

## ARTS IMPACT LESSON PLAN

### Visual Arts and Math Infused Lesson

#### *Radial Symmetry*

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#### Enduring Understanding

Repeating lines and elements radiating from a central point based on a circle can create radial symmetry in art.

#### Lesson Description (Use for family communication and displaying student art)

*In this visual arts and math lesson, students analyze radial symmetry in nature and artwork. They create a radial symmetry design and emboss it on a copper circle.*

### Learning Targets and Assessment Criteria

**Target:** Recognizes and creates designs with radial symmetry.

**Criteria:** Draws approximate repeating shapes, lines, or dots using identical techniques that originate and repeat from a center point (circumcenter).

**Target:** Includes a wide variety of embossed design techniques.

**Criteria:** Uses both the front and back of the metal circle and applies raised and indented shapes, lines, and dots.

**Target:** Maintains craftsmanship towards the design as a whole.

**Criteria:** Handles materials gently and uses tools without damaging the copper by folding, creasing, puncturing, or flattening the surface.

**Target:** Demonstrates perseverance.

**Criteria:** Persists in adapting ideas to work through challenges to complete the repoussé that shows radial symmetry.

#### Vocabulary

Arts Infused:

Balance  
Central Point  
Radial Symmetry  
Repetition  
Rotation

Math:

Reflection  
Transformation  
Translation

Arts:

Craftsmanship  
Emboss  
Indent  
Relief  
Repoussé  
Repoussage  
Stylus

#### Materials

##### Museum Artworks or Performance

Seattle, WA

Seattle Art Museum

Tacoma, WA

Children's Museum of Tacoma  
Tacoma Art Museum

##### Materials

Images of plants, animals, or objects that show radial symmetry; chart paper or whiteboard and markers; Copper 36 gauge cut into 6" circles; Steel stylus tools; Fun Foam sheets; Rulers; Template; Copper tape for edges (optional); Contemplative music; Class Assessment Worksheet

*continued*

#### Learning Standards

##### WA Arts Learning Standards in Visual Arts

*For the full description of each standard, see:*  
<http://www.k12.wa.us/Arts/Standards>

**Creating (Concepts: Line, Shape, Form, Space, Balance, Repetition, Symmetry. Technique: Repousse)**

1. Generate and conceptualize artistic ideas and work.
  2. Organize and develop artistic ideas and work.
  3. Refine and complete artistic work.
- Performing/Presenting/Producing**
4. Select, analyze, and interpret artistic work for presentation.
  5. Develop and refine artistic techniques and work for presentation.
  6. Convey meaning through the presentation of artistic work.

**Responding**

7. Perceive and analyze artistic work.
8. Interpret intent and meaning in artistic work.
9. Apply criteria to evaluate artistic work.

**Connecting**

11. Relate artistic ideas and works with societal, cultural, and historical context to deepen understanding.

*continued*

Seattle Art Museum images:  
*Painted Woven Hat*, 1895, Charles Edansaw,  
83.226



*Tile with Twelve-pointed Star*, 15<sup>th</sup> century,  
Persian, 39.61



Tacoma Art Museum images:  
*Egg and Cross*, 1996, Michael Gregory



Internet and books: Metropolitan Museum of  
Art, Hellenistic Phiale, 300 BC; other photos  
of cultural examples of radial symmetry:  
Rangoli, Mandala, Hex, Millefiori, Tapa,  
Quilt, Arabic and Gothic designs

## Learning Standards

### Early Learning Guidelines, if applicable

For a full description of Washington State Early Learning and Child Development Guidelines see: <http://www.del.wa.gov/development/guidelines/>

(Ages 4-5) 6. Learning about my world: Math: Create own patterns with a variety of materials. Describe what the pattern is. Arts: Show an increasing ability to use art materials safely and with purpose.

### Common Core State Standards (CCSS) in Math

<http://www.k12.wa.us/CoreStandards/Mathematics/default.aspx>

4.G.A.3. Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded along the line into matching parts. Identify line-symmetric figures and draw lines of symmetry.

### CCSS Mathematical Practices

5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.

