



Lessons from the Salvadori Classrooms  
LESSON TITLE: Ornament Your Home  
PREPARED BY: Kubi Ackerman (revised by Michael Bettencourt)  
TOPIC: Home  
SSLAM: Home / Math / Put Together  
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## Ornament Your Home

### Content Focus: Math

- Geometric Shapes and Relationships
- Measurement: Objects and Units

### Content Focus: Art

- Aesthetics

### Content Focus: Technology

- Engineering Design







### Content Focus: Built Environment

- Measuring/Estimating
- Observing/Surveying
- Style

### Performance Outcome(s)

- Recognize the ubiquity of ornamentation within the built environment and identify examples of ornament.
- Develop an understanding of the geometric nature of ornamentation.
- Explore the qualities of symmetry and use symmetrical transformations to create a geometrical pattern.
- Increase proficiency with measurement tools.

### Standards/Interdisciplinary Connections

					
<b>S</b>	<b>S</b>	<b>L</b>	<b>A</b>	<b>M</b>	<b>T</b>
Science	Social Studies	Language Arts	Art - Visual	Math	Technology

How To Read The Symbols: The symbols in **bold** indicate the subject standards that this lesson satisfies.



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### Lesson Outline (multiple-lesson project)

1. Motivation
2. The Challenge
3. Procedure
4. Present
5. Extensions And Variations
6. Middle School Standards

### Salvadori Prerequisites

- FOUNDATION - BASIC SKILLS: Observing/Surveying; Measuring/Estimating (Activity #1)
- FOUNDATION - ARCHITECTURE 101: Style (Activity #1)

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### CONCEPTS

- While styles and methods of ornamentation vary widely over time and among peoples of different cultures, the impulse to decorate domestic living spaces appears to be virtually universal.
- Ornamentation is often designed through the application of simple geometric principles. Complex motifs can result from simple shapes subject to symmetrical transformations.
- The three primary types of two-dimensional symmetry are **line symmetry**, **translational symmetry**, and **rotational symmetry**.

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### RESOURCES

#### On-Line

- <http://www.bonner-design.com/geometric/> - Islamic geometric patterns
- [http://www.digibooks.cz/helper/logo/folklor/480\\_011\\_kraslice/480\\_011.htm](http://www.digibooks.cz/helper/logo/folklor/480_011_kraslice/480_011.htm) - Ornamented Easter Eggs

#### Books

- Schmitt, Ronald E., *Sullivan-esque: Urban Architecture and Ornamentation*. University of Illinois Press, July 2002.



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## MATERIALS

### Students

- : Fact Sheet
- Paper, pencils, rulers, triangles, compasses, protractors, colored pencils or markers

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## MOTIVATION

*Look around the classroom.*

- Are there any features of the room that have no function except to make the room look nicer?*

*Pay special attention to surfaces such as the floors and walls.*

- Is there a decoration or pattern that stands out?*

*It could be as simple as the alternating colors of your floor's square tiles.*

*The decorative features of architectural spaces are called **ornaments**. Generally, an ornament has no "practical" purpose but serves to make buildings, furniture, or other objects more attractive.*

*People of every culture have traditions for beautifying their living environments.*

- Why do you suppose that adornment is such a universal impulse?*
- Can you think of examples of ornamentation in your own home?*
- What are some common features of this ornamentation?*

*Often ornamentation features design elements that are repeated, reflected or rotated around a point or axis to give a sense of balance and proportion. These are examples of different types of transformations that involve **symmetry**.*

- Can you find examples of each of these types of symmetry in your classroom?*
- Why do you think symmetrical designs are so pleasing to the eye?*



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## THE CHALLENGE

*Your challenge is to create a two-dimensional symmetrical ornament for your home. Start by learning about the different types of symmetry to help you find examples of symmetrical ornamentation in your environment. Then, experiment to create a symmetric ornament of your own.*

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## PROCEDURE

Hand out the ●: Fact Sheet showing examples of ornamental styles from various time periods and cultures. Give students an opportunity to observe and discuss what they notice.

- *What characterizes something as an “ornament”?*
- *Do you think different cultures have similar definitions of what constitutes an ornament?*
- *What are some similarities between the examples shown? What are some of the differences?*
- *What types of elements in the built environment tend to have ornamentation?*

Ask students what they know about symmetry and whether they can identify which of the examples on the ●: Fact Sheet possess symmetry. Ask them to identify symmetrical shapes or objects within the classroom and to specify whether they possess line, translational or rotational symmetry. (While people are most familiar with line symmetry, they can generally identify the other two types quite easily.)

