Movin' and Changin'

ID: 12217

Time required
45 minutes

Activity Overview

In this activity, students investigate transformation, slides and scaling, of a triangle using lists. They will add, subtract and multiply numbers to the list and describe the changes that have occurred. Students are to make the connection between changing the x- or y-values and the transformation.

Topic: Geometry

- *Transform shapes using lists*
- *Describe informal transformations such as slides and scaling*

Teacher Preparation and Notes

- *TI-Navigator is not required for this activity, but an extension is given for those teachers that would like to use it.*
- *Students should already be familiar with entering data in lists and setting up stat plots.*
- ***To download the student worksheet and TI-Navigator files, go to education.ti.com/exchange and enter "12217" in the quick search box.***

Associated Materials

- *MGAct18_Movin_worksheet_TI73.doc*
- *MGAct18_Nav01_Triangle_TI73.act*
- *MGAct18_Nav02_Quad1_TI73.act*
- *MGAct18_Nav03_Quad3_TI73.act*
- *MGAct18_LrnChk_TI73.edc*

Suggested Related Activities

To download the activity listed, go to education.ti.com/exchange and enter the number in the quick search box.

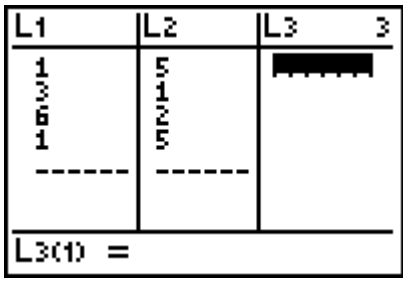
- *Reflections (TI-73 Explorer with TI-Navigator) — 6686*
- *Transforming "F" on the Coordinate Plane (TI-73 Explorer) — 8039*
- *Flipping Over the Coordinate Plane (TI-73 Explorer) — 6685*

Problem 1 – Move Those *x*'s

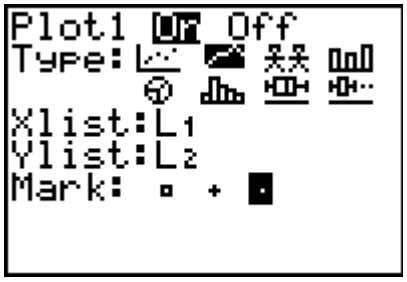
In Problem 1, students enter two lists of numbers (coordinates) and look at reflecting a figure along the *x*-axis. Help students see the pattern in *x*-values with the given transformations.

Questions 1-2

To enter the data, press [LIST]. Enter the *x*-coordinates in L1 and the *y*-coordinates in L2. If there is already data in the lists, return to the Home screen and press and [2nd] [0], select **ClrAllLists**, and press [ENTER]. The return to the lists.

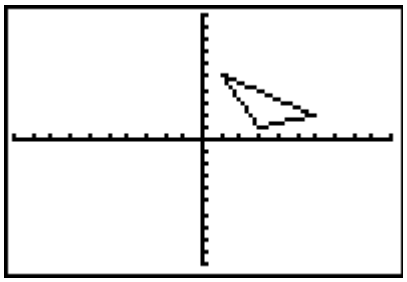


After entering the coordinates, press [2nd][Y=]# [ENTER]# to set up **Plot1**. Notice that the Type is set to instead of the typical . This will connect the points to form the figure. Set up **Plot2** in a similar manner replacing L1 with L3 and L2 with L4.

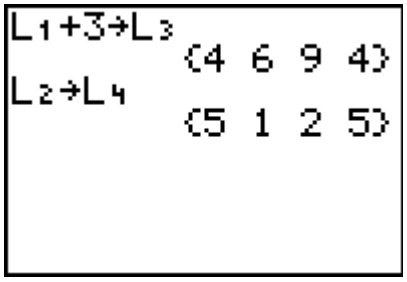


Note: To enter the names of the lists (L1, L2, L3, L4), press [2nd] [LIST] and select the appropriate name.

Students may notice that the figure is a triangle which has only 3 vertices, but the lists show 4 points. Explain to them that one 2 coordinates are the same. One vertex is repeated so the plot could draw the sides of the triangle.

