Mosaic Math

Enduring Understanding
Mosaic designs use symmetry, shapes, and angles to create patterns. Mosaics are a means of decoration and storytelling.

Essential Questions
What can the imagery depicted in mosaics tell us about life in ancient Roman culture? How is symmetry used in mosaics?

What Students Will Learn
• Mosaics serve the function of communication and storytelling.
• Mosaics are designed with symmetry.
• Mosaics are often the most intact portion of an archeological site and provide a tremendous amount of historical information about the Roman people.

What Students Will Do
• Analyze and interpret Roman mosaics; compare and contrast styles, patterns, and depictions
• Identify lines of symmetry (reflection, rotation, translation and glide).
• Research and plan their own mosaic design.
• Create their own mosaic.
• Optional activity: 100 Square Mosaic (fraction, decimal, and percentage).

Materials
For Each Student
• “Creating Lines of Symmetry” (page 86)
• “Describe a Roman Mosaic” (page 87)
• “Design a Mosaic” (page 88)

SUBJECTS: art, math, social studies
SKILLS:
• Bloom’s Taxonomy: Evaluation, Synthesis, Analysis
• Facets of Understanding: Interpretation, Application
DURATION: 45-60 minutes
CLASS SIZE: individuals or teams

The materials used for this project can vary from simple to elaborate. This depends on access to materials, classroom time for the project, and resources in your community.

Below are options for your classroom. Consider thinking outside the box and resourcing materials locally such as tile remnants from tile setting, stone and pebble collecting, etc. Consider making it a small group activity. One person can create the base and grid, one can cut out all the tiles and another draw out the design. Everyone can work together to stick the tiles to the base.

Option 1: Paper mosaics
Level: Basic to Moderate
http://downloads.bbc.co.uk/history/handsonhistory/romans_mosaic.pdf

Paper (colored as well as black and white) can serve as a simple resource to create fantastic mosaic projects. You will need:
• Colored paper. As simple as construction paper, or you can order mosaic paper kits
from art supply resources. Another resource in your local community would be outdated paint sample swatches from local paint, and hardware stores that can be cut into smaller squares. Yet another method could be to first paint large pieces of paper with acrylic paint (It has a gloss sheen when dry), then cut them into small squares.

- Rulers and pencils, Grid Paper
- Scissors
- Glue: White Elmer’s glue or glue sticks
- Card-stock/poster-board: Initial backing for the mosaic. Important that the finished project has a strong backing that stays flat.

**Option 2: Bean Mosaics**

**Level: Basic**

Dried beans are an accessible, abundant resource at your local grocery store. These dried beans come in a variety of colors. Beans are less geometric for the planning portion of this project; however, symmetry can easily be achieved through thoughtful preparation.

- Black, White, Red, Yellow, and Brown beans are the most common colors in bulk
- Elmer’s Glue
- Poster board
- Rulers and Pencils, Grid Paper

**Option 3: Glass and Ceramic Mosaic Kits**

**Level: Advanced**

Glass and ceramic tiles for mosaics can be ordered from art supply and craft suppliers. A simple web search pulls up options for a kit of materials. Ordering these kits requires a larger budget due to the nature of the materials needed for this project. Be sure to have a good sense of the quantity needed to complete each student’s mosaic. You may also visit a hardware supply store to purchase small black and white tiles, the smaller, the better.

- Mosaic glass or ceramic tile kit
- Strong material backing: Recommend a Hardy-board backing from a Hardware store. Knowledge of cutting the Hardy-board is necessary to make a class set and the desired size.
- Mosaic Glue and Grout
- Buckets for mixing grout. Trowel for spreading, and sponges for cleaning grout. Knowledge of grout application is necessary.

**Background Information**

Decoration takes on many forms and defines a culture’s aesthetic. Adornment of an inhabited space communicates its importance to a guest, a visitor, or a stranger. Society has learned to understand that beautification of a space also communicates status by the owner of the home, or the importance of a public space by the arrangement of objects, the vast open expanse of architecture, and the subject matter of the decorative elements within that space.

Through learned skill, craftsmen utilized materials to adorn the homes and spaces of ancient Romans by arranging tesserae (small squares of colored stone, glass, or ceramic) in elaborate arrangements that decorated floors, entryways, and hallways. At times, this adornment was a geometric pattern that lined a hallway, or marked the entrance to a space. Other mosaics were embellished scenes depicting everyday life, animals and plants, myth and legend, people and historical battles. These mosaics have proven invaluable for today’s study of ancient life, providing glimpses into the past of how Romans dressed, what they ate, how they understood their surroundings, and what they found to be important.

Some more expensive mosaics could be commissioned privately, or purchased at a market in the form of a panel as if purchasing a painting, or a ceramic object. These panels would be owned by an individual or a family, and could be installed or even removed from its place. A panel purchased at a workshop or market could depict anything from a decorative overflowing bowl of fruits to a classical Greek mythological or historical story. A private commission could have been a portrait of a family member, or a desire to have a specific subject matter rendered in the permanent form of a mosaic. These panels would be installed in a specific location, and then the artisan would frame the panel with more geometric patterns to finalize the space.

**Preparing to Teach**

1. Research Roman mosaics. A great resource for this information can be found on sites related to the Naples Museum of Archeology. [This Ancient History](#) article online is a fantastic resource that provides a rich overview of Roman mosaics.
2. Decide which option of mosaic the class will produce and gather materials.
3. Make copies of “Creating Lines of Symmetry,” “Describe a Roman Mosaic,” and “Design a Mosaic” sheets for each student.
4. Post the essential question.
5. Prepare to share Background Information.

