Traditional Transformations, Part 1

Translations: Seminole Patchwork

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Grade Level	9th – 10th Grade	**Time Frame**	85-105 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 culture of the Seminole tribe and their patchwork. They will then use these patterns to explore transformations, specifically translations represented graphically, algebraically, verbally, and with vectors. Students will apply what they have learned to create their own patchwork design and demonstrate their understanding of translations. This is the first lesson of five in the "Traditional Transformations" lesson series.

Snapshot

Engage

Students watch a video about the tradition of Seminole patchwork.

Explore

Students make observations and discover patterns through an I Notice, I Wonder activity.

Explain

Students complete guided notes with the class and formalize their understanding of translations, focusing on different representations: algebraic notation, vectors, graphical, and verbal.

Extend

Students apply what they have learned to graph translations, then write procedural rules and create generalizations to apply to other problems.

Evaluate

Students create their own personally meaningful patchwork pattern with two examples of translations; they then swap designs and find and record the mathematical translation of their peer's design.

Standards

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

- Detailed Designs— Traditional Transformations, Part 1 - Spanish.docx
- Detailed Designs— Traditional Transformations, Part 1 - Spanish.pdf
- Detailed Designs— Traditional Transformations, Part 1.docx
- Detailed Designs— Traditional Transformations, Part 1.pdf
- Guided Notes (Teacher Guide and Model Notes)—Traditional Transformations, Part 1.docx
- Guided Notes (Teacher Guide and Model Notes)—Traditional Transformations, Part 1.pdf
- Guided Notes—Traditional Transformations, Part 1 - Spanish.docx
- Guided Notes—Traditional Transformations, Part 1 - Spanish.pdf
- Guided Notes—Traditional Transformations, Part 1.docx
- Guided Notes—Traditional Transformations, Part 1.pdf
- Lesson Slides—Traditional Transformations, Part 1.pptx
- Translating Me—Traditional Transformations, Part 1 - Spanish.docx
- Translating Me—Traditional Transformations, Part 1 - Spanish.pdf
- Translating Me—Traditional Transformations, Part 1.docx
- Translating Me—Traditional Transformations, Part 1.pdf
- Trying Translations—Traditional Transformations, Part 1 - Spanish.docx
- Trying Translations—Traditional Transformations, Part 1 - Spanish.pdf
- Trying Translations—Traditional Transformations, Part 1.docx
- Trying Translations—Traditional Transformations, Part 1.pdf

Materials

- Desmos account
- Guided Notes handout (attached; one per student; printed front/back)
- Guided Notes (Teacher Guide and Model Notes) document (attached; for teacher use)
- Translating Me handout (attached; one per student; printed front only)
- Pencils
- Paper
- Compass (one per student)
- Straightedge (one per student)
- Student devices with Internet access
- Individual grid dry erase boards (optional; one per student)
- Dry erase markers (optional; one per student)

15 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 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 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.

Teacher's Note: Desmos Classroom Activity Preparation

To use this Desmos Classroom activity, select the following link: "Traditional Transformations, Part 1." 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/.

To set up the activity's pacing for students, select "View Dashboard" (next to the session code). In the upper-left corner of your screen, select the icon above the word "Pacing." Desmos Classroom should then prompt you to select the first and last screens that you want students to see. When prompted to set a range, select screens 1 and 4. Select "Restrict to Screens 1–4" to confirm your selection. This enables students to access only screens 1–4 at this time. For more information about teacher pacing, go to https://k20center.ou.edu/externalapps/pacing-activities/.

Provide students with your session code. Then, have students go to student.desmos.com 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 the lesson using **screens 1–2** of the Desmos Activity. **Screen 1** displays the lesson series' essential question. **Screen 2** identifies the lesson's learning objectives. Review each of these with students to the extent you feel necessary.

Direct students' attention to **screen 3**. Have students watch the "Seminole Patchwork and Translations" video on the screen, which is of Jaylee Lowe, a Seminole patchwork maker, sharing her knowledge of her tribe and how she uses translations in her Seminole patchwork creations.

Embedded video
https://youtube.com/watch?v=As9ckub13eM

After the video, direct students to move to **screen 4** and introduce the class to the Caption This instructional strategy. Direct students to write a caption for the photograph on their screen using the information they learned from the video. If time allows, ask for a few volunteers to share with the whole class.

10 minutes

Explore

Press the orange plus sign, on the Dashboard, three times to allow students to progress to **screens 5-7**. Have students find partners or assign students partners. Then introduce students to the I Notice, I Wonder instructional strategy. Explain that they will focus on what they notice for this activity and will later be asked about what they wonder.

Share with students that during this activity, they will be working with a specific Seminole patchwork pattern known as *Man on Horse*. Direct students to identify the corresponding points from the initial unshaded image to the final shaded image and complete the table for each graph. Tell students to pause at the end of each question, look for patterns in the table, and type what they notice.

