Traditional Transformations, Part 5

Composition of Transformation: Fashion Design

Michell Eike, Laura Halstied, Teresa Lansford, Patricia McDaniels-Gomez
Published by *K20 Center*

This work is licensed under a Creative Commons CC BY-SA 4.0 License

Grade Level	9th – 10th Grade	**Time Frame**	100-120 minutes
Subject	Mathematics	**Duration**	2-3 class periods
Course	Geometry		

Essential Question

How are transformations and symbolism used through indigenous cultures?

Summary

In this lesson, students will explore the mathematics behind fashion design and summarize their knowledge of transformations. They will then apply what they have learned to solve a puzzle and demonstrate their understanding of composition of transformations. Prerequisite knowledge for this lesson includes the following vocabulary: transformation, preimage, image, translations, reflections, rotations, and dilations. This is the fifth lesson of five in the "Traditional Transformations" lesson series.

Snapshot

Engage

Students watch a video about a fashion designer and how she integrates her culture into her creations.

Explore

Students sort photographs by type of transformation and then reflect on their learning of transformations and indigenous culture.

Explain

Students complete a foldable with the class and formalize their understanding of compositions of transformations.

Extend

Students apply what they have learned about composition of transformations to solve a puzzle.

Evaluate

Students demonstrate their understanding by finding the unknown transformation given the preimage and image.

Standards

ACT College and Career Readiness Standards - Mathematics (6-12)

G407: Translate points up, down, left, and right in the coordinate plane
G512: Find the coordinates of a point rotated 180° around a given center point
G607: Find the coordinates of a point reflected across a vertical or horizontal line or across y = x
G608: Find the coordinates of a point rotated 90° about the origin
G703: Use scale factors to determine the magnitude of a size change

Oklahoma Academic Standards Mathematics (Geometry)

G.2D.1.11: Use numeric, graphic, and algebraic representations of transformations in two dimensions (e.g., reflections, translations, dilations, rotations about the origin by multiples of 90 °) to solve problems involving figures on a coordinate plane and identify types of symmetry.

Attachments

- Composition Exit Ticket—Traditional Transformations, Part 5 - Spanish.docx
- Composition Exit Ticket—Traditional Transformations, Part 5 - Spanish.pdf
- Composition Exit Ticket—Traditional Transformations, Part 5.docx
- Composition Exit Ticket—Traditional Transformations, Part 5.pdf
- Identity Chart—Traditional Transformations, Part 5 - Spanish.docx
- Identity Chart—Traditional Transformations, Part 5 - Spanish.pdf
- Identity Chart—Traditional Transformations, Part 5.docx
- Identity Chart—Traditional Transformations, Part 5.pdf
- Lesson Slides—Traditional Transformations, Part 5.pptx
- Multiple Transformations—Traditional Transformations, Part 5 - Spanish.docx
- Multiple Transformations—Traditional Transformations, Part 5 - Spanish.pdf
- Multiple Transformations—Traditional Transformations, Part 5.docx
- Multiple Transformations—Traditional Transformations, Part 5.pdf
- Transformation Puzzle (Key)—Traditional Transformations, Part 5.docx
- Transformation Puzzle (Key)—Traditional Transformations, Part 5.pdf
- Transformation Puzzle—Traditional Transformations, Part 5 - Spanish.docx
- Transformation Puzzle—Traditional Transformations, Part 5 - Spanish.pdf
- Transformation Puzzle—Traditional Transformations, Part 5.docx
- Transformation Puzzle—Traditional Transformations, Part 5.pdf

Materials

- Lesson Slides (attached)
- Identity Chart handout (attached; one per pair; printed front only)
- Foldable handout (attached; one per student; printed front/back)
- Multiple Transformations (attached; one per student; printed front only)
- Transformation Puzzle handout (attached; one per pair; printed front/back)
- Transformation Puzzle (Key) document (attached; for teacher use)
- Composition Exit Ticket handout (attached; one half per student; printed front only)
- Pencils
- Paper
- Scissors (one per student)
- Coloring utensils (optional)

10 minutes

Engage

Teacher's Note: Respecting Native Cultures

To provide a real-world example of geometric transformations, we are incorporating tribal culture from some of the 39 Tribes of Oklahoma. Students will be able to experience real-world connections and learn more about a few of the indigenous tribes of Oklahoma in order to learn these Geometry standards in a more authentic and concrete way.

This lesson series is centered around the arts and crafts of various tribes of Oklahoma. Tell students about the Indian Arts and Crafts Act of 1990, which says that no non-Native person is to create tribal art and sell it as tribally made. During these lessons, inform students that they are creating their own artwork inspired by specific tribes' customs, but they are not creating the tribes' art.

Introduce the lesson using the attached **Lesson Slides**. **Slide 3** displays the lesson series' essential question. **Slide 4** identifies the lesson's learning objectives. Review each of these with your class to the extent you feel necessary.

