Tessellations

ID: 10252

Time required
60 minutes

Activity Overview

In this activity, students will explore tessellations of triangles and quadrilaterals. They will use the transformation tools of symmetry, reflections, rotations, and/or translations.

Topic: Transformational Geometry

- *Given a reflection line and a geometric figure, reflect the figure to discover that lengths, angles, areas and shapes are preserved under reflections and orientations are reversed.*
- *Given a center and angle of rotation, rotate a figure to discover that lengths, angles, areas, shapes and orientation are preserved under rotations.*
- *Join the corresponding vertices of two congruent triangles and determine the isometry that links them.*

Teacher Preparation and Notes

- *This activity is designed to be used in a high school or middle school geometry classroom.*
- *This activity is designed to be **student-centered** with the teacher acting as a facilitator while students work cooperatively. Use the following pages as a framework as to how the activity will progress.*
- *A tessellation is a tiling pattern that covers the plane without any gaps or overlaps. Where the tiling shapes meet (either at vertices or along edges), exactly 360° must be accounted for by the angles of the shapes.*
- *Notes for using the TI-Nspire™ Navigator™ System are included throughout the activity. The use of the Navigator System is not necessary for completion of this activity.*
- ***To download the student and solution TI-Nspire documents (.tns files) and student worksheet, go to education.ti.com/exchange and enter "10252" in the keyword search box.***

Associated Materials

- *Tesselations_Student.doc*
- *Tesselations.tns*
- *Tesselations_Soln.tns*

Suggested Related Activities

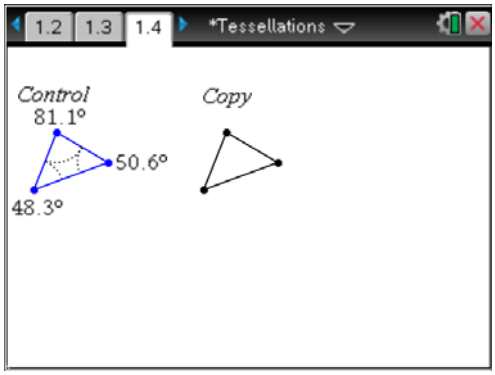
To download any activity listed, go to education.ti.com/exchange and enter the number in the keyword search box.

- *Transformation: Reflections (TI-Nspire technology) — 13129*
- *Glide Reflections(TI-Nspire technology) — 13133*

Problem 1 – Triangles

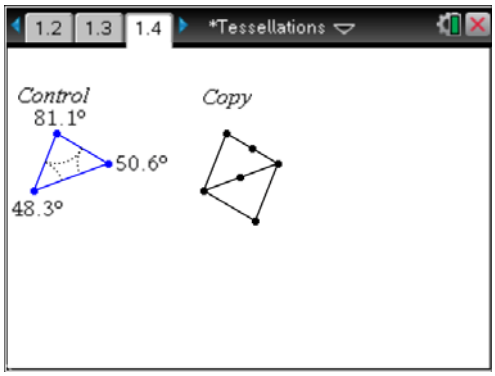
Students can read the directions for the first problem on pages 1.2 and 1.3. When they advance to page 1.4, they will see a **Control** triangle and a **Copy** triangle.

Using the **Angle** tool in the Measurement menu, students are to measure the angles of the Control triangle only.



Students are to construct the midpoints of the sides of the Copy triangle using the **Midpoint** tool in the Construction menu.

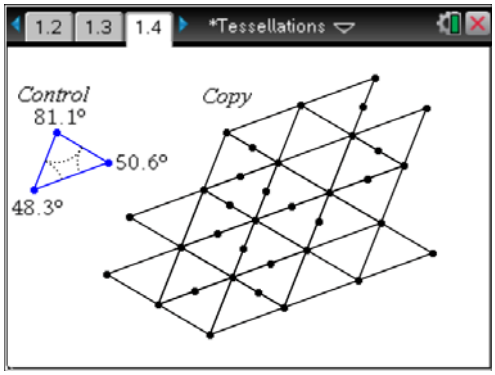
The **Symmetry** tool performs a reflection through a point (which is equivalent to a half-turn or 180° rotation. Students should select the tool, select the triangle, and then select the midpoint. This will reflect the triangle through the midpoint.



