



Geometry and Art in Global Faith Traditions (Lesson one of two)

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Objective

Math

- To apply knowledge and skills related to Shape and Space Transformations, and Patterns and Relations (Patterns).

Art (Integrated within the lesson)

- To interpret artworks, using structural devices and strategies.
- To develop awareness of themes with an emphasis on discovering global and personal similarities between the meaning and symbolism of geometric patterns in expressions of beliefs.

 **Time** approximately 45 minutes

✂ Materials

- See Supplementary Resources- Use examples provided from web sites
- Student handout #1
- Each student will need
 - power polygons, - at least 4 different polygons
 - paper, 2 sheets of at least 8 ½ x 11 inches.
 - a straightedge

[Optional – a circular object with a diameter between 4 and 6 inches (10 – 15 cm)]

- coloured pencils.
- scissors to cut circle

Getting Started

Knowledge Now

- Discuss with students what they already know and understand about tessellating shapes from their work in math.
- Ask students to describe where they have seen tessellating patterns in their day-to-day experiences.
- Discuss with students the idea of repeating patterns as symbols.
- Ask students to identify patterns that are used as symbols in their day-to-day life.

Engaging Interest

- Write the following headings on an organizer (chart paper or board) repeating patterns/symbols/possible meanings of symbols
- Using the web sites listed in the Supplementary Resources, or using school library resources, show students examples of geometric patterns that can be found in the faith traditions of Christianity, Islam, Buddhism, and Judaism.

Learning Activities

- Distribute the student handout and have the students read the introduction.
- Using the organizer, review and record students' observations and thoughts as they:
 - Identify repeating geometric patterns that may be evident in familiar symbols
 - Discuss the meanings of these symbols
- Have students draw and colour a repeating pattern. (Please refer to the Student Handout #1.) It may or may not be tessellating. You may want the students to work in partners (think-pair-share) to practice setting up the design, symmetry and potential colour scheme of their pattern. They can offer each other constructive suggestions.

** On all of these drawings, you can left click on the picture and, putting the cursor on the lower right red box that shows up, you can "pull" the drawing down to the right and enlarge it. This makes it easier for students to view if you are using your classroom monitor.*

Assessment/Analysis

- Ask the students the following questions:
 1. What tessellating patterns do you see? Do any of these patterns show symmetry?
 2. Why would we use a circular pattern as a symbol for the earth?
 3. Imagine a group of people holding hands in a circle. What would you think if you saw this?
 4. What could a circle mean to you as a symbol?
- Discuss with the students, the concept that repeating patterns can be something we see and also something we do. What repeating patterns of behaviour do we have in the classroom to help us keep order? How do these repeating patterns create order?

Application

- Ask the students how they could show respect for the symbols of the faith traditions that have been discussed.

Activities for Extension and/or Integration

The activities in this lesson make it an integrated Math / Art lesson. To further integrate this lesson, the teacher may:

- Bring some examples of repeating patterns that are used as expressions of beliefs to the classroom.
- In *Quest 2000*, grade 5, on pages 236 and 237, there are examples of tessellations and symmetrical patterns. Students' attention may be drawn to the use of colour in the creation of symmetry.

Subject and Level Learner Outcomes for

Grade 5 Mathematics

Strand: Shape and Space (Transformations)

- Build, represent and describe geometric objects and shapes. [C, PS]
- Cover a surface, using one or more tessellating shapes. [PS, T, V]
- Create tessellations, using regular polygons. [PS, T]

Strand: Patterns and Relations (Patterns)

- Construct, extend and summarize pattern, including those found in nature, using rules, charts, mental mathematics and calculators.
- Describe how a pattern grows, using everyday language in spoken and written form. [C, CN]
- Construct and expand patterns in two and three dimensions, concretely and pictorially. [PS, V]
- Predict and justify pattern extensions. [C, R]

Grade 5 Art Level three

Reflection

- Component 3: APPRECIATION: Students will interpret artworks for their symbolic meaning.
 - A. Artistic style affects the emotional impact of an artwork.
 - C. Artworks contain symbolic representations of a subject or theme.
 - D. Artworks can be appreciated at many different levels, literal and symbolic.

Composition

- Component 7: EMPHASIS: Students will create emphasis through the use of structural devices and strategies.
 - B. The important area in a composition can be enhanced by radial, conical and framing structures.
 - D. Arrangements of forms into shapes and patterns can tighten a design, direct attention and hold interest in a composition.
- Component 8 UNITY: Students will create unity by integrating the parts of a composition into the whole.
 - A. Implied line produces tensions and connections to achieve unity.
 - C. Transitions of colour, texture or tone relate the parts of a composition to a unified whole.