### ICON KEY:

 = Indicates note or reminder for teacher

 = Embedded assessment points in the lesson

### Pre-Teach

Discuss how to use art materials safely. Introduce symmetry and radial symmetry.

### Lesson Steps Outline

**1.** Introduce and define radial symmetry. Discuss the radial symmetry evident in the world around us.

 Criteria-based process assessment: Understands radial symmetry. Gives examples of radial symmetry in the world around us.

**2.** Lead analysis of artworks that show evidence of radial/rotational symmetry. Ask for aesthetic responses to the effect radial symmetry has within the artwork.

 Criteria-based process assessment: Analyzes radial symmetry in artworks.

**3.** Discuss the tradition of radial symmetry in the art of many cultures throughout history and the beliefs that are connected to those art forms.

 Criteria-based process assessment: Observes the traditional uses of radial symmetry in art and discusses the range of purposes and beliefs.

**4.** Introduce the copper material and the tradition of repoussé.

**5.** Demonstrate the division of a copper circle with a template and the application of the center design. Demonstrate the varied uses of stylus tool, addition of layers and the reversal of the copper to include both embossing and indenting in the finished design.

**6.** Demonstrate and encourage use of all tools and exploration beforehand on scrap pieces to establish the pressure needed. Lead class in experimentation on scrap copper pieces with a stylus tool.

**7.** Distribute materials and guide class through the process of tracing the edges of the template to create clear pie-shaped sections that meet at the center point. Direct students to create a center/navel/seed design.

Criteria-based teacher checklist: Draws approximate repeating shapes, lines, or dots using identical techniques that originate and repeat from a center point (circumcenter).

**8.** Guide to students to create their repoussés. Challenge them to use their 21<sup>st</sup> Century Skill of Perseverance to complete their artwork. Initiate a quiet, contemplative process for the class with music to encourage focus.

Criteria-based teacher checklist, self-assessment: Uses both the front and back of the metal circle and applies raised and indented shapes, lines and dots. Handles materials gently and uses tools without damaging the copper by folding, creasing, puncturing or flattening the surface. Persists in adapting ideas to work through challenges to complete the repoussé that shows radial symmetry.

**9.** Lead a group critique of the radial designs, remarking on successful evidence of the meeting of criteria.

Criteria-based teacher checklist, peer assessment: Uses both the front and back of the metal circle and applies raised and indented shapes, lines and dots. Handles materials gently and uses tools without damaging the copper by folding, creasing, puncturing or flattening the surface. Persists in adapting ideas to work through challenges to complete the repoussé that shows radial symmetry.

## LESSON STEPS

### 1. Introduce and define radial symmetry. Discuss the radial symmetry evident in the world around us.

- *Where do we see something in nature that radiates evenly from the center?*

▣ Show images of objects such as snowflakes, spider webs, flowers.

- *Where do we see something in everyday life that radiates evenly from the center?*

▣ Show images of bicycle wheels or kaleidoscopes, pinwheels.

- *Let's make a list of the properties and qualities of radial symmetry to create a definition on the board.*

☑ Criteria-based process assessment: Understands radial symmetry. Gives examples of radial symmetry in the world around us.

### 2. Lead analysis of artworks that show evidence of radial/rotational symmetry. Ask for aesthetic responses to the effect radial symmetry has within the artwork.

▣ Display *Egg and Cross* by Michael Gregory and *Painted Wooden Hat* by Charles Edanshaw.

- *In what way does the artist arrange the elements of this piece to elicit our attention and reflection?*
- *Where does the artist repeat an element?*
- *How does the radial symmetry change our experience of the artist's expression?*

☑ Criteria-based process assessment: Analyzes radial symmetry in artworks.

### 3. Discuss the tradition of radial symmetry in the art of many cultures throughout history and the beliefs that are connected to those art forms.

▣ Display Rangoli, Mandala, Hex, Millefiori, Tapa, Quilt, Arabic, and Gothic design examples.

- *Let's observe how radial symmetry is used in the art of many cultures.*
- *What do you see?*
- *How do you think these artists used radial symmetry to show what they believed? Why?*

☑ Criteria-based process assessment: Observes the traditional uses of radial symmetry in art and discusses the range of purposes and beliefs.