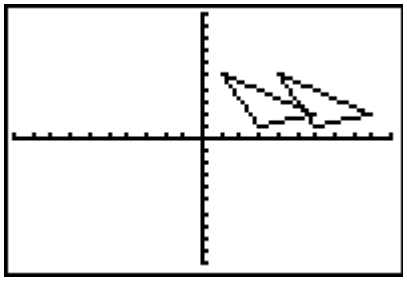


On the Home screen, students will transform the lists. To perform the calculations for Exercise 1, press the following: [2nd] [LIST] [1] [+] [3] [STO▶] [2nd] [LIST] [3] [ENTER] and [2nd] [LIST] [2] [STO▶] [2nd] [LIST] [4] [ENTER].This will change translate the elements in L1 and store them in L3 and store L2 without change into L4. Students need to view the graph before entering the commands for Exercise 2.



Questions 3-5

Students should recognize that the *x*-values changed by the amount added or subtracted. They should see the effect on the figure, shifting left or right. If needed, you can give students additional translations for deeper understanding.

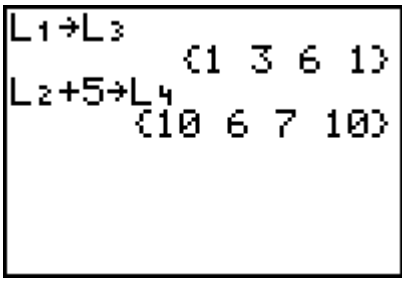


Problem 2 – Move Those *y*'s

In Problem 2, students look at changing the *y*-values of coordinates and the resulting translation.

Questions 6-7

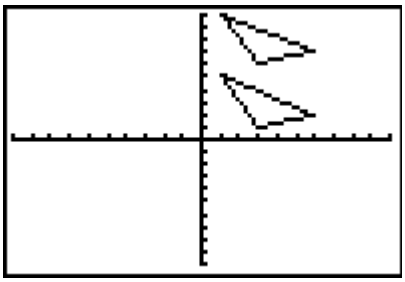
The same lists are used from Problem 1. In this set of exercises, students will be manipulating the *y*-values to see the resulting translation.



Keystrokes for the Home screen calculations are very similar to Exercises 1 & 2. This time, L2 is being adjusted before storing to L4. Be sure to discuss the translation with students after viewing the graph for Exercise 6 and then again after viewing the graph for Exercise 7.

Questions 8-10

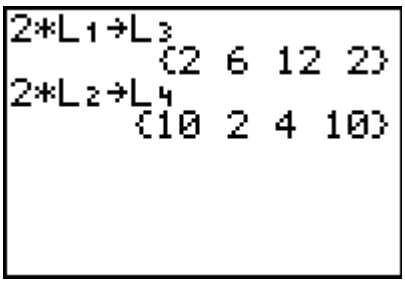
Students should recognize that the *y*-values are changed by the number added or subtracted. They should also see the shift up or down of the triangle.



Problem 3 – Change That Shape

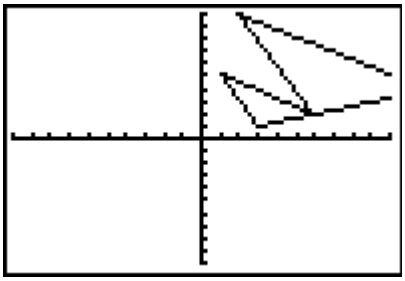
Questions 11-12

Students will again use the Home screen to perform the translation of the lists. Unlike the previous problems, both the *x*- and *y*-values will change, multiplied by a scale factor. When entering the fraction in Exercise 12, students need to use parentheses.



Questions 13-15

Students should observe that each *x*-value and *y*-value doubles when multiplied by 2 and is halved when multipled by $\frac{1}{2}$. They should also see that the triangle doubles its size or halves its size. It is important that students understand that the figure will get smaller or bigger in size when *both* the *x*- and *y*-values are multiplied by the *same* scale factor.



Solutions – student worksheet

Problem 1

1. See worksheet for sketch.
2. See worksheet for sketch.
3. The *x*-values increased or decreased by 3.
4. The triangle moved to the right or left by 3.
5. The figure shifts along the *x*-axis by the number added or subtracted.