Students could also use the **Rotation** tool to complete the tessellation by placing the number 180 on the screen. They should select the tool, select the rotation point (the midpoint), select the number, and then select the triangle.

Students should continue to make copies of the triangle using the **Midpoint** and **Symmetry** and/or **Rotation** tools until they cover a portion of the screen with the tessellation.

They are to make a sketch on the worksheet.

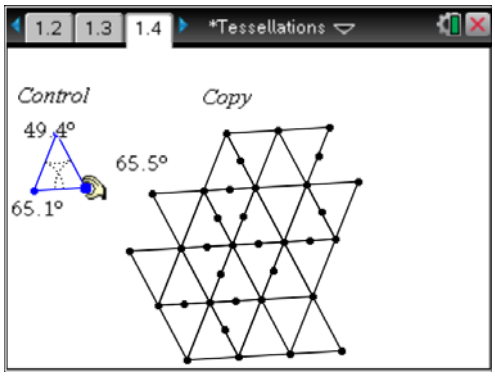


TI-Nspire Navigator Opportunity: *Screen Capture*

See Note 1 at the end of this lesson.

Once finished, students can drag a vertex of the Control triangle and observe the changes in the tessellation.

They can then answer the questions on the worksheet.



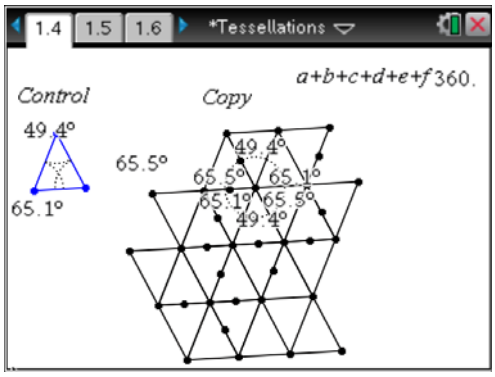
Ask students: *How many angles come together at one vertex of the tessellation? What are the measures of these angles?*

Students may measure the angles directly using the **Angle** tool or use deductive reasoning to conclude what the measures are based on the symmetry transformation.

Then, they should find the sum of the measures of the angles at one vertex.

Using the **Text** tool, students can create an expression (**a + b + c + d+ e + f**) to sum up the 6 angles. Then they can evaluate the expression using the **Calculate** tool.

Lastly, they can drag a vertex of the Control triangle and observe the results.



TI-Nspire Navigator Opportunity: *Quick Poll*

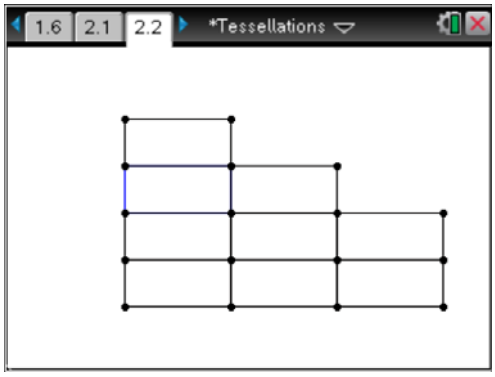
See Note 2 at the end of this lesson.

Problem 2 – Rectangles

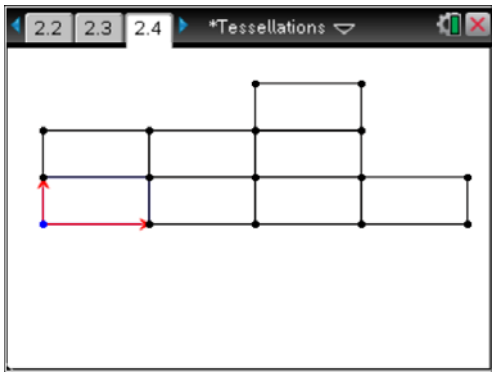
On page 2.2, students are to use the **Reflection** tool to tessellate the rectangle.

To perform the reflection, they need to select the rectangle and a line of reflection. The line of reflection may be any side of the rectangle.

Once students have covered a portion of the screen with the rectangles, they should make a sketch and record their observations.