- F. Pervasive colour, texture or tone can unify a composition, as from an overall wash of paint, a glaze, a textural additive, a surface treatment, or the like.

Expression

- Component 10 SUBJECT MATTER: Students will develop themes, with an emphasis on global awareness, based on:
 - B. Environments and places,
 - E. People
- Component 10 (iii) MEDIA AND TECHNIQUES: Students will use media and techniques, with an emphasis on more indirect complex procedures and effects in drawing, painting, print making, sculpture, fabric arts, photography and technographic arts.
 - A. Drawing
 - Continue to explore ways of using drawing materials.
 - Use drawing tools to make a variety of shapes and structures extending beyond previous levels to exploring and enclosing forms, active and passive forms, concave, convex forms, concentric and branching structures.

Safe and Caring Topics and Concepts

- **Respecting Diversity and Preventing Prejudice**
 - Recognizing and appreciating that individuals, families and cultures are unique
 - Building respect for diversity

Teaching Strategies

	Cooperative Learning	Inquiry Learning	Direct Instruction
Go to http://www.sacsc.ca/Resources_Strategies.htm for strategy descriptions	<ul style="list-style-type: none"> • Think-pair-share 		<ul style="list-style-type: none"> • Lecture / demonstration

Generalization and Transfer	Peer Teaching	Empathy/Affective Education	General Teaching Activities/Ideas
<ul style="list-style-type: none"> • Modeling 			<ul style="list-style-type: none"> • Brainstorming

Supplementary Resources

School Based Resources

Subject search words to locate resources available in your school are:

- World religions
- Religious Art and Architecture

Web Resources

The visual resources that are part of the student package come from a variety of sites established by museums and school districts, and posted for use by classroom teachers. If the teacher has the technological resources these sites are a “gold mine” of visuals – showing the art of many faiths as well as text resources that provide a quick and easy read so that the teacher can provide accurate information to the students.

All faiths

<http://re-xs.ucsm.ac.uk/>

This is a site developed for classroom religious education in public schools in the UK. Through this site you will find many links fairly quickly. Some pages cannot be displayed – but many can be. I suggest beginning with “About RE-XS.”

Christianity

www.newyorkcarver.com/geometry/rose.htm

Islam, Tibetan / Buddhist

www.graphics.cornell.edu/online/mandala/

www.askasia.org/adult_free_zone/virtual_gallery/student_art_showcase/kidmandala/mandala.htm

www.askasia.org/frclasrm/lessplan/1000030.htm

www.askasia.org/image/drawing/i000531b.htm

<http://www.exoticindiaart.com/article/mandala/>

Judaism

www.md.huji.ac.il/special/chagall/asher.html

www.menorah.org/starofdavid.html (very good historical background)

http://en.wikipedia.org/wiki/Star_of_David

Animism / nature (Although the lessons in this package do not contain any examples of natural geometric patterns, this web site is listed in case teachers want to include this aspect.)

www.sacredarch.com/sacred_geo_exer_snowflake.htm

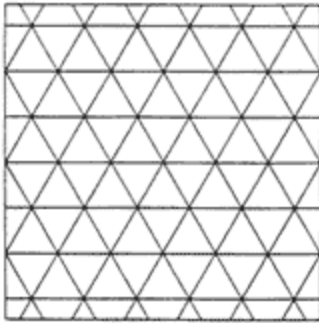
www.sacredarch.com/sacred_geo_exer_sunflower.htm

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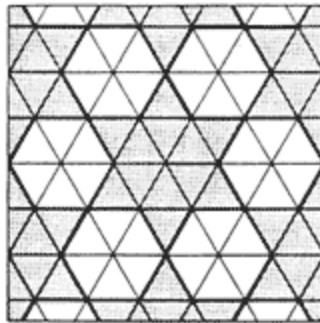
Geometric Pattern # 1 Islamic (Tessellating)

Construction of an Islamic Pattern, part b

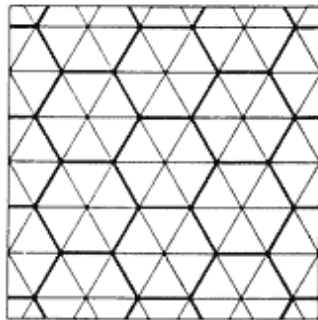
[Click here for related lesson plan](#)



7. A grid of equilateral triangles (equal sides and angles) is the basis for many Islamic designs.



8. Islamic artists designed patterns on the grid from center outward with no gaps and no overlaps.



9. A grid of hexagons is embedded in the grid of equilateral triangles.

www.askasia.org/frclasrm/lessplan/1000030.htm

www.askasia.org/image/drawing/i000531b.htm

Islamic

In the Islamic art that is found on mosques, repeating patterns represent the unchanging laws of God. There is logic and an order to everything in the universe. Following this

respect for the logic and order, that is, the rules of the universe, Moslems are expected to follow rules that Mohammed gave them. These rules are called the “Pillars of Faith.”

