Transformations With Lists

ID: 10278

Time required
40 minutes

Activity Overview

Students will graph a figure in the coordinate plane. They will use list operations to perform reflections, rotations, translations and dilations on the figure, and graph the resulting image using a scatter plot.

Topic: Transformational Geometry

- *Perform reflections, rotations, translations and dilations using lists and scatter plots to represent figures on a coordinate plane.*

Teacher Preparation and Notes

- *This activity is designed to be used in a high school geometry or algebra classroom.*
- *If an original point on the coordinate plane is denoted by (x, y), then each of the following ordered pairs denotes a transformation:*

(x, –y)	*reflect over x-axis*	*(–y, x)*	*rotate 90º around origin*
(–x, y)	*reflect over y-axis*	*(–x, –y)*	*rotate 180º around origin*
(y, x)	*reflect over y = x*	*(y, –x)*	*rotate 90º around origin*

- *To perform a translation, add or subtract a constant from the list with the x-values or the y-values of the figure.*
- *To perform a dilation, multiply a constant scale factor by the list with the x-values or the y-values of the figure.*
- *This activity is designed to be student-centered with the teacher acting as a facilitator while students work cooperatively. If desired, have students work in groups of 3. Each person in the group should enter a different combination of lists for Problem 2 and the group should discuss the results.*
- ***To download the student TI-Nspire document (.tns file) and student worksheet, go to education.ti.com/exchange and enter "10278" in the quick search box.***

Associated Materials

- *TransformationWithLists_Student.doc*
- *TransformationsWithLists.tns*

Suggested Related Activities

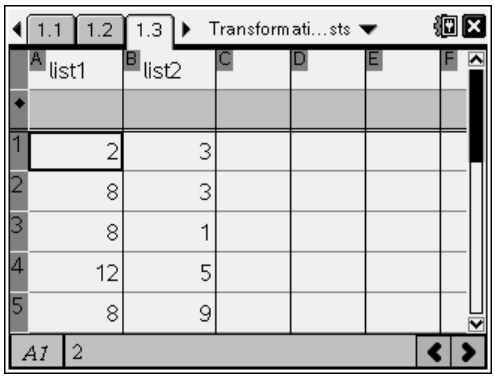
To download any activity listed, go to education.ti.com/exchange and enter the number in the quick search box.

- *Transformers (TI-Nspire technology) — 8772*
- *"Fishing for Points"—Transformations Using Lists (TI-84 Plus or TI-73 Explorer) — 8823*
- *Movin' and Changin' (TI-73 Explorer and TI-Navigator) — 12217*

Problem 1 – Creating a Scatter Plot

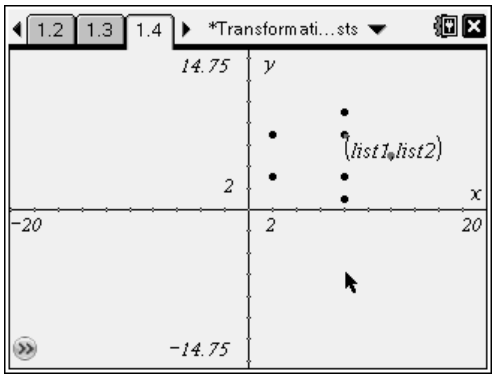
Students should open the file and read the directions on page 1.2.

On page 1.3, the spreadsheet contains two lists: **list1** contains the *x*-values and **list2** contains the *y*-values of a figure.



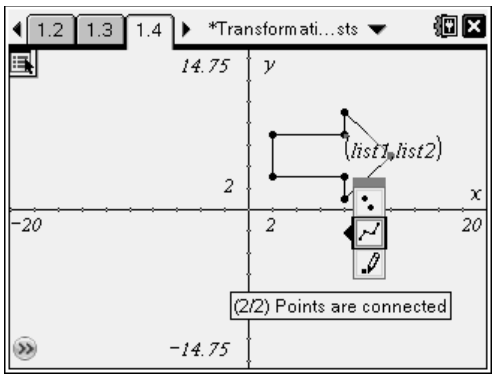
Students are to create a scatter plot of *list1 vs. list2* on page 1.4.