Problem 2

6. See worksheet for sketch.
7. See worksheet for sketch.
8. The *y*-values increased or decreased by 3.
9. The triangle moved to up or down by 3.
10. The figure shifts along the *y*-axis by the number added or subtracted.

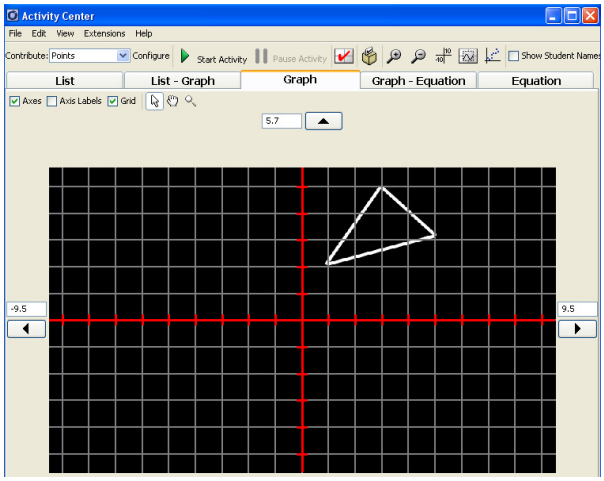
Problem 3

11. See worksheet for sketch.
12. See worksheet for sketch.
13. Both the *x*-values and *y*-values doubled or halved.
14. The triangle doubled or halved in size.
15. The figure increases or decreases in size.

Extension – TI-Navigator™

1. Throughout the lesson, use **Screen Capture** to check student work. **Quick Poll** can also be used to gauge the class understanding of translations. You could ask students give a specific coordinate of the new figure before they actually display the translated figure. For example, after completing Exercises 1 and 2, you could ask students where the top point would end up if you added 6 to L1.

2. Load the ***MGAct18_Nav01_Circle_TI73.act*** activity settings file. This will bring up a triangle similar to the one used in Exercise 1. Divide students into 3 groups. (count off 1, 2, and 3 and repeat) Each group will be assigned one vertex of the triangle. They should move their cursor the "direction" given by you. For example, say "Perform the translation $x + 2$". Students should shift their vertex to the right 2 places and submit that point.



   If any of the points are off, you can click **View** and select **Individualize Student Cursors** from the dropdown menu to see that particular student.

   Repeat with several different "directions". You may even want to allow one of the students to call out a translation and then have the class move the triangle accordingly. Have groups switch vertices occasionally too.

   After doing this several times with the *x*-values, switch to adjusting the *y*-values. Then, go between *x* and *y* translations to ensure students understand when the figure shifts left and right and when it shifts up and down.

3. Load the ***MGAct18_Nav02_Quad1_TI73.act*** activity settings file. This will configure the Activity Center for each student to input 3 points. Begin the activity, and have students translate the triangle as directed by you ($x+2$ or $y-4$ for example). After students have submitted their points, you can look at an individual student's triangle by clicking on the points that they submitted.

4. Repeat step 3 with ***MGAct18_Nav02_Quad3_TI73.act***. This positions the original triangle in Quadrant III so students can work with translating negative *x*- and *y*-values.

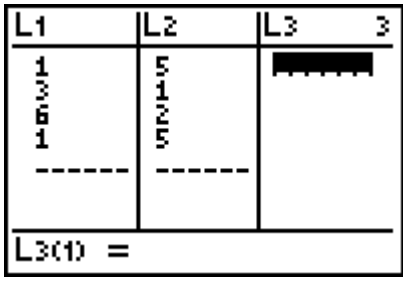
5. Use ***MGAct18_LrnChk_TI73.edc*** to assess student understanding of the materials covered.

Problem 1 – Move Those *x*'s

Press [LIST] to enter the numbers shown at the right. Use the arrow keys to move from one list to another.

List L1 represents the *x*-values.

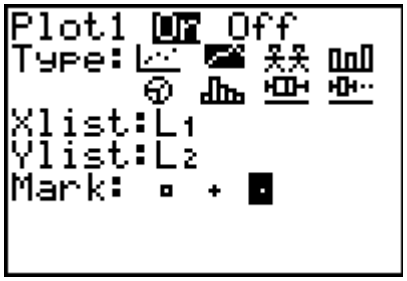
List L2 represents the *y*-values.