Geometric Pattern #2 (Repeating) Buddhist Mandala



Teacher: Tracy Finnegan.

School: PS 102, Elmhurst (Queens), NY

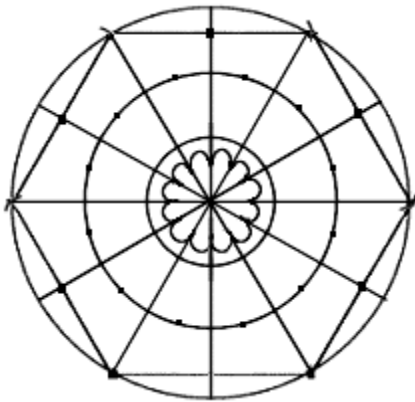
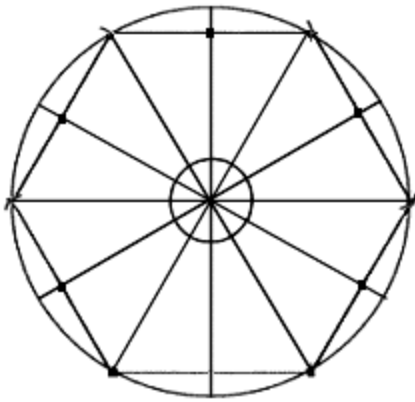
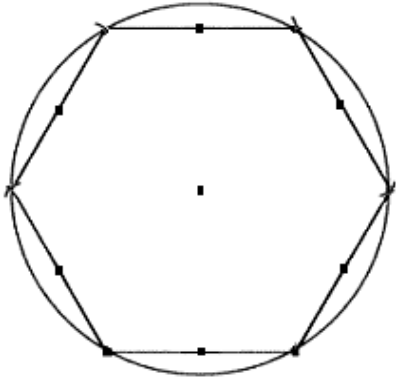
Class: 3-303

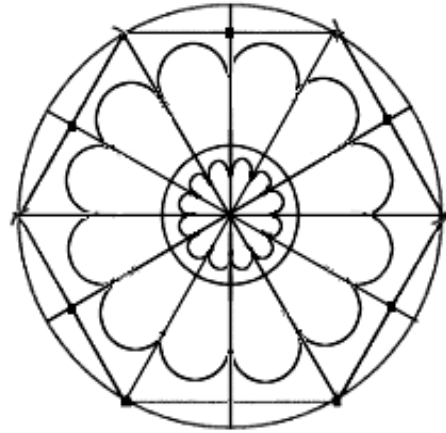
www.askasia.org/adult_free_zone/virtual_gallery/student_art_showcase/kidmandala/mandala.htm

Buddhist

The students in Tracey Finnegan’s class used geometric shapes and patterns to create their mandalas. You can see the symmetry of the pattern in this example. Mandalas first were made in Tibet, India, Nepal, China, Japan, Bhutan, and Indonesia, more than 1500 years ago. They have been made with paints, dyes, and even coloured sand. A mandala is a diagram intended to symbolize the universe or cosmos. They were made to help people meditate about what it means to be a human being in the world. The pattern of the circle is a symbol of the earth and the universe.

Geometric Pattern #3 Christian (Rose Window – when repeated this can become a tessellated pattern) www.newyorkcarver.com/geometry/rose.htm





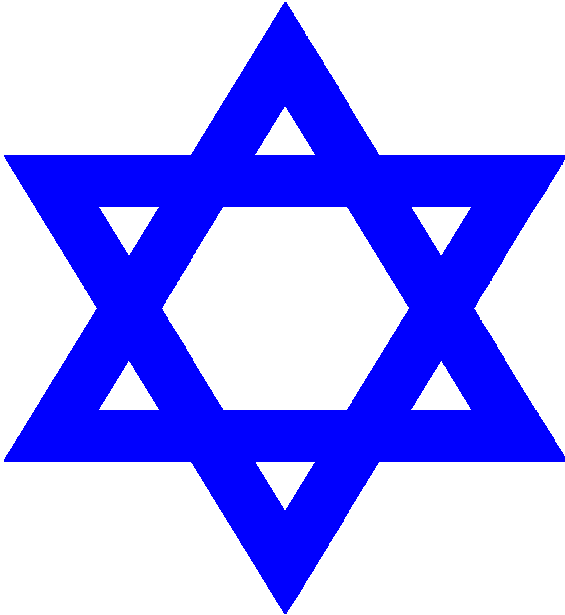
www.constructingtheuniverse.com/Chartres%20Window.html

