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

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

G407: Translate points up, down, left, and right in the coordinate plane

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

- Lesson Slides (attached)
- Detailed Designs handout (attached; one per student; printed front/back)
- Guided Notes handout (attached; one per student; printed front/back)
- Guided Notes (Teacher Guide and Model Notes) document (attached; for teacher use)
- Trying Translations handout (attached; one per student; printed front only)
- Translating Me handout (attached; one per student; printed front only)
- Pencils
- Paper
- Compass (one per student)
- Straightedge (one per student)
- Patty Paper (optional; 1-2 per student)
- 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 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. Review with students 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 the class to the extent you feel necessary.

Show **slide 5** and introduce the "Seminole Patchwork and Translations" video on the slide, 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, transition to **slide 6** and introduce the class to the Caption This instructional strategy. Direct students to get a piece of paper and write a caption for the photograph on the slide 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

Show **slide 7** and pass out a copy of the attached **Detailed Designs** handout to each student. Have students find partners or assign 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 write what they notice.

As students complete question 1, transition to **slide 8**. Give students a moment to check their work with what is on the slide and make corrections as needed. Then bring the class together for a discussion and ask for volunteers to share what they noticed.

Repeat this procedure with the next two questions using **slides 9-10**.

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 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.

Move to **slide 11** and 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 toward wondering if 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 includes vocabulary words 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.

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

Display **slide 12** and provide the attached **Guided Notes** handout to each student.

Introduce the following vocabulary to the class: *transformation*, *translation*, *preimage*, *image*, and *rigid motion*. Guide students to write the vocabulary words on their handout. Then talk through the table on the 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.

Then 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 complete the examples together as a class. After example 1, consider asking the students to try example 2 on their own before bringing the class back together to ensure everyone is understanding.

Give each student a compass and straightedge, then guide the class through how to complete a translation not on the coordinate plane with example 3.

Teacher's Note: Guiding the Lesson

Now is the time to 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.

Additional Scaffolding

For the Explain and Extend portions of this lesson, consider using patty paper. Patty paper is a great supply to use to help students who struggle with seeing transformations. If patty paper is not available, consider using parchment paper, wax paper, or tracing paper instead. Give each student a piece of patty paper to help take the preimage and translate it with the following steps:

1. Trace the preimage with a pencil.
2. Label the vertices.
3. Flip the paper over.
4. Use the see-through property of the paper to draw the vertices (on the back of the paper). Draw the vertices heavily, as the goal is to later use the lead from the pencil to transfer it onto the handout. *Make sure kids move their patty paper off of their handout when drawing the vertices on the back to make sure the lead from the front of the patty paper does not transfer.*
5. Flip the paper over.
6. Line up the traced preimage with the given preimage. Then move the paper corresponding to the given translation: left or right a units and up or down b units.
7. Trace the vertices on the patty paper such that the pencil lead transfers from the patty paper to the handout.
8. Label the new vertices on the handout. Consider just lifting part of the patty paper at a time to keep track of the original vertices.
9. Lift the patty paper and use a straightedge to connect the vertices.

25 minutes

Extend

Teacher's Note: Preparation

Decide whether you want the Trying Translations handout to be guided practice or independent practice. The sample responses to the handout are on hidden slides, so if you would like the class to check their work as they go, unhide **slides 14-16**.

Now it is time for students to apply what they have learned; display **slide 13**. Give each student a copy of the **Trying Translations** handout. 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. As pairs work, remind them to pick and label 6 points on the preimage and the 6 corresponding points on the image.

Challenge students to work independently on question 3.

Teacher's Note: Optional Slides

Unhide and transition through slides 14-16 so students can check their work. If time allows, ask for volunteers to explain their work for each question.

Once students complete their handout, display **slide 17**. 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.

A modified Inverted Pyramid strategy is used for this activity. Have students write their work for this activity on the back of their Trying Translations handout.

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).

Encourage students to use their own words and apply what they have learned today to write their steps. At this time, they should not be working with a partner. Give students a few minutes to complete this step.

Display **slide 18** and direct students to find one (1) partner that has their same group number. 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). Give students a few minutes to complete this step.

Show **slide 19** and have everyone with the same group number come together. In other words, your classroom will have a total of 4 large groups. Instruct students to compare their steps again and create one set of steps for the whole group that everyone agrees upon. Give students several minutes to complete this step, depending on your class size.

Transition to **slide 20** and ask the groups to each 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. Allow 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.

Show **slide 21** 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. Tell 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 or not it is okay for their preimages and images to overlap. There is not a right answer here; just be sure to clearly communicate expectations.

Instruct students to draw their preimage and two translations on the jacket; 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.

Display **slide 22** and instruct students to find a partner and trade papers. Instruct students 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. Show **slide 23** and direct students to talk with their partner and check their translations. Is what Person B 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 quick 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