Press [2nd] [Y=] and select **Plot1**. Match the settings as shown at the right.

Press [ZOOM] and select **ZStandard** to view the graph.

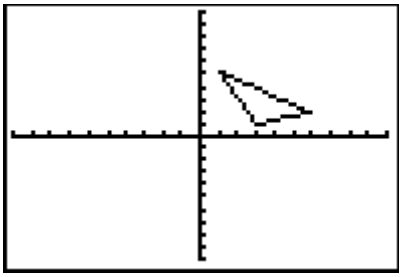
Press [2nd] [Y=] again and select **Plot2**. Use the same settings as Plot1, but for **Xlist** select L3 and for **Ylist** select L4.



Press [2nd] [MODE] to return to the home screen. For Exercises 1 and 2, enter both expressions and then press [GRAPH]. Sketch the graph. To enter the arrow, press [STO▶].

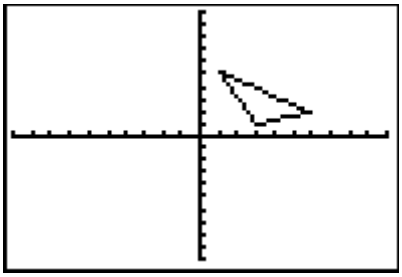
1. L1 + 3 → L3

L2 → L4



2. L1 – 3 → L3

L2 → L4



3. How did the *x*-values change? _____

_____

4. How did the triangle move? _____

_____

5. What happens when a number is added to or subtracted from the *x*-values of a figure? _____

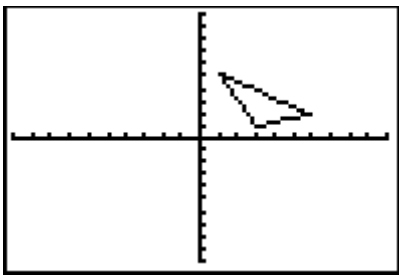
_____

Problem 2 – Move Those *y*'s

Return to the home screen. For Exercises 6, 7, 11, and 12 enter both expressions and then press GRAPH. Sketch the graph.

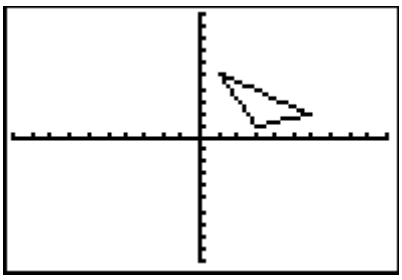
6. $L1 \rightarrow L3$

$L2 + 5 \rightarrow L4$



7. $L1 \rightarrow L3$

$L2 - 5 \rightarrow L4$



8. How did the *y*-values change? _____

9. How did the triangle move? _____

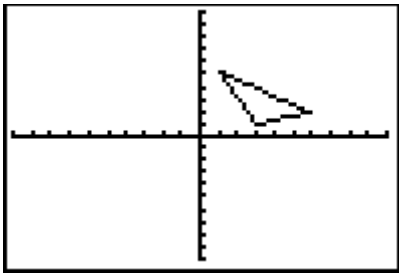
10. What happens when a number is added to or subtracted from the *y*-values of a figure? _____

_____

Problem 3 – Change That Shape

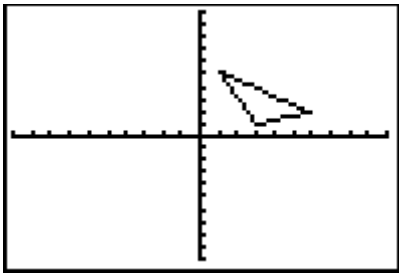
11. $2 * L1 \rightarrow L3$

$2 * L2 \rightarrow L4$



12. $\frac{1}{2} * L1 \rightarrow L3$

$\frac{1}{2} * L2 \rightarrow L4$



13. How did the *x*-values and the *y*-values change? _____

_____

14. How did the triangle change? _____

_____

15. What happens when a number between 0 and 1 or greater than 1 is multiplied by the *x*- and *y*-values of a figure? _____

_____