Reflections of Points and Figures
ID: 12136

Time required
45 minutes

Activity Overview

In this activity, students review basic geometry vocabulary while investigating reflections on a coordinate grid.

Topic: Geometry

- *Apply transformations and use symmetry to analyze mathematical situations*
- *Describe sizes, positions, and orientations of shapes under informal transformations such as flips, turns, 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 be familiar with entering data in lists and creating scatter plots.*

- ***To download the student worksheet and TI-Navigator files, go to education.ti.com/exchange and enter "12136" in the quick search box.***

Associated Materials

- *MGAct17_Reflections_worksheet_TI73.doc*

- *MGAct17_Nav01_TI73.act*

- *MGAct17_Nav02_TI73.act*

- *L3.73l*

- *L4.73l*

Suggested Related Activities

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

- *Flipping over the Coordinate Plane (TI-73 Explorer with TI-Navigator) — 6685*

- *Reflections (TI-73 Explorer with TI-Navigator) — 6686*

- *Reflecting Objects (TI-73 Explorer with GeoBoard App) — 5229*

- *Mapping a Leaf (TI-73 Explorer) — 4019*

Problem 1 – Where Did All the *y*'s Go?

Questions 1-3

Students should begin to see the pattern of reflecting a point over the *x*-axis and *y*-axis.

If you want to give students additional points for practice, you can enter a new point on the graph, follow these key presses. [LIST] [ENTER] and enter the *x*-coordinate in L1 and the *y*-coordinate in L2 (or other lists of your choice). Then display the scatter plot again by pressing [GRAPH].

As a class challenge, you could use the overhead calculator, plot a point, and have students "race" to find the reflection given verbally by you. For example, call two students to the front of the class. Plot (1, 5) and display the graph. Call out a reflection, such as "over the *x*-axis" and the student that places their finger on the correct location first wins.
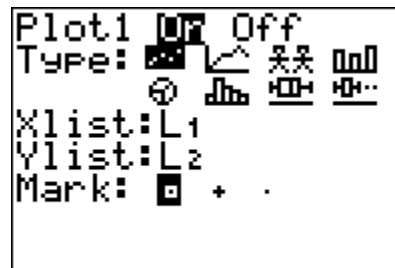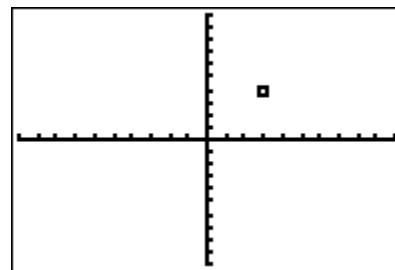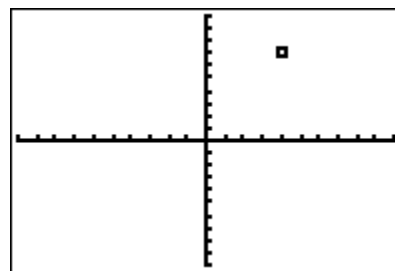
Problem 2 – Explore *x*-Coordinate in Reflections

Questions 4-6

Now students concentrate on what happens to the *x*-coordinate during reflections over both the *x*-axis and the *y*-axis.

Again, follow extensions ideas in Problem 1 for the *x*-coordinate reflections as well.

Students should realize that the *x*- and *y*-coordinates behave oppositely when reflected over the same axis. For example, when a point is reflected over the *x*-axis, the *y*-value changes sign (either positive to negative or vice versa) but the *x*-coordinate remains the same. The same happens for a reflection over the *y*-axis. The *y*-coordinate remains the same when reflected over the *y*-axis but the *x*-coordinate changes sign.

Problem 3 – Reflecting Figures over the *x*- and *y*-axes

Questions 7-9

In each question, students should enter the lists given, create a scatter plot and display the graph.

For Question 7, press [LIST] and move to L1. If there is data in L1 and L2, move to the header of L1 and press [CLEAR] [ENTER]. Do the same for L2 if there is data in L2.
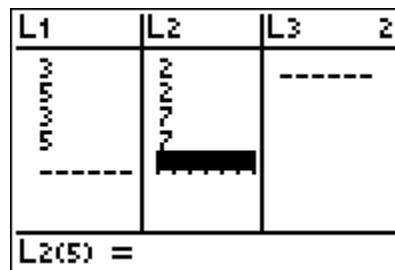
Then, move the cursor back to row one of L1. Press [3] [ENTER] [5] [ENTER] [3] [ENTER] [5] [ENTER]. Move to L2 by pressing [▶]. Enter the data for L2, [2] [ENTER] [2] [ENTER] [7] [ENTER] [7] [ENTER].