To do this, they need to select **MENU > Graph Type > Scatter Plot**, and choose **list1** as the *x*-list and **list2** as the *y*-list by pressing (var)



To create the figure, students need to connect the points by selecting **MENU > Actions > Attributes**, highlight the scatter plot, and choose **Points are connected**.

Note: If desired, students can hide the Entry Line by pressing (ctrl) + G. The label of the scatter plot may be hidden as well.

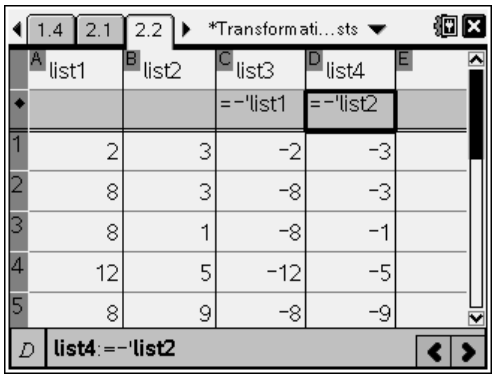


Problem 2 – Reflections and Rotations

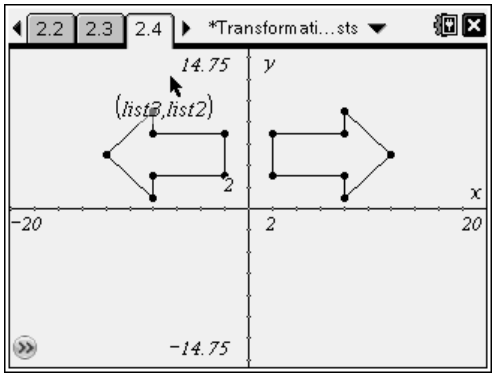
On page 2.1, students are told that the same lists, **list1** and **list2**, are repeated on page 2.2 and the same connect scatter plot is on page 2.4.

They need to enter **=–list1** in the formula bar of Column C to create **list3**, the opposite of each of the *x*-values in **list1**.

Then, they need to enter **=–list2** in the formula bar of Column D to create **list4**, the opposite of each of the *y*-values in **list2**.



Students are to move to page 2.4, where they need to create scatter plot **s2** with connected points using the following combinations of lists.



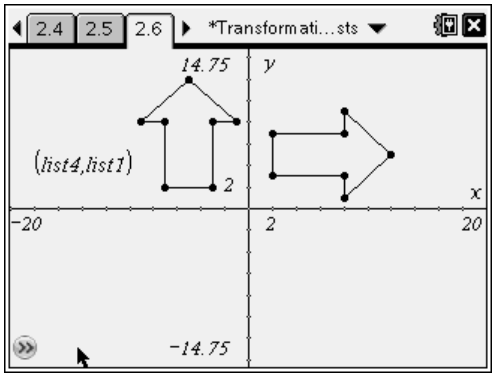
For each combination, students need to determine what type of reflection occurred.

A: $x \leftarrow$ **list3** and $y \leftarrow$ **list2** (over y-axis)

B: $x \leftarrow$ **list1** and $y \leftarrow$ **list4** (over x-axis)

C: $x \leftarrow$ **list2** and $y \leftarrow$ **list1** (over $y = x$)

The same set-up is used to explore rotations. Students are to read the directions on page 2.4 and then create a scatter plot **s2** on page 2.5 using the following combinations of lists.



For each combination, students need to determine what type of rotation occurred.