Students receive feedback on the screen for each corresponding point. Once all points are correctly identified and accurately written as ordered pairs, they will be prompted with a question asking what they noticed and a place to enter a response.

As students finish screen 5, bring the class together to discuss what they noticed. Repeat this for screens 6-7.

Teacher's Note: Guiding the Activity

Remember that this is not yet the point in the lesson to answer questions or worry about proper vocabulary. Some students may remember translations from middle school while others do not, and that is okay.

This is the time to ask guiding questions and push students to see the connection between the visual translation of the graph with the numeric translation in the table. For example, ask guiding questions on question 1 (screen 5) to help students see how the final image is 7 units left of the initial image on the graph and the x-coordinates of the corresponding points have a difference of 7, while the y-values are the same. They will then see the algebraic connection during the Explain portion of the lesson.

On the Dashboard, press the orange plus sign to allow students to progress to **screen 8**. Ask the class to share anything else they noticed and whether there is now anything they wonder.

Facilitate a discussion about what they wonder and push the conversation towards wondering whether there is an easier way to describe corresponding points or an easy way to write the pattern of what changed between corresponding points. Use this idea of efficiency in notation to transition to the Explain portion of the lesson, where proper vocabulary is introduced.

20 minutes

Explain

Customizing Student Learning

The Guided Notes handout has vocabulary with illustrations and three practice problems. The first two examples are polygons on the coordinate plane, while the third example is a polygon not on the coordinate plane. Use the **Guided Notes (Teacher Guide and Model Notes)** document as reference. If you want students to only work with translations on the coordinate plane, delete example 3 before printing the handout. Example 3 is not in the Desmos activity, since it is a hands-on construction.

The activities that follow during Extend and Evaluate are all on the coordinate plane.

Give each student a copy of the attached **Guided Notes** handout, then press the orange plus sign on the Dashboard to enable students to progress to **screen 9**. Introduce the following vocabulary to the class: *transformation*, *translation*, *preimage*, *image*, and *rigid motion*. This is both on screen 9 and on the handout. Guide students to write the vocabulary words on their handout.

Press the orange plus sign on the Dashboard to enable students to progress to **screen 10**. Talk through the table (both on the screen and handout), explaining the different ways to represent a transformation: graphically, verbally, and algebraically. Remind students that mapping notation here is just like mapping domain and range values from Algebra 1.

On the Dashboard, press the orange plus sign to enable students to progress to **screen 11**. Introduce the concept of a vector to students as well as its notation.

Teacher's Note: Guiding the Activity

Explain to students that vectors are often named with lower-case letters and are printed in bold font; however, we traditionally write vectors by hand with a lower-case letter with an arrow above it or as two capital letters, representing the beginning and ending points of the vector, with one arrow over the two capitals letters. The notation does vary slightly among different authors.

Also help students see why they should care about vectors; vectors are used a lot to help explain our physical world. When physicists describe how fast a ball is thrown, they measure the components of its movement: the vertical and horizontal velocities, represented as vectors. We use vectors to describe forces pushing on an object from different directions.

Direct students' attention to the back of their handout and press the orange plus sign on the Dashboard twice to allow students to progress to **screens 12-13**. Direct students to follow the directions on the screen and use the Desmos Classroom activity to complete example 1 on their handout.

Use the teacher dashboard to determine when students are ready for example 2. When they are, press the orange plus sign on the Dashboard to allow students to progress to **screen 14**. Consider asking the students to try example 2 on their own before bringing the class back together to ensure everyone is understanding. Here students will see a "Translate" button when they complete their table. Pressing the button shows the preimage translate to where it should go and provides feedback to the students.

Give each student a compass and straightedge and direct them to set aside their device. Then guide the class through how to complete a translation not on the coordinate plane with example 3.

Teacher's Note: Guiding the Lesson

Encourage academic vocabulary by having students drop the middle school language of “slide” and adopt the high school language of “translate.”

This is also the time in the lesson to correct any misunderstandings and directly answer questions.

Have students add their completed Guided Notes to their math notebooks if that is a classroom norm.

25 minutes

Extend

Now it is time for students to apply what they have learned. Direct their attention back to their Desmos Classroom activity. On the Dashboard, press the orange plus sign three times to allow students to progress to **screens 15-17**. Here students are given a preimage and either a verbal description, algebraic rule, or vector to apply and sketch the image.

Have students work with their partner from before or direct them to find a new partner to complete questions 1-2 on screens 15-16. Students will receive feedback and be able to see their image translate from the preimage to the coordinates they enter.

Challenge students to work independently on question 3 on screen 17.

As students complete screen 17, introduce them to the Inverted Pyramid strategy. Press the orange plus sign on the Dashboard and direct their attention to **screen 18**.

Divide the class into 4 groups. This can be done by numbering students 1-4 or by grouping students based on where they are seated. The groups should be approximately equal in size. At this point, students just need an assigned group number and do not need to physically get into a group.