Word Bank

mosaic: A picture or pattern produced by arranging together small colored pieces of hard material, such as stone, tile, or glass.
tessellae (tesserae): An individual tile, usually formed in the shape of a cube, used in creating a mosaic. It is also known as an abaciscus or abaculus.
pattern/rhythm: is an underlying structure that organizes surfaces or structures in a consistent, regular manner.
unity: The relationship among the elements of a visual that helps all the elements function together.
symmetry/balance: Refers to the sense of distribution of perceived visual weights that offset one another.
reflection symmetry: an image is reflected through a mirror line.
rotation symmetry: an image is repeated as it rotates around a center point.
translation symmetry: a repetition of an image along a line.
glide symmetry: a combination of reflection and line (translation) symmetry.
emphasis: Defined as an area or object within the artwork that draws attention and becomes a focal point.

Misconception Alert!

Studying Roman Art means that you are spanning over 2,000 years and 3 continents. Roman artisans were greatly influenced by the Greeks, Asians, and Egyptians. They adapted their techniques and borrowed ideas as the empire expanded. Therefore, one could say that Roman art evolved over time as they discovered new forms of expression and materials. Romans liked to reference Greek mythology, or obtain copies of famous works to display their knowledge and wealth. When we reference Roman Art, it is important to understand the time and the place where the work existed.

Uncovering Prior Knowledge

Have students fold a piece of paper in half, and open it out again. Coat a piece of string with paint and lay it onto one side of the paper. Then fold the paper over the string, hold it in place and pull the string out. When you open it up you will have a symmetrical print.

Discovering New Knowledge

What can the imagery depicted in mosaics tell us about life in ancient Roman culture? How is symmetry used in mosaics? Inform students that this question will guide their learning. Indicate the Word bank words (mosaic, tessellae, pattern, unity, symmetry, emphasis) and inform students that they will use these words as tools and define them during the lesson.

1. Distribute “Creating Lines of Symmetry” to each student. Go over the four different lines of symmetry. Tell students: Draw lines of symmetry as we discuss each mosaic. Or students can fold the paper to determine the lines of symmetry. The mosaic floors are all found in Villa A at Oplontis. Assist students in defining mosaic and symmetry.
2. Ask students: What shapes do you see in the mosaics? Squares, rhombuses, diamonds, etc.
3. Ask students: What angles do you see in the mosaics?
4. Tell students: Imagine you are an archaeologist and you have just uncovered a Roman mosaic at a villa near Pompeii. You call the Museum of the Rockies to tell them about your thrilling discovery. Describe the complete pattern as precisely as you can so someone else can draw it without actually seeing the design. Try to describe the shapes, symmetry, and angles:
5. Ask students: Does the mosaic have any symmetry? How have the artists used symmetry to create a pattern? What angles do the shapes make in the mosaic?

6. What do the materials used and designs tell you about the elite Romans who used mosaics to decorate their floors and walls? Share background information with students.

Create a Mosaic: This activity is for all grade levels just adjust the complexity of design, materials, and size of tesserae according to grade/skill levels.

1. Have students research Roman mosaic designs with geometric patterns or pictures of animals. Students can replicate a Roman mosaic or design their own mosaic.

2. Have students work out their designs on a piece of paper using a ruler and pencil.

3. Students should use gridded paper to help keep symmetry in their planning. Distribute “Design a Mosaic” art.

4. Refer students to an online resource/activity if the internet is available. This website will allow for some experimentation and discovery. Mosaic Online Activity: Planning and experimenting with pattern. This online resource is a great way to quickly experiment with pattern, and to make a plan for your own mosaic. There are examples and a wide variety of skill levels including black and white and color.

5. Encourage symmetry and balance if they are working with a geometric pattern.

6. Once students have a plan, hand out their final art-boards that serve as the backing for their mosaic.

7. Have students grid their artboard using the dimensions of their tesserae (tiles).

8. Students will then plan out their entire design, designating squares to colors.

9. Students will then adhere their tesserae to the art-board with the appropriate adhesive.

10. Finished art-boards should be left to dry.

Assessment

Project based assessment is a great opportunity to use a performance based method of assessing student work. Performance Standards: Criteria, Craftsmanship, Creativity

Assess student understanding in each category with the scale below for a total of 30 points. Students receive 20 points for a completed project and class critique for a total of 50 points.

- Advanced Proficient: 9-10 pts
- Proficient: 6-8 pts
- Developing: 3-5 pts
- Emerging: 0-2 pts

Reflecting on New Knowledge

Classroom Critiques are a great method to assess understandings informally amongst peers. There is a method of communication in this setting that serves the student; their ideas, frame of reference, and context. A great method of discovering the student’s new knowledge is to set up a class critique where the students speak to the group about their work. Have the students cover these talking points:

- The content of their mosaic.
- The process of arriving at their design.
- The challenges they faced and how they overcame it to finish their work.
- Their favorite part of the project.

Have the students’ peers participate by prompting them to engage in the discussion of the work. The reflection of new knowledge will be evident in this process.
Use a pencil to draw lines of symmetry for each mosaic. The mosaic floor images are all from Villa A at Oplontis.

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Describe a Roman Mosaic

Imagine you are an archaeologist and have just uncovered a Roman mosaic from Pompeii.

You call the Museum of the Rockies to tell them about your amazing discovery!

Describe the design and pattern above in words so someone else will be able to draw the design back at the museum. The museum would like to recreate the floor mosaic as part of an exhibit. Describe the design using shapes, symmetry, and angles.

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Design A Mosaic

A mosaic is a design or decoration made from small pieces of glass or stone arranged into a pattern. Some elite Romans decorated the floors of their homes with mosaics. Plan the design for your own mosaic by filling in the squares. Then you will be ready to create your own mosaic! The Romans used lots of different patterns and pictures. Perhaps you can get some ideas from the mosaics on display at the museum.
Mosaic Math
100 Square Mosaic

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