Show **slide 5** and introduce the "Apparel Designing and Culture" video on the slide, which is of Leslie Deer sharing her knowledge of her tribe and how her culture influences her work in her career as a fashion designer.

Embedded video
https://youtube.com/watch?v=nKjKx2iDJnM

15 minutes

Explore

Teacher's Note: Desmos Classroom Activity Preparation

To use Desmos Classroom for the following Card Matching activity, select the following link: "Traditional Transformations, Part 5." Create an account or sign in under the "Activity Sessions" heading. After you log in, the green "Assign" dropdown button will be active. Click the arrow next to the word "Assign," then select "Single Session Code." After making some setting selections, select "Create Invitation Code" and give the session code to students. For more information about previewing and assigning a Desmos Classroom activity, go to https://k20center.ou.edu/externalapps/using-activities/.

For more detailed information about Desmos features and how-to tips, go to https://k20center.ou.edu/externalapps/desmos-home-page/.

Display **slide 6** and provide students with your session code. Then, have students go to student.amplify.com/join/ and enter the session code.

Teacher's Note: Sign-in Options

If students sign in with their Google or Desmos accounts, then their progress is saved, and they can resume the activity or view their work later. If students continue without signing in, they can complete the activity, but they must do so in one sitting. It is strongly recommended that students sign in; otherwise, they risk losing their work.

Introduce students to the Card Sort instructional strategy and have students work independently to sort cards into the following categories.

- Translations
- Reflections
- Rotations
- Dilations

Challenge students to put at least two cards in each category.

Teacher's Note: Desmos Classroom Card Sort

This card sort may be overwhelming on small screens. Share the following tips with students to avoid frustration:

- **Enter full screen:** To increase the size of your workspace, select the expanding arrows in the center of the top pane of the window.
- **Organize your workspace:** In the same way you would arrange cards on a physical surface, organize the cards on your screen.
- **Condense a stack of cards:** Once you have more than one card in a category, click the arrow.
- **Enlarge the card:** Click on the card to magnify the image.

Use **slide 7** to share this advice with your students.

Use the Dashboard to observe students' progress. Once students finish sorting their cards, have them find a partner or assign partners. Have pairs spend a few minutes discussing their cards and how they chose to sort them. As time allows, consider showing a volunteer's set of cards and having the volunteer share his/her reasoning.

Teacher's Note: Guiding the Activity

Keep in mind that there is more than one "right" answer. The patterns in the photographs often have more than one type of transformation represented. Encourage students to pick the transformation that stood out to them as they sort the cards into categories. Students will later learn about compositions of transformations during the Explain portion of the lesson, so now is not yet the time to introduce this concept.

Now, display **slide 8** and introduce the Identity Chart strategy. Give each pair of students a copy of the attached **Identity Chart** handout and direct them to write words or phrases at the end of each arrow describing what they have learned during this lesson series on transformations.

If you have the space, consider having students hang their Identity Charts on the wall for everyone to see. This can give students a sense of pride in their learning—they know so much more now than they did before!