#### 4. Introduce the copper material and the tradition of repoussé.

- *Repoussé means to 'push back' in French. This method often includes both embossing and indenting a metal surface from both sides to create a slightly projecting relief surface.*

▣ Show the Hellenistic Phiale.

- *What do you see in the center of this gold repoussé example?*
- *We do not know the specific artist, only that it was created around 300 BC. Art historians have found that it is meant to represent the navel of the universe. All around the navel are symmetrically arranged bees and acorns. What do you think that might mean? (plenty of food)*
- *How does this radially symmetrical arrangement express to, or tell, the viewer more about the way Hellenistic artists saw the world?*

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#### 5. Demonstrate the division of a copper circle with a template and the application of the center design. Demonstrate the varied uses of stylus tool, addition of layers and the reversal of the copper to include both embossing and indenting in the finished design.

▣ The even number of sections on the template can vary with the artistic developmental growth of each group of students.

- *I am making sure to include a variety of design elements that I invent like dots and tiny shapes and stars. I complete a whole layer of the same one element before I go onto my next idea.*
- *Each time, I'm checking to see if the repetition falls on a rotation that can be found in each section.*
- *I am not sure that I can draw the exact same bee each time, so I am not going to try to do anything too complicated for this design. I have some raised details and some pushed in details for greater interest.*

▣ Show before and after design examples.

▣ Model self-assessment and subsequent refinement of design to meet criteria. Model journal entry to reflect on the design and document potential personal meaning.

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#### 6. Demonstrate and encourage use of all tools and exploration beforehand on scrap pieces to establish the pressure needed. Lead class in experimentation on scrap copper pieces with a stylus tool.

- *Watch me as I use several different tools and experiment on some scrap pieces.*
  - *Now it's your turn to practice.*
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**7. Distribute materials and guide class through the process of tracing the edges of the template to create clear pie-shaped sections that meet at the center point. Direct students to create a center/navel/seed design.**

- *Use the template to trace the design on your copper circle.*
- *First, draw a radial symmetry design on your template. You will repeat shapes, lines, and/or dots that begin and repeat from a center point — the circumcenter. You can use transformations like translations, reflections, and rotation.*
- *You will emboss that design on your copper circle.*

Criteria-based teacher checklist: Draws approximate repeating shapes, lines, or dots using identical techniques that originate and repeat from a center point (circumcenter).

**8. Guide to students to create their repoussés. Challenge them to use their 21<sup>st</sup> Century Skill of Perseverance to complete their artwork. Initiate a quiet, contemplative process for the class with music to encourage focus.**

- *As you emboss your radial symmetry designs on your repoussé, remember to use your 21<sup>st</sup> Century Skill of Perseverance. Adapt your design if you need to. Work through the challenges. Don't give up.*
- *Ask yourself, are you using different techniques for embossing your design? Are you using the front and back of your copper circle? Does your design show radial symmetry?*
- *Handle your material carefully. Try not to damage your copper by folding, creasing, puncturing, or flattening it.*

Advise students during the process of doing their repoussé designs, brainstorming ways to edit or enhance faint marks or stray non-symmetrical elements so that they will meet criteria.

Students may reflect in the journals.

Criteria-based teacher checklist, self-assessment: Uses both the front and back of the metal circle and applies raised and indented shapes, lines and dots. Handles materials gently and uses tools without damaging the copper by folding, creasing, puncturing or flattening the surface. Persists in adapting ideas to work through challenges to complete the repoussé that shows radial symmetry.

**9. Lead a group critique of the radial designs, remarking on successful evidence of the meeting of criteria.**

- *Where do we see successful use of a variety of inventive designs, of raised designs, of indented designs, of especially careful attention to symmetry and craftsmanship?*

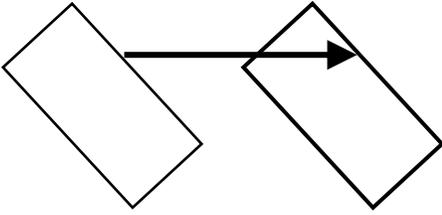
Criteria-based teacher checklist, peer assessment: Uses both the front and back of the metal circle and applies raised and indented shapes, lines and dots. Handles materials gently and uses tools without damaging the copper by folding, creasing, puncturing or flattening the surface. Persists in adapting ideas to work through challenges to complete the repoussé that shows radial symmetry.

