled the x-coordinates? (The tree would be wider.)*

Give students a copy of the original tree drawing and a Student Activity sheet. Have them list the ordered pairs in order, and then have them enter the coordinates in the calculator. This will need to be done in list format. The x-coordinates should be entered in one list and the y-coordinates in a second list. They need to be entered in the order that they would be drawn. (For the calculator to make a connected drawing, students will have to enter ordered pair **A** into the calculator at the beginning and end of the lists.)

To enter items in a list:

1. Clear the Home screen and press LIST.

2. If there are existing lists, press ▶ to move to the first unused list and enter the x-coordinates in order, pressing ENTER after each entry.

3. Move to the next list and do the same for the *y*-coordinates.

   In the illustration on the previous page, Lists 1 and 2 are used.

To create a plot of the lists:

Tip: You must have the same number of entries in both L1 *and* L2 *in order to plot. Otherwise, you will get ERR: DIM MISMATCH when you try to graph.*

1. Before plotting the ordered pairs on the calculator, make sure that only **Plot 1** is on. Press [2nd] [PLOT] and see if Plots 2 and 3 are off. If not, select **4:PlotsOff** and press [ENTER].

2. To graph the tree, press [2nd] [PLOT] and choose **Plot 1** by pressing [ENTER].

3. Select **On** and press [ENTER]. Press [▼] to move to type, use the arrow keys to choose the connected line graph, and press [ENTER]. Move down to **Xlist** and choose the list that your *x*-coordinate data is in by pressing [2nd] [STAT], moving to your list, and pressing [ENTER]. Do the same for **Ylist**. Move down to **Mark**, choose the third mark (the small dot), and press [ENTER].
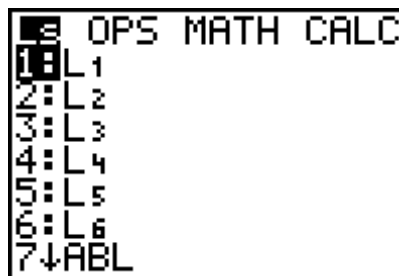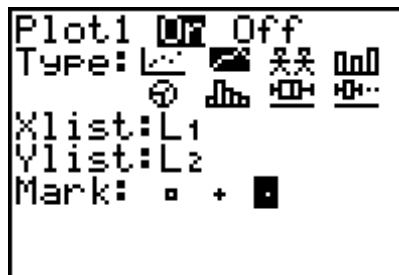
Tip: You can use the first mark to make the tree look like it has ornaments on it.

4. In order to see the entire tree on the calculator, you need to set the viewing window before graphing. Press [WINDOW] and discuss with students what the **Xmin**, **Xmax**, **Ymin**, and **Ymax** values should be.

*Tip: Do not change the* **Δ X =** *value. The calculator adjusts this value automatically. Leave* **Xscl** *and* **Yscl** *at 1. These determine the distance between tick marks on the graph. To turn off the tick marks, set* **Xscl** *and* **Yscl** *at 0.*

5. Since the highest *x* value is 13 and the highest *y* value is 15, and the coordinates will be doubled, the window settings shown at the right are suggested. We chose large values for **Xmax** and **Ymax** because we want to investigate what happens when we double the values of the coordinates.
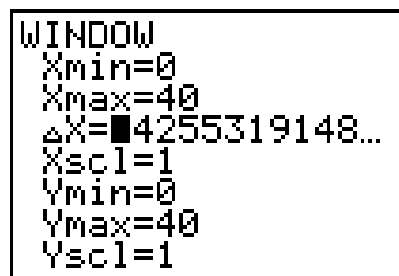
Tip: If you want everyone's graph to look the same, have all students use the same window values.

6. Press GRAPH to see the connected coordinate graph. Use the TRACE key to explore the graph. Press ▶ repeatedly to highlight points on the graph in the order they were entered in the lists. Press ◀ to move back through the points.
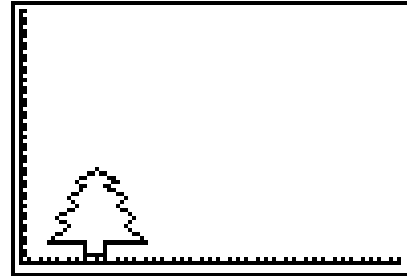
Now the students can begin exploring changing the shape of the tree by changing the coordinates.

1. To change the coordinates, you need to get back to the original list that the data is in. Press LIST and use the arrows to move to the top of the list containing the x-coordinates. (Make sure your cursor is on the list name, not inside the list). If, for example, you wanted to see what the tree would look like if the x-coordinates were doubled, press 2nd [STAT], choose **L1** (the list containing the x-coordinates), multiply by 2, and press ENTER. This will multiply every x-coordinate in **L1** by 2.

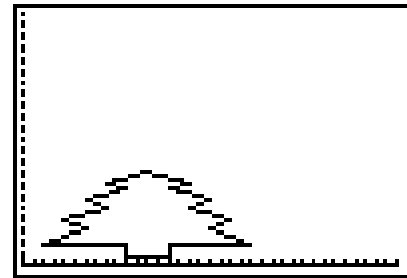Have students predict and explain what will happen to the shape.

2. Press GRAPH to see the changes.

Have the students continue to experiment with changing the shape of the tree by changing the y-coordinates. Have the students record on the Student Activity sheet how the shape of the tree changes each time.

(Press ZOOM **7:ZoomStat** to see the view shown at the right.)