This example is the north rose window of Chartres Cathedral. How do you know it is geometrically designed?

Christian Rose Window

The rose was a symbol of spring and everything that was beautiful. It became a symbol of Mary, the mother of Jesus. The word “rosary” comes from this symbol. In some windows, Jesus is placed in the centre of the window.

Jewish Star of David



http://en.wikipedia.org/wiki/Star_of_David



by Rabbi Shraga Simmons

www.aish.com/literacy/concepts/Star_of_David.asp

The star is a hexagram that is a symbol of God's rule over the universe. The 6 points of the star symbolize the six directions, north, south, east, west, up and down. The Star of David is also known as the Shield of King David. Today, the Star of David is on the flag of the state of Israel.

Geometry and Art in Global Faith Traditions

Patterns of many descriptions are found in all aspects of our lives. People find patterns in nature and we copy these patterns in many ways for many reasons. Many people are interested in seeing how geometry was applied in the art of sacred traditions worldwide

In your grade 5 math classes you have learned that a regular tessellation is made with just one regular polygon repeated over and over. You learned that all the tiles that make up the pattern are congruent. When you look out into your schoolyard, you might see a fence with a regular tessellating pattern. If you have the Quest 2000, Grade Five text book, on pages 233 – 235 you will see some examples of tessellating patterns that might be found in and around homes. If you think about homes you have been in, you may remember tiling patterns in a kitchen or in a bathroom. When you go into a mall, you have likely seen tiling in some stores.

In this lesson you will learn about tessellating patterns and other geometric patterns that people around the world use to express their religious beliefs. Your teacher will help you to find examples of geometric patterns that come from different faith traditions.

Your job is to:

1. Read the descriptions that follow each pattern. With a pencil or a highlighter pen, mark the words that seem important to you.

Islamic

There is logic and an order to everything in the universe. In Islamic art, repeating patterns represent the unchanging laws of God. Moslems are expected to follow rules that Mohammed gave them. These rules are called the “Pillars of Faith.”

Buddhist Mandala

The students in Tracey Finnegan’s class used geometric shapes and patterns to create their mandalas. You can see the symmetry of the pattern in this example. Mandalas first were made in Tibet, India, Nepal, China, Japan, Bhutan, and Indonesia, more than 1500 years ago. They have been made with paints, dyes, and even coloured sand. A mandala is a diagram intended to symbolize the universe or cosmos. They were made to help people meditate about what it means to be a human being in the world. The pattern of the circle is a symbol of the earth and the universe.

Christian Rose Window

The rose was a symbol of spring and everything that was beautiful. It became a symbol of Mary, the mother of Jesus. The word “rosary” comes from this symbol. In some windows, Jesus is placed in the centre of the window.

Judaism: *Star of David*

The star is a hexagram that is a symbol of God's rule over the universe. The 6 points of the star symbolize the six directions, north, south, east, west, up and down. The Star of David is also known as the Shield of King David. Today, the Star of David is on the flag of the state of Israel.

2. Choose a pattern that you like.
3. Create a pattern similar to the one you chose.

If you have chosen the **Islamic** tessellating pattern, you must use at least 4 different polygons. You may slide, turn, flip and trace the polygons you choose for your pattern. You may use a straightedge.

If you have chosen a **Buddhist** mandala, you must use at least 4 different polygons. If your teacher gives you a copy of a circle, you must find the centre point. To do this, cut the circle, fold it in half and in half again. Open it and lay it flat. The centre point is located where the fold lines cross. Mark this with a pencil mark. Now you may use your straightedge or polygons to create a symmetrical pattern.

If you do not have a copy of a circle, use a template, or tracer. Cut this out and find the centre by folding the circle.

If you have chosen the **Christian** Rose Window, follow the directions for the mandala.

If you have chosen the **Jewish** Star of David, use your polygons to create the triangles and trace these. Use a straightedge to draw the lines that finish the pattern.

4. Colour your pattern.