



artsNOW

Integrated learning solutions

MANDALAS AND MEASUREMENTS

Grade Band: 7

Content Focus: Visual Arts & Math



LEARNING DESCRIPTION

In this lesson, students will create a mandala utilizing concentric circles, pattern, color theory, circumference, and radius.

LEARNING TARGETS

Essential Questions	"I Can" Statements
How can I calculate radius using the circumference of a circle?	I can calculate radius using the circumference of a circle.
How can I calculate circumference using the radius of a circle?	I can calculate circumference using the radius of a circle.
How can I create a mandala using concentric circles?	I can create a mandala using concentric circles. I can use pattern and color to create a visually interesting artwork.



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How can I use pattern and color to create a visually interesting artwork?

GEORGIA STANDARDS

Curriculum Standards	Arts Standards
<p>7.GSR.5: Solve practical problems involving angle measurement, circles, area of circles, surface area of prisms and cylinders, and volume of cylinders and prisms composed of cubes and right prisms.</p> <p>7.GSR.5.4 Explore and describe the relationship between pi, radius, diameter, circumference, and area of a circle to derive the formulas for the circumference and area of a circle.</p> <p>7.GSR.5.5 Given the formula for the area and circumference of a circle, solve problems that exist in everyday life.</p>	<p>VA7.CR.1 Visualize and generate ideas for creating works of art.</p> <p>VA7.CR.3 Engage in an array of processes, media, techniques, and/or technology through experimentation, practice, and persistence.</p> <p>VA7.CR.4 Incorporate formal and informal components to create works of art.</p> <p>VA7.CN.3 Utilize a variety of resources to understand how artistic learning extends beyond the walls of the classroom.</p>

SOUTH CAROLINA STANDARDS

Curriculum Standards	Arts Standards
<p>7.GM.4 Investigate the concept of circles.</p> <p>a. Demonstrate an understanding of the proportional relationships between diameter, radius, and circumference of a circle.</p> <p>b. Understand that the constant of proportionality between the circumference and diameter is equivalent to π.</p> <p>c. Explore the relationship between circumference and area using a visual model.</p> <p>d. Use the formulas for circumference and area of circles appropriately to solve real-world and mathematical problems.</p>	<p>Anchor Standard 1: I can use the elements and principles of art to create artwork.</p> <p>Anchor Standard 2: I can use different materials, techniques, and processes to make art.</p> <p>Anchor Standard 7: I can relate visual arts ideas to other arts disciplines, content areas, and careers.</p>

KEY VOCABULARY

Content Vocabulary	Arts Vocabulary
<ul style="list-style-type: none"> <u>Radius</u> - The distance from the edge of a circle to its center 	<ul style="list-style-type: none"> <u>Radial balance</u> - A type of balance in art in which all elements are symmetrically balanced in multiple directions from a central point



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- Circumference - The perimeter of a circle
- Diameter - The width of a circle
- Pi - The ratio of the circle's circumference to its diameter
- Concentric circles - A circle within a circle that has the same central point

- Line - One of the Elements of Art; a mark made by a moving point
- Shape - One of the Elements of Art; a flat, enclosed object that has two dimensions
- Pattern - Repetition of line and shape
- Contrast - Two elements side by side that draw attention to their differences
- Color wheel - A tool artists use to organize color schemes
- Complementary colors - Two colors across from each other on the color wheel (ex: orange and blue)
- Analogous colors - Colors next to each other on the color wheel (ex: yellow, orange, and red)

MATERIALS

- Ruler
- White paper
- Pencils
- Colored pencils or markers
- Compass

INSTRUCTIONAL DESIGN

Opening/Activating Strategy

- Conduct the See, Think, Wonder visual literacy protocol using an [image of Tibetan monks creating a sand mandala](#).
 - First, students will identify what they see in the image. Emphasize that they should make objective observations about the mandala.
 - Next, ask students to identify what they think about the image. Emphasize that students should be creating inferences using visual evidence from the mandala.
 - Finally, ask students what they wonder about the image.
- Facilitate a class-wide discussion around students' observations, inferences, and questions. Draw students' attention to how the artist uses line and shape to make the mandala (observations could include circles within circles, repeating designs, etc.).
- Explain to students that mandala art is an art form that dates back to 500 BCE in India.