Turn on Stat Plot 1 by pressing ⌈2nd⌉ ⌈Y=⌉ ⌈ENTER⌉. Press
⌈ENTER⌉ to select ON. Make sure Xlist is L1 and Ylist is
L2. Then press ⌈ZOOM⌉ and select **ZStandard**.

If you use TI-Navigator, each pair of lists could quickly be
sent to students so they could easily create the images
on their calculator.

Plot1 On Off
Type: ▣ ⌁ ⩊ ⊞
       ⊙ ⊞ ⊞ ⊞
Xlist:L₁
Ylist:L₂
Mark: ▣ + ·

Question 7 – Rectangle   Question 8 – Hexagon   Question 9 – Letter "L"

Students can enter the new L1 and L2 into lists L3 and L4 and then create a second plot of L3
vs. L4 to verify that they have correctly reflected the figure.

Question 10

With this question, students should realize that a reflection over both axes will create a
change in sign for both the *x*-coordinate and the *y*-coordinate.

Solutions – student worksheet

Problem 1

1. Original: (3, 4)   *y*-axis reflection: New: 4, no change

    x-axis reflection: New: –4, *y*-coordinate is now negative

2. Original: (–5, 3)   *y*-axis reflection: New: 3, no change

    x-axis reflection: New: –3, *y*-coordinate is now negative

3. *y*-coordinate changes sign when reflected over the *x*-axis; *y*-coordinate remains the same
    when reflected over the *y*-axis.

Problem 2

4. Original: (4, 7)   *y*-axis reflection: New: –4, *x*-coordinate is now negative

    x-axis reflection: New: 4, no change

5. Original: (–2, –4) *y*-axis reflection: New: 2, *x*-coordinate is now positive

    x-axis reflection: New: –2, no change

6. *y*-coordinate changes sign when reflected over the *x*-axis; *y*-coordinate remains the same
    when reflected over the *y*-axis.

Problem 3

7. R1: New L1: {-3, -5, -3, -5} New L2: {2, 2, 7, 7}

    R2: New L1: {3, 5, 3, 5} New L2: {–2, –2, –7, –7}

8. R1: New L1: {–3, –6, –1, –8, –3, –6} New L2: {2, 2, 4, 4, 6, 6}

    R2: New L1: {3, 6, 1, 8, 3, 6} New L2: {–2, –2, –4, –4, –6, –6}

9. reflection over both axes: L3: {–3, –3, –4, –6, –4, –6} L4: {–8, –2, –8, –2, –4, –4}

10. both coordinates change sign with a reflection over both axes

Extension – TI-Navigator^{TM}

1. Use TI-Navigator to send any lists of coordinates used in the activity to students. This will eliminate any error created by students entering data individually into lists.

2. Screen capture can be used to ensure students have generated the correct figures in Exercises 7-9.

3. Load **MGAct17_Nav01_TI73.act** into Activity Center. This sets up the Activity Center so that the students will have two lists: X and Y.

Place students in groups. Have each group create a shape with as many vertices as group members, using only one calculator to enter the data. Give restrictions such as: this shape must be regular, or this shape must have a right angle.

Have each group member enter the coordinates of one vertex in the X and Y lists and submit them to Activity Center. Once the data is submitted, hide all the data. Then display the points of one group at a time by highlighting the name of the person logged in for a specific group. Discuss each group's results with the entire class, giving specific emphasis to any patterns within the points themselves.

4. After students have created original images in Part 1, load **MGAct17_Nav02_TI73.act** into Activity Center. This sets up Activity Center so that students will have four lists: the original X, and Y that they entered, plus an additional RX and RY, which will be where the students will enter the coordinates of the point after it has been reflected.

Tell students to write the points of the vertices so that the new shape is the reflection of the old shape. Tell them which axis to reflect across.

Display individual group results as you did in Part I above.

Discuss each group's results with the entire class, giving specific emphasis to any patterns within the points themselves. For example, students should recognize that $(x, –y)$ is the reflection of (x, y) over the *x*-axis.