

Geometric Tessellations
Suggested Grades: 5 through 7
Lesson by: Meagan McCormick

(Be sure to contact the Castellani Art Museum for a copy of the teacher resource guide containing the images, activities, and additional information associated with this lesson plan.)

Disciplines: NYS Learning Standards

◆ **The Arts- Visual Arts**

Standard 1: Creating, Performing, and Participating in the Arts

Performance Indicator (1): Students will make works of art that explore different kinds of subject matter, topics, themes, and metaphors. Students will understand and use sensory elements, organizational principles, and expressive images to communicate their own ideas in works of art. Students will use a variety of art materials processes, mediums, and techniques, and use appropriate technologies for creating and exhibiting visual art works.

Standard 2: Knowing and Using Arts Materials and Resources

Performance Indicator (2): Students will know and use a variety of visual arts materials, techniques, and processes. Students will know about resources and opportunities for participation in visual arts in the community (exhibitions, libraries, museums, galleries) and use appropriate materials (art reproductions, slides, print materials, electronic media). Students will be aware of vocational options available in the visual arts.

Standard 3: Responding to and analyzing Works of Art

Performance Indicator (3): Students will reflect on, interpret, and evaluate works of art, using the language of art criticism. Students will analyze the visual art characteristics of the natural and built environment and explain the social, cultural, psychological, and environmental dimensions of the visual arts. Students will compare the way in which a variety of ideas, themes, and concepts are expressed in other disciplines.

◆ **Mathematics**

Standard 1: Analysis, Inquiry, and Design

Performance Indicator: Mathematical Analysis:

(1) Abstraction and symbolic representation are used to communicate mathematically.

(3) Critical thinking skills are used in the solution of mathematical problems

Performance Indicator: Engineering Design:

(1) Engineering Design is an iterative process involving modeling and optimization finding the best solution within given constraints which is used to develop technological solutions to problems within given constraints.

Standard 3: Mathematics

Performance Indicator: Mathematical Reasoning:

(1) Students use mathematical reasoning to analyze mathematical situations, make conjectures, gather evidence, and construct an argument.

Performance Indicator: Modeling/Multiple Representation:

(4) Students use mathematical modeling/multiple representation to provide a means of

presenting, interpreting, communicating, and connecting mathematical information and relationships.

Descriptive Title: Geometric Tessellations

Context (Rationale):

This lesson is important to teach students that studying mathematics is not just learning about numbers but understanding the important part that it plays in everyday life. Mathematics surrounds us and influences much of what we do. While we usually think of numerical operations and calculations as a part of mathematics, there is another element. We can see mathematics all around us, in man-made objects as well as our natural environment. Everything that is visible has shape and form, often creating patterns that are beautiful as well as important and functional. Many of these patterns are tessellations. In everyday language, tessellation means “tiling”. Mathematically speaking, “regular” tessellation means a pattern of identical shapes that fit together and endlessly cover a plane. Square tiles on a kitchen floor “tessellate” because the squares fit together without any gaps or overlaps. Other shapes that will successfully tile a floor are equilateral triangles and hexagons. Two shapes that won’t work as tiles are pentagons and heptagons. After studying various pieces of art, students will be able to identify which work represents tessellation, identifying the shapes used and recognizing the patterns created. Students will be able create their own tessellations and discuss their meanings and significance.

Performance Task:

The student will be able to:

- List the different geometric shapes
- Identify geometric shapes in their immediate surroundings
- Define tessellation
- Define polygons, regular polygons, and determine if all regular polygons will tessellate
- Identify different polygonal shapes found in the tessellations
- Discuss why specific shapes may have been used
- Understand the importance of motion and symmetry creating tessellations
- Create own tessellation using the correct polygonal shapes

Art Resources:

- Lisa 1971, Alvin Loving, Castellani Art Museum
- 666, 1971, Robert Indiana, Castellani Art Museum
- Untitled 1973, Alfred Jensen, Castellani Art Museum
- Untitled 1973, Alfred Jensen, Castellani Art Museum
- Family Portrait, Per II, 1975, Alfred Jensen, Castellani Art Museum
- Visual presentation of polygonal shapes illustrating which will tessellate and which will not

Art Materials:

- Pencil
- Eraser
- Rulers
- Tracing Paper
- Drawing Paper
- Markers/ Colored Pencils

Motivation:

The teacher will motivate the students by asking them to describe how they might define the term *mathematics*. Is it more than just the study of numbers? The teacher will then ask them if they realize that they can see math all around them. The teacher will remind them that studying shapes and forms is a part of mathematics called geometry. These shapes and forms form patterns which can be both beautiful and important and can be found in art, architecture, and even in plants and biology. Many of these shapes form tessellations. At that point the teacher may ask them to look around the room and see if they can find specific shapes and identify them with their proper names. Do they form tessellations? The teacher will then tell them that they will view artwork that illustrates tessellation.

Presentation:

1. Once the students arrive at the museum the teacher will bring them into the gallery where the artwork illustrating tessellations is displayed.
2. The teacher will first introduce the concept of tessellation by using the motivational questions to encourage students to think of the shapes and forms that surround their lives.
3. The teacher will give a short presentation defining the mathematical term polygon, giving specific examples of different types of polygons and describing all of their physical properties.
4. The teacher will define tessellation and show students specific examples of how polygons are used to create tessellations.
5. Besides pointing out what they see in the gallery and throughout the museum the students will be encouraged to think of other types of tessellations that they see in their environment. These could include brick walls, paving stone, linoleum flooring, chain link fence, honeycomb, and even a pineapple.
6. The teacher will ask students to describe what they see when they look at the artwork exhibited in the gallery. Do they see examples of tessellation?

7. Based on student responses the teacher will describe each piece of art in further detail, giving background information.
8. The teacher may want to give a short demonstration to the students to illustrate how to create a tessellation depending on grade level.
9. The teacher will then tell students that they will create their own tessellation and personalize it by including within the pattern some facet of their life or something that has special meaning to them.

Assessment Tools and Evidence:

Tools: At the end of the session the teacher will ask students to volunteer to share their tessellations with the rest of the class describing the polygons used to create their piece of artwork and describe what it means to them.

Evidence: The evidence of whether or not the students understood the concept of tessellation will be determined by the artwork they create and their description.

Teacher Reflection/Follow Up: Did the students understand the concept of tessellation? Do they see examples of tessellation in everyday life? The teacher will make decisions based on student artwork and explanations as well as feedback from classroom teachers.