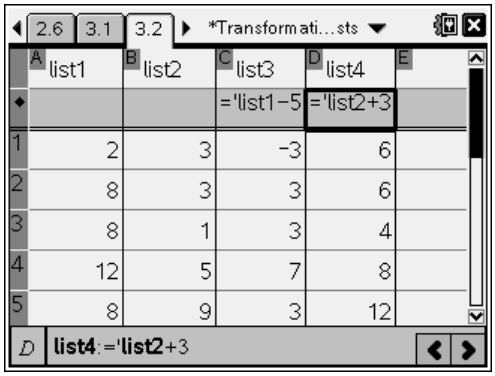
D: $x \leftarrow$ **list4** and $y \leftarrow$ **list1** (90° around origin)

E: $x \leftarrow$ **list2** and $y \leftarrow$ **list3** (–90° around origin)

F: $x \leftarrow$ **list3** and $y \leftarrow$ **list4** (180° around origin)

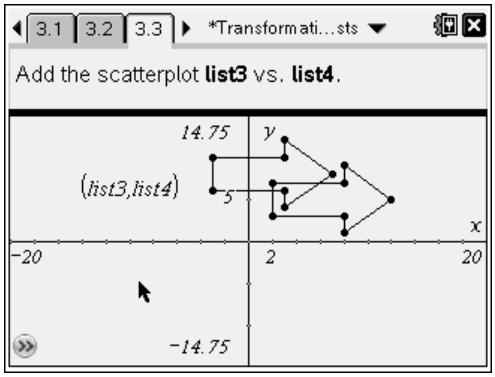
Problem 3 – Translations

The same **list1** and **list2** are repeated in the spreadsheet on page 3.2. Students are to use **list3** and **list4** to translate the figure.



In the formula bar for **list3** (Column C), students need to type **=list1–5** to translate the x-values. In the formula bar for **list4** (Column D), they need to type **=list2+3** to translate the y-values.

On page 3.3, students are to create scatter plot **s2** with $x \leftarrow$ **list3** and $y \leftarrow$ **list4**.

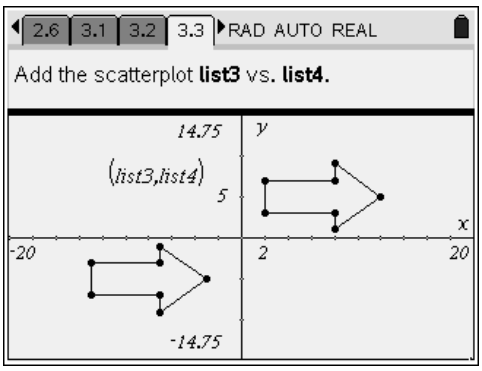


Ask students: *Where did the image shift? How many units left/right and how many units up/down?*

Note: If desired, students can select **MENU > View > Show Grid** to better see the units of shift.

Then students are to edit the formulas for **list3** and **list4** to translate the figure into Quadrant 3.

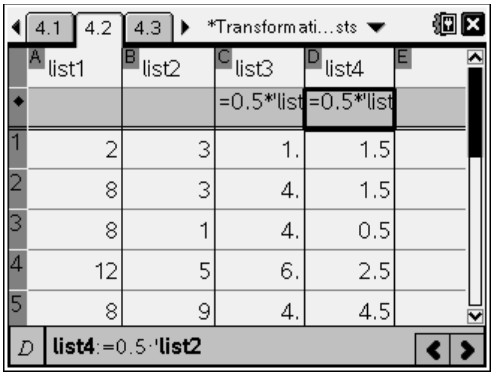
Possible formulas are **=list1–15** for **list3** and **=list2–10** for **list4**.



Problem 4 – Dilations

The same **list1** and **list2** are repeated in the spreadsheet on page 4.2. Students are to use **list3** and **list4** to dilate the figure.

In the formula bar for **list3** (Column C), students need to type **=0.5*list1** and in the formula bar for **list4** (Column D), they need to type **=0.5*list2**.



On page 4.3, students are to create scatter plot **s2** with *x* ← **list3** and *y* ← **list4**.

Ask students: *What happened to the image?*

Then they are to edit the formulas for **list3** and **list4** to dilate the figure into Quadrant 3.

Possible formulas are **=–0.5*list1** for **List3** and **=–0.5*list2** for **list4**.