Math Objectives

- Students will use a pre-made .tns file to study the composition of isometric transformations.
- Students will reflect a translated figure to create a glide reflection.
- Students will use appropriate tools strategically (CCSS Mathematical Practice).

Vocabulary

- glide
- reflection
- translation
- isometry

About the Lesson

- The estimated time for this activity is 30 to 45 minutes.
- Send the file Glide_Reflections.tns to student handheld devices. If you are planning for students to create the file, take time to follow the directions prior to facilitating the process with students.
- This activity is designed to be student-centered, with the teacher acting as a facilitator while students work cooperatively. The student worksheet is intended to guide students through the activity and provide a place to record their answers.

TI-Nspire™ Navigator™ System

- Use Screen Capture to observe students' work as they proceed through the activity.
- Use Live Presenter to have a student illustrate how he/she used a certain tool.

TI-Nspire™ Technology Skills:

- Download a TI-Nspire document
- Open a document
- Move between pages
- Grab and drag a point

Tech Tips:

- Make sure the font size on your TI-Nspire handheld is set to Medium.
- Once a function has been graphed, the entry line can be graphed by pressing ctrl G. The entry line can also be expanded or collapsed by clicking the chevron.

Lesson Materials:

Create Instructions
Glide_Reflections_Create.pdf

Student Activity
Glide_Reflections_Student.pdf
Glide_Reflections_Student.doc

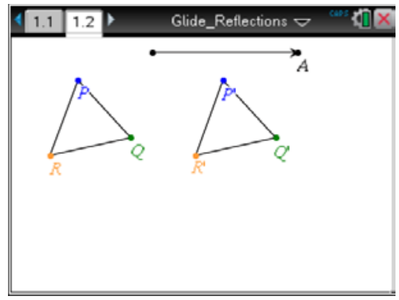
TI-Nspire document
Glide_Reflections.tns

Visit www.mathnspired.com for lesson updates and tech tip videos.

Discussion Points and Possible Answers

Tech Tip: If students experience difficulty dragging a point, check to make sure that they have moved the arrow until it becomes a hand (). Press ctrl to grab the point and close the hand ().

Move to page 1.2.



Part 1 – Exploring a translated triangle

On page 1.2, Δ*PQR* maps onto Δ*P*'*Q*'*R*' using a translation as determined by the vector at the top of the screen.

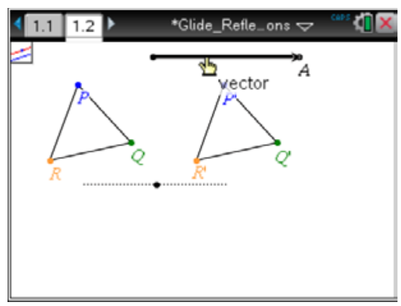
A **translation** is an example of an *isometry* since a translation produces an image that is congruent to the pre-image**.**

1. Δ*PQR* ≅ Δ***P*'*Q*'*R*'**

2. Grab and drag point *A* to change the magnitude and direction of the vector. Describe the changes that occur in image Δ*P*'*Q*'*R*' as you change the vector.

   <u>Answer:</u> The position of Δ*P*'*Q*'*R*' changes, but there are no changes in the size, shape, or orientation of the image.

Next, you will make a line parallel to the vector through a point somewhere in the plane.



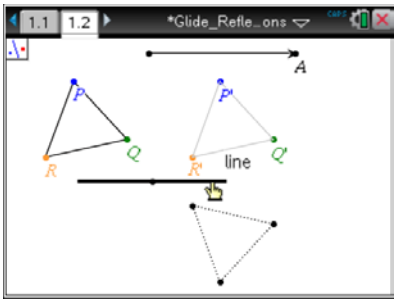
Step 1: Press **Menu > Construction > Parallel**.

Step 2: Move to a location below the triangles and press to mark a point.

Step 3: Move the cursor near the vector until you see and the word *vector*. Press .

Step 4: Press esc to exit the **Parallel** tool.

To reflect $\Delta P'Q'R'$ over the line, do the following:



Step 1: Press **Menu > Transformation > Reflection**.

Step 2: Move toward the translated triangle $P'Q'R'$. Press [ctrl] to select this triangle.

Step 3: Move the cursor to the line and press [ctrl].

Step 4: Press [esc] to exit the **Reflection** tool.

3. Is the new image congruent to $\Delta P'Q'R'$? How do you know?

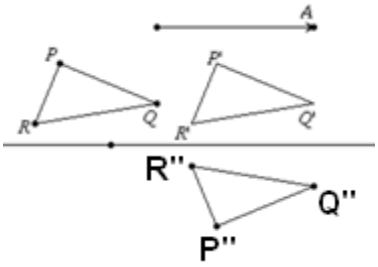
   Answer: Yes. The lengths of the sides of the pre-image are congruent to the lengths of the sides of the image.

4. Is the reflected image congruent to the original triangle, ΔPQR? How do you know?

   Answer: Yes. The new reflected image is congruent to $\Delta P'Q'R'$ and $\Delta P'Q'R' \cong \Delta PQR$; therefore, the new reflected image is congruent to the original triangle.

5. Using P'', Q'', and R'', write the label for each vertex of the reflected triangle in the figure at the right.

   Answer: See the figure at the right.



6. An isometry is a transformation that produces an image that is congruent to the pre-image. What two isometric transformations were used in this activity?

   Answer: translation and reflection

- When two or more transformations are performed in sequence to produce a single transformation, the result is called a *composition* of the transformations.
- One example of a composite transformation is a **glide reflection**. A **glide reflection** is a transformation in which every point P is mapped onto a point P'' by the following steps:
  1. A translation maps P onto P'.
  2. A reflection over a line parallel to the direction of the translation maps P' onto P''.

7. Is a glide reflection an isometry? How do you know?

   Answer: Yes, a glide reflection is an isometry because the image is always congruent to the pre-image.

> **Teacher Tip:** This is a special case of the Composition of Isometries Theorem which states: The composition of two (or more) isometries is an isometry.

Wrap Up

Upon completion of the discussion, the teacher should ensure that students understand:

- What a composition of isometric transformations is.
- How to reflect a translated figure to create a glide reflection.