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- Tell students that they will be creating their own mandalas using mathematical concepts.

Work Session

- Give each student a circumference measurement (it should be for a circle that could fit on an 8.5x11 inch piece of paper).
- Explain to students that they will be creating their own mandala art using the circumference measurement given to them as a starting point.
- Their mandalas will be made up of concentric circles—circles within circles with the same middle point. Show students an image of a mandala again and point out the concentric circles.
 - To create their first circle, each student will calculate the radius of their circle using the circumference they were assigned.
 - Students will use a ruler to draw the radius of the circle. Then, using a compass, students will draw their circle on their white paper.
 - Next, students should divide their radius into three parts. For example, if their radius is 3 inches, they could divide their radius into increments of 1 inch. The parts do not have to be equal. For example, if the radius is 3.5 inches, students could divide the radius into .5 inch, 1 inch, and 2 inches.
 - Students should then use their compass to create two more circles using the radiuses they created from the original radius. When this is done, students will have three concentric circles.
 - Students should then calculate the circumference of each of the two smaller circles.
- Explain to students that radial balance is a type of balance in art where all elements are equally arranged around a central point. Mandalas are examples of art with radial balance because all elements are equally arranged around a central point. Go back to an image of a mandala.
- Draw students' attention to the patterns in the mandala. Explain to students that pattern in art is a repetition of line and shape. Explain to students that they will use line and shape to create three different patterns. One pattern will go in each circle.
 - Allow students time to work on designing their mandalas by adding patterns using pencil.
- Next, show students an image of a [Color Wheel](#). Explain that colors across from each other on the color wheel (such as yellow and purple) are complementary colors—they contrast each other. Explain that colors next to each other on the color wheel are analogous colors.
- Tell students that they will be adding color to their mandalas. One circle should have a complementary color scheme (red-green, yellow-purple, or orange-blue), and one should have an analogous color scheme (example—green, blue, and violet; red, orange, and yellow). Students can use any colors they choose for their final circle.
- Students should add color using colored pencils or markers.
- Students should finish their mandalas by writing the equation for circumference followed by the three equations for their three circles.

Example:

$$C = 2\pi r$$

$$18.84 = 2\pi 3$$

$$12.56 = 2\pi 2$$

$$6.28 = 2\pi 1$$



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Closing/Reflection

- Conduct a gallery walk so that students can see how their classmates used math to create their artwork.
- Facilitate a discussion around the process of creating mandalas and how math is used in visual art.

ASSESSMENTS

Formative

Teachers will assess student understanding by observing whether students are able to:

- Find the radius of the first circle and circumference of the next two circles.
- Identify analogous colors and complementary colors.
- Write their equations for circumference using their own individual numbers.

Summative

CHECKLIST

- Students can create mandalas using concentric circles.
- Students can utilize a variety of patterns and color schemes in their mandala designs.
 - Each circle should have a different pattern.
 - One circle should have an analogous color scheme.
 - One circle should have a complementary color scheme.
- Students can correctly calculate circumference and radius.
- Students can write the equation for circumference correctly on their artwork.

DIFFERENTIATION

Acceleration:

- Do not give students a circumference. Instead, give students a sheet of 8.5x11 blank paper. Explain that students will need to create a circle on their paper that is large enough to draw two other circles in. Allow students to determine the radius of the first circle, draw the circle, and then calculate the circumference.
- Require students to also find the area of each of their circles.
- Have students conduct an independent study on the history of mandalas focusing on how math is used in the design.
- 7th Grade Georgia Social Studies connection - Have students research the history of mandalas in India, which is a country of study in Georgia Social Studies.

Remediation:

- Allow students to trace half-circle templates with whole number diameters to create their three circles. Students will still need to measure and calculate circumference and radius.
- Allow students to work with a partner on calculations. Students will create their own artwork but will have the same measurements.
- Use one set of calculations for the whole class; work through the calculations together. Students will create their own artwork but will have the same measurements.



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ADDITIONAL RESOURCES

- [History of the Mandala](#)
- [Image of Tibetan monks creating a sand mandala](#)
- [Color Wheel](#)

**This integrated lesson provides differentiated ideas and activities for educators that are aligned to a sampling of standards. Standards referenced at the time of publishing may differ based on each state's adoption of new standards.*

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