## TRANSFORMATION DEFINITIONS

**transformation (geometric):** A change in position/location of a figure. Types of transformations include translation (slide), reflection (flip), rotation (turn), (or combinations of these).

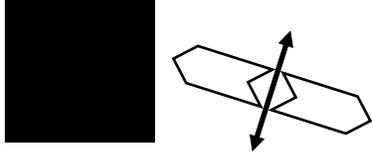
**translation/slide:** A transformation of a figure by sliding without turning or flipping in any direction.

*Example:*



**reflection or reflection on a line:** A transformation of a figure by flipping the figure over a line, creating a mirror image.

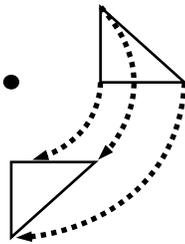
*Examples:*



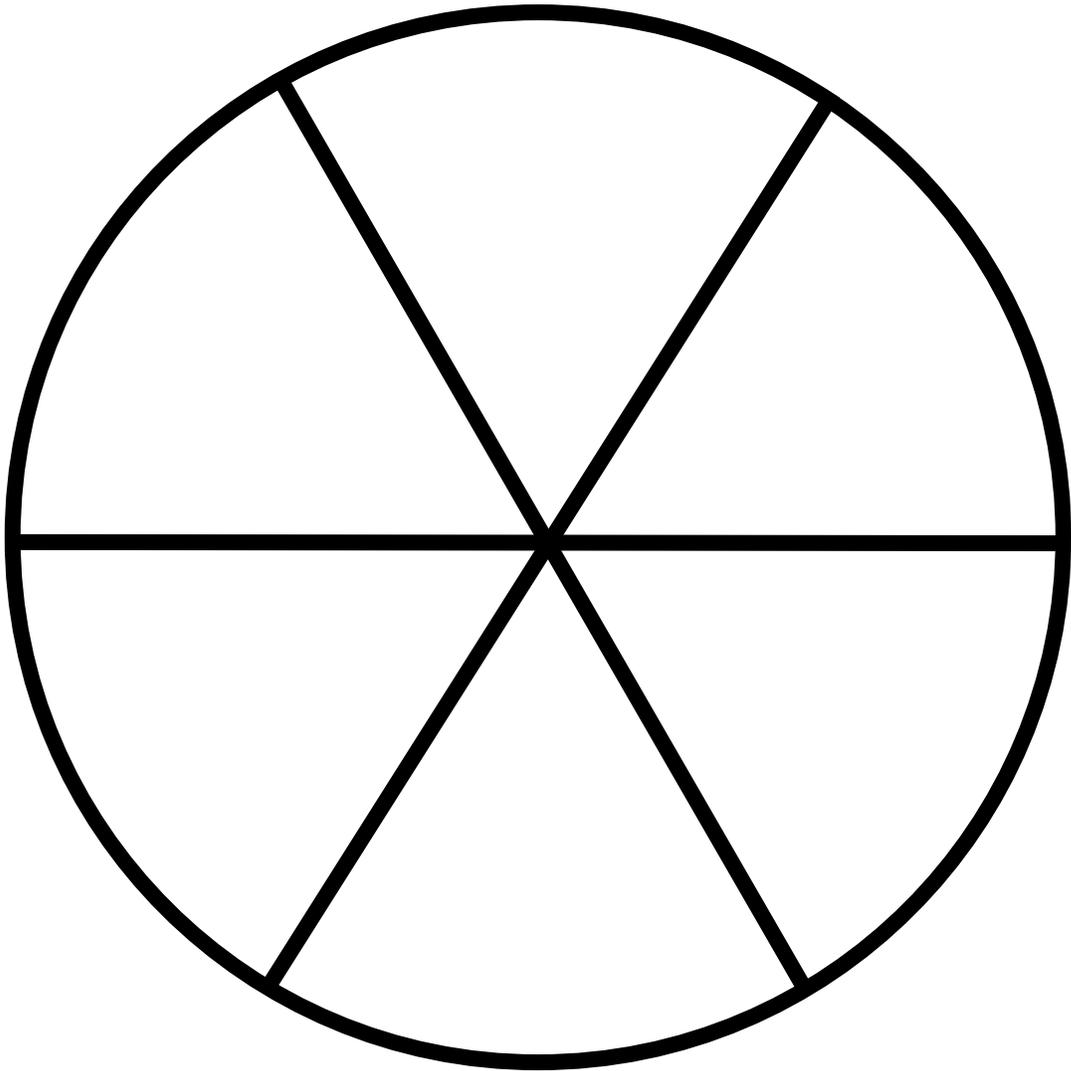
# translation

**rotation/turn:** A transformation of a figure (or points) in a plane resulting from turning a figure around a center point  $O$ —either clockwise counterclockwise.

*Example:*



# point O



## ARTS IMPACT LESSON PLAN Arts Infusion

### *Radial Symmetry*

Teachers may choose to use or adapt the following self-assessment tool.

### STUDENT SELF-ASSESSMENT WORKSHEET

Disciplines	VISUAL ARTS/ MATH	VISUAL ARTS	VISUAL ARTS	VISUAL ARTS	Total
Concept	<b>Symmetry</b>	<b>Repoussé Techniques</b>	<b>Craftsmanship</b>	<b>Perseverance</b>	4
Criteria	Draws approximate repeating shapes, lines, or dots using identical techniques that originate and repeat from a center point (circumcenter).	Uses both the front and back of the metal circle and applies raised and indented shapes, lines and dots.	Handles materials gently and uses tools without damaging the copper by folding, creasing, puncturing or flattening the surface.	Persists in adapting ideas to work through challenges to complete the repoussé that shows radial symmetry.	
Student Name					

**ARTS IMPACT LESSON PLAN Arts Infusion**

*Radial Symmetry*

**CLASS ASSESSMENT WORKSHEET**

Disciplines	VISUAL ARTS/ MATH	VISUAL ARTS	VISUAL ARTS	VISUAL ARTS	Total 4
Concept	Symmetry	Repoussé Techniques	Craftsmanship	Perseverance	