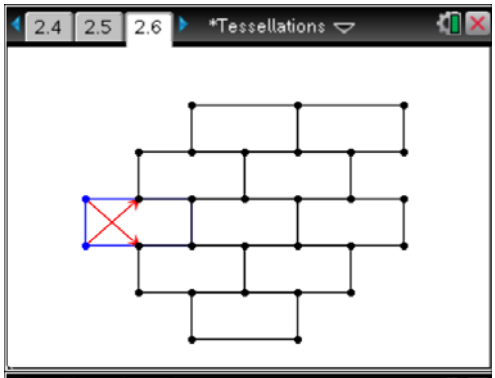
On page 2.4, students are given the same rectangle, but this time they are to use the **Translation** tool and the constructed vector to create the tessellation.



To perform the translation, students need to select the rectangle and then the vector. They can create additional vectors, from the Points & Lines menu, as needed.

Students should make a sketch and record observations on the worksheet when finished.

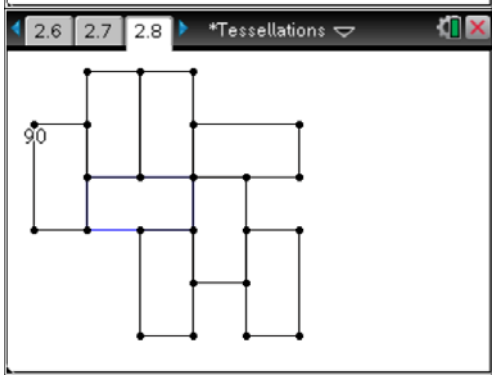
On page 2.6, different vectors are used. Before beginning, ask students what pattern they think will result.



On page 2.8, students will use the **Rotation** tool. The number 90 has been placed on the screen.

To perform the rotation, students need to select the rectangle, the number 90, and a point as the center of rotation (a vertex of the rectangle).

The rotation is completed in a *counter-clockwise* direction.

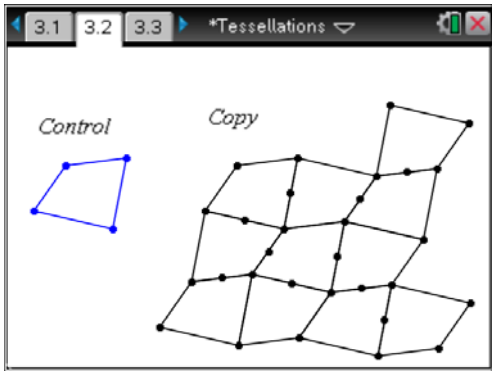


TI-Nspire Navigator Opportunity: *Screen Capture*

See Note 3 at the end of this lesson.

Problem 3 – Quadrilaterals

On page 3.2, students will see a **Control** quadrilateral and a **Copy** quadrilateral.

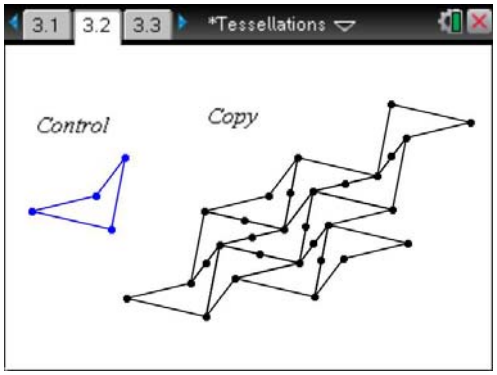


They are to use any of the Transformation tools from the previous Problems to create the tessellation of the quadrilateral.

Ask students*: How many angles come together at one vertex of the tessellation? What are the measures of these angles?*

Students are to use the **Text** and **Calculate** tools to find the sum of the measures.

They can then drag a vertex of the Control quadrilateral and observe the results.



TI-Nspire Navigator Opportunities

Note 1
Problem 1, *Screen Capture*

Use *Screen Capture* to display the progress of the class as they tessellate the screen. It will be interesting for students to see that they all end up with the same tessellation, even though everyone did their symmetries in a different order.

Note 2
Problem 1, *Quick Poll*

Send two *Quick Polls* for the questions on 1.5 and 1.6.

Note 3
Problem 2, *Screen Capture*

Use *Screen Capture* to display the progress of the class as they tessellate each of the screens on pages 2.2 to 2.8. It will be interesting for students to see that they all end up with the same tessellation, even though everyone did their isometries in a different order.