Explain that each group will be given a different translation process to describe. Based on their assigned group number, direct students to independently write the steps for their groups' procedure.

- **Group 1:** Students in group 1 should each write the steps needed to take a graphical representation of a translation and represent it as an algebraic rule.
- **Group 2:** Students in group 2 should each write the steps needed to take a graphical representation of a translation and represent it as a vector.
- **Group 3:** Students in group 3 should each write the steps needed to take an algebraic rule and apply it graphically (draw the translation).
- **Group 4:** Students in group 4 should each write the steps needed to take a vector and apply it graphically (draw the translation).

Direct students to enter their group number on screen 18.

On the Dashboard, press the orange plus sign to allow students to progress to **screen 19**. Direct students to independently answer the question on their screen. Once they click the "Submit" button, they are prompted to find a partner with the same group number.

Once students are in pairs, press the orange plus sign on the Dashboard to enable students to progress to **screen 20**. Instruct pairs to compare their steps and work together to write a new set of steps that is more efficient and still general. Ask if there are places where steps could be combined or are not actually needed to reach the goal. Encourage students to use variables instead of specific numerical values to help generalize their steps (allowing their steps to apply to more than just one problem). Once they click submit, they are prompted to find everyone with the same group number to create one large group. In other words, the classroom will have a total of 4 large groups.

Once students are in large groups, press the orange plus sign on the Dashboard and direct students' attention to **screen 21**. Instruct students to compare their steps again and create one set of steps for the whole group that everyone agrees upon. Once they click submit, they are prompted to select a spokesperson. Have each spokesperson share out with the class. Consider having a recorder from each group write the steps on the board or on a piece of chart paper. Gives students time to ask questions and provide feedback. Encourage students to take notes on the agreed upon steps.

Teacher's Note: Guiding the Activity

As students are working together to create a procedure for how to take one representation of a translation to another representation, circulate the room and ask guiding questions to help students refine their steps into general steps that will work all of the time and not just some of the time.

15 minutes

Evaluate

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.

On the Dashboard, click the orange "Stop" button; students can now complete the Desmos activity at their own pace.

Direct students' attention to **screen 22** and give each student a copy of the attached **Translating Me** handout. Remind students that the Seminole patchwork patterns often represent the creator. Have students think about how to symbolize something important to them: something important from their school or home life or something from their personal interests.

Instruct students that once they think of a (school appropriate) design, they need to add this preimage to the jacket and to be sure to leave enough room to translate the image twice. Remind students that their image will likely need to be a little abstract to create a polygon. Also let them know that later they will be asked to share the meaning of their design with a partner. Tell students your preference regarding whether it is okay or not for their preimages and images to overlap. There is not a right answer here; just be sure to clearly communicate expectations.

Guide students to use **screen 23** as a place to brainstorm ideas.

Instruct students to draw their preimage and two translations on the jacket on their handout, then label each *preimage*, *image 1*, and *image 2*. The two translations are each independent translations from the same preimage. In other words, students translate the preimage to create *image 1*, then apply a different translation to the preimage to create *image 2*.

Optional Pacing

If time is a concern, this task could be sent home and completed outside of class.

Direct students' attention to **screen 24** and instruct students to trade papers. Ask them to complete questions 1-2 at the bottom portion of the handout and represent *image 1* with an algebraic rule and *image 2* with a vector.

Remind the class of the Caption This instructional strategy. Direct their attention to **screen 25** and have students talk with their partner and check their translations. Is what Person B has described algebraically what Person A planned/graphed?

After a couple of minutes, instruct students to now share about the meaning of their preimage design with their partner. After a few minutes, direct students to question 3 and have them write a 1-3 sentence caption about the meaning of the design and the math involved for their partner's jacket based on their conversation.

Use the activities from Extend and Evaluate to determine whether students are ready for the next lesson or whether students need additional practice. Consider having students practice with more basic shapes, like translating triangles or even just individual points. Extra practice can be done quickly and easily on individual grid dry erase boards.

The "Traditional Transformations, Part 2" lesson is about reflections, reflective symmetry, and Osage ribbonwork.

Teacher's Note: ACT Prep

Interpreting the graphical representation and the algebraic notation of translations are skills needed for the ACT exam. These questions often only ask students to translate one point as opposed to a whole figure since it is a timed exam.

Vectors and their component form notation are also a topic on the ACT.

Resources

- K20 Center. (n.d.). Caption this. Strategies. https://learn.k20center.ou.edu/strategy/82
- K20 Center. (n.d.). Desmos classroom. Tech Tools. https://learn.k20center.ou.edu/tech-tool/1081
- K20 Center. (n.d.). I notice, I wonder. Strategies. https://learn.k20center.ou.edu/strategy/180
- K20 Center. (n.d.). Inverted pyramid. Strategies. https://learn.k20center.ou.edu/strategy/173
- K20 Center. (2023, July 5). *Seminole Patchwork and Translations* [Video]. YouTube. https://www.youtube.com/watch?v=As9ckub13eM