Criteria	Draws approximate repeating shapes, lines, or dots using identical techniques that originate and repeat from a center point (circumcenter).	Uses both the front and back of the metal circle and applies raised and indented shapes, lines and dots.	Handles materials gently and uses tools without damaging the copper by folding, creasing, puncturing or flattening the surface.	Persists in adapting ideas to work through challenges to complete the repoussé that shows radial symmetry.	
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30.					
Total					
Percentage					

*What was effective in the lesson? Why?*

*What do I want to consider for the next time I teach this lesson?*

*What were the strongest connections between visual arts and math?*

Teacher: \_\_\_\_\_

Date: \_\_\_\_\_

### VISUAL ARTS AND MATH INFUSED LESSON: *Radial Symmetry*

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Dear Family:

Today your child participated in an **Arts and Math** lesson. We talked about radial symmetry in visual art and math.

- We looked at a Native American hat and a contemporary painting and found the ways the artists used radial symmetry and how it adds visual interest. We also looked at radial symmetry in visual art examples from around the world and the different meanings associated with those designs.
- We each made a copper Repoussage. This is a piece of art produced by a metal working process known as repoussé. Repoussé means to 'push back' in French. This method often includes both embossing and indenting a metal surface from both sides to create a slightly projecting relief surface.
- We incorporated a radial symmetry design, repeating shapes, lines, and dots in different sections of the design around a central point.
- We practiced artistic craftsmanship. We used the copper material carefully so that we would not damage it as we worked with it.
- We used the 21<sup>st</sup> Century Skill of Perseverance as we adapted our ideas to work through challenges to complete the repoussé that showed radial symmetry.

At home, you could look for examples of radial symmetry in nature and in the objects around you.

#### Enduring Understanding

Repeating lines and elements radiating from a central point based on a circle can create radial symmetry in art.