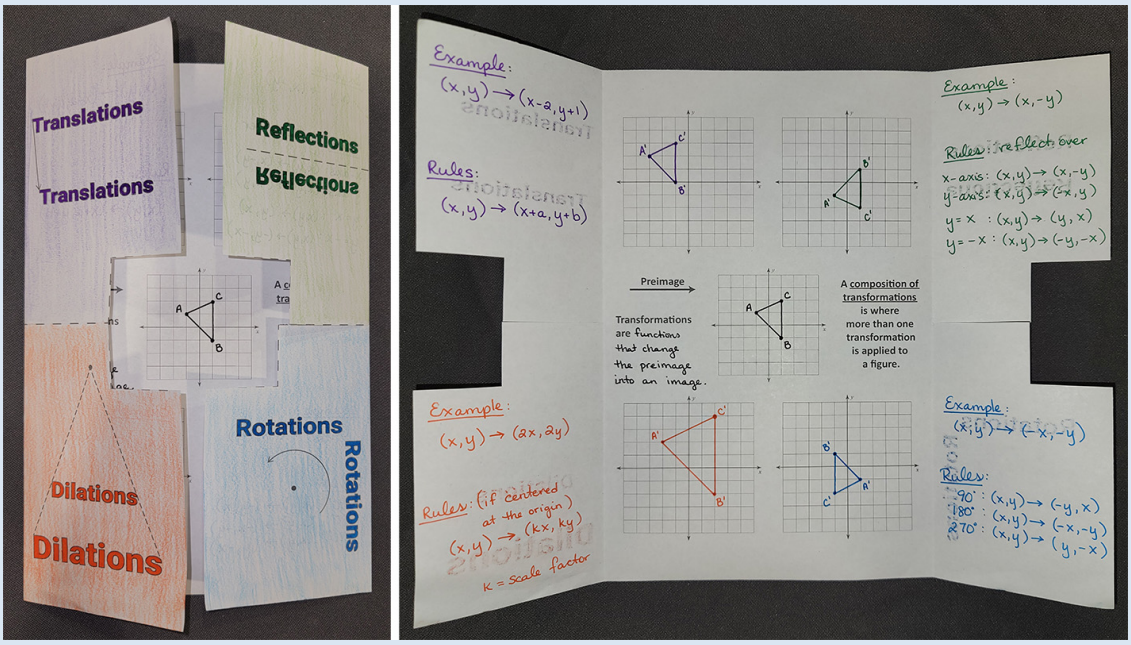
10 minutes

Explain

Teacher's Note: Activity Preparation

Before introducing the Foldable, create one yourself as a model. Even if you choose to not complete the Foldable by writing in it, at least complete the steps of cutting and folding to help students better understand what they are creating. If they can see the goal, they are more likely to be successful.

Sample Foldable



Display **slide 9** and give each student a copy of the attached **Foldable** handout and a pair of scissors. Instruct students to fold along the solid lines and cut along the dashed lines. The only dashed lines that should not be cut are the ones adjacent to the words “Reflections” and “Dilations.” Use the slide to help point to students where they should and should not cut. Let students know that the goal is to have four flaps, one for each type of transformation.

Transition to **slide 10** and direct students to create their own preimage on the center graph. Let them know that they need to label at least 3 vertices.

Show **slide 11** and instruct students to open one flap of the Foldable and apply a transformation of their choice that represents that transformation and to write the rules for that transformation inside the flap. For example, if students unfold the “Reflections” flap, they can choose the line they want to reflect their preimage over. If they choose to reflect their preimage over the x-axis, then they should write, “Reflection over the x-axis” and draw the resulting image on the provided graph. Then in the empty space, have students use prior resources or recall the algebraic rules for reflections and record those in that space. Have students repeat these steps for the remaining corners. Let students know that they are bringing all of their knowledge about transformations together into one place for easy reference.

As students complete writing in the four corners, direct their attention to the center. Have students write the definition of “Transformation” in their own words or have a class discussion and have them write the agreed upon definition in their foldable: “Transformations are ...”

Transition to **slide 12** and explain that a *composition of transformations* is when more than one transformation is applied to a figure.

40 minutes

Extend

Teacher's Note: Copying Art

While we want to celebrate the important contributions of Native people and ensure students learn about these art forms, we must be mindful that copying tribal designs is considered disrespectful and is strongly discouraged because many of these designs hold historical and familial meaning. Please help students be aware of this historic theft from Native people and understand why it is important that such theft does not continue.

Display **slide 13** and introduce the vocabulary of *glide reflection*. Then, give each student a copy of the attached **Multiple Transformations** handout.

Move to **slide 14** and let the class know that some compositions of transformations can be represented in more than one way, sometimes even as a single transformation. Direct their attention to Example 1 and have students write two different ways to transform the preimage to the image.

As students finish Example 1, show **slide 15** and ask for volunteers to share. Students will see the most common transformations on the screen: two reflections or one translation.

Use **slides 16-17** to repeat these steps for Example 2.

Show **slide 18** and give each pair a copy of the attached **Transformation Puzzle** handouts. These handouts include one page (front/back) for Student A, one page (front/back) for Student B, and the graph (front only) for both students to share. Have students decide among themselves who is Student A and who is Student B – it does not matter. Let them know that they are each responsible for completing half of the puzzle. For example, Student A is given one preimage to use for questions 1-3. Questions 1-3 are 3 separate compositions of transformations that Student A needs to complete, then draw each image on the graph paper. Student B has the same procedure, but a different preimage or a different composition of transformations to complete. Each student has 12 tasks to complete. When both students are done, their transformations will create a tribal pattern: a thunderbird. Use the attached **Transformation Puzzle (Key)** document to see the expected results.

5 minutes

Evaluate

Display **slide 19** and use the Exit Ticket strategy to individually assess what students have learned from the lesson. Give each student a half-sheet of the attached **Composition Exit Ticket** handout. Use the hidden **slides 20-25** for a sample response.

Collect student responses and check for understanding.

Alternative Pacing

If time allows, consider reviewing slides 20–25 after collecting the Composition Exit Ticket.

You may choose to assign the Composition Exit Ticket as homework and review the work on slides 20-25 as bellwork during the next class period.

Resources

- K20 Center. (n.d.). Bell Ringers and Exit Tickets. Strategies. https://learn.k20center.ou.edu/strategy/125
- K20 Center. (n.d.). Card Sort. Strategies. https://learn.k20center.ou.edu/strategy/147
- K20 Center. (n.d.). Identity Chart. Strategies. https://learn.k20center.ou.edu/strategy/2729
- K20 Center. (2023, July 5). *K20 ICAP - Apparel designing and culture* [Video]. YouTube. https://youtu.be/nKjKx2iDJnM