If students want to return to the original shape, they need to think of how to "undo" the change they made to the coordinates. For example, if the values in **L1** have been multiplied by 2, now they could be divided by 2 to return to the original values.
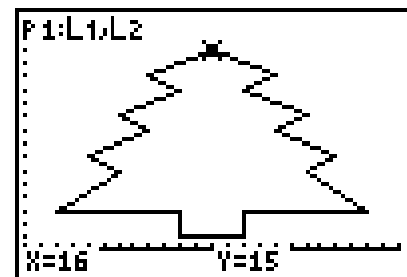
Wrap-Up

Ask students these questions:

♦ *What made the tree tall and narrow? (For example, doubling the x-coordinates but leaving the y-coordinates.)*

♦ *What made the tree short?*

♦ *What made the tree wider?*

Assessment

Use another set of ordered pairs to create a picture on the calculator. Have students alter the graph in some way and then give it to a partner to see if the partner can determine how they changed the graph.

Extension

♦ Have students make a drawing of themselves on graph paper using ordered pairs by measuring their arms, legs, trunk, head, and so forth, and scaling it down to graph paper. Then have them explore by shrinking themselves or making themselves taller using the TI-73.

Name _____

Date _____

Activity 5

Do You See What I See?

List the ordered pairs for the original tree.

A (,   )   K (,   )

B (,   )   L (,   )

C (,   )   M (,   )

D (,   )   N (,   )

E (,   )   O (,   )

F (,   )   P (,   )

G (,   )   Q (,   )

H (,   )   R (,   )

I (,   )   S (,   )

J (,   )   A (,   )

1. Changing the x- and y-coordinates:

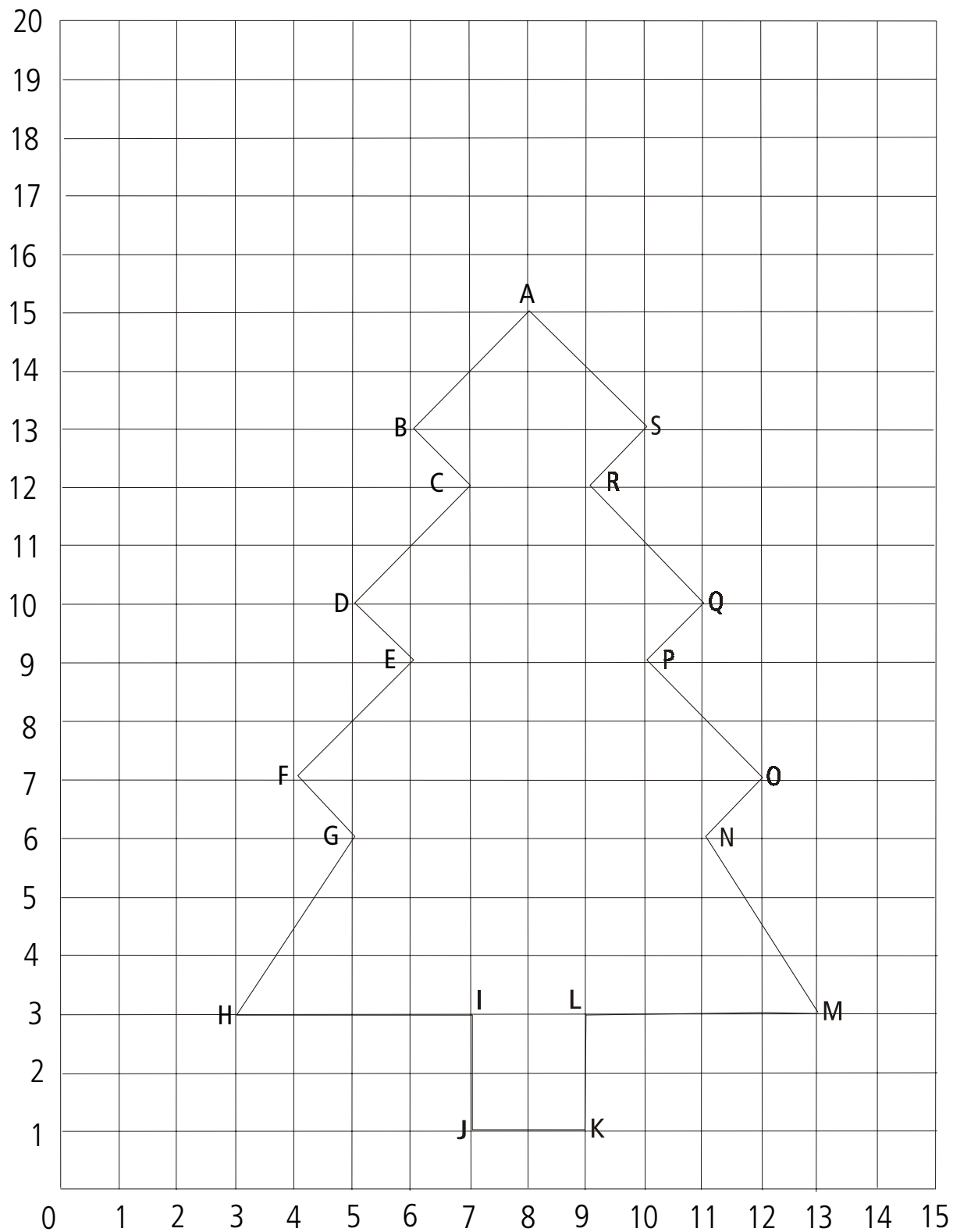   When I _____ the *x* values, the graph changed by _____.

   When I _____ the *y* values, the graph changed by _____.

2. What made the tree tall and narrow?

   _____

3. What made the tree short?

   _____

4. What made the tree wider?

   _____

Tree Graph