Hand out the ●: Fact Sheet and ask students to complete the exercises on it.

Students draw an example of a two-dimensional symmetrical ornament from their homes, classrooms or school buildings, specifying whether it is from the walls, ceiling, floor, a rug, piece of furniture, decorative object, or some other source. They identify the type or types of symmetries used in the design of the ornament.

- *Is the ornament designed in a particular “style”?*
- *Is it similar to any of the ornamental styles shown in the Fact Sheet?*
- *Why do you suppose the designer/builder chose to include the ornament?*
- *Had you noticed it before?*

Explain to students that they will be designing a two-dimensional ornament for their homes. First they decide on the type of surface for their design. Options include wallpaper, trim and molding, rugs, doors, ceramics. This decision will affect the size and scale of the design they develop.

Refer students to the ●: Fact Sheet to evaluate whether any one particular style has special appeal to them. If so, the student can use the geometric elements commonly used in that style.



(Additional research could be helpful in this endeavor.) If no style particularly appeals, ask them to develop a series of geometric shapes from their own imagination. These basic elements will serve as the building blocks from which more complex patterns will develop.

Distribute the activity sheet to guide students through a series of exercises in which they experiment with three types of symmetry to create the motif for an ornamental design. The final stage has them selecting one of the designs, creating a precise drawing of the design, and coloring it.

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## PRESENT

Students present their work to the class, explaining what their primary shapes were, the type(s) of symmetry they used, the surface the ornament is intended for, and whether they were inspired by any particular ornamental style.

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## EXTENSIONS AND VARIATIONS

- After a lesson on the geometry and mathematics of tessellations, design wallpaper patterns using tessellations.
- Explore three-dimensional symmetry in architectural façades and spaces and design their own symmetrical 3-D façade.
- Find examples of symmetry in nature. Choose one example and develop a pattern based it.
- Analyze the similarities and difference between rotational symmetry and point symmetry. (A figure has point symmetry if every point in the figure has a corresponding point that is at the same distance from the figure's center. Describe the type(s) of symmetry a square exhibits. What about the letter N?

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## MIDDLE SCHOOL STANDARDS

### Social Studies

- Culture

### Language Arts

- Speaking, Listening, and Viewing (E3c )

### Art - Visual

- Subject Matter, Symbols, and Ideas
- Relation to History and Culture
- Connections Between Visual Arts and Other Disciplines



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## **Math**

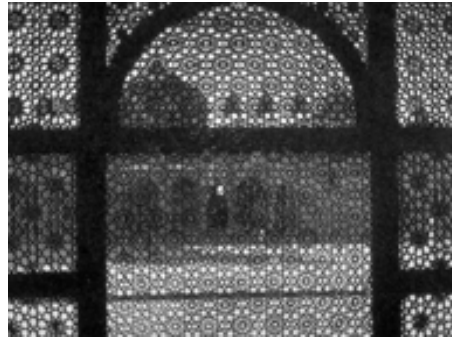
- Geometry
- Measurement
- Connections

## **Technology**

- Design (8)

## Ornament Your Home

Look carefully at the pictures and captions below. They are examples of how people from different periods in history and in different parts of the world have ornamented their buildings.



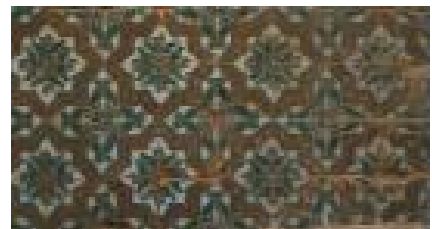
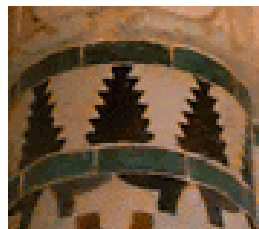
What are some similarities between the examples? What are some differences?

Which of the ornaments shown are **symmetrical**?

Identify the types of two-dimensional symmetry you are familiar with. The three primary types are **line symmetry, rotational symmetry, and translational symmetry.**

**Line symmetry** refers to shapes or designs that are symmetrical across one or more lines. Another way to think about this is that if you folded the shape on the line of symmetry, the edges of the shape would align. Think of a mirror being placed along a line on or near a shape to produce a new composite shape, that includes the original and reflected versions, with line symmetry.

Examples:



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Activity: Which of these shapes or designs have line symmetry? Draw in the line(s) of symmetry for those that do.

How many lines of symmetry does a circle have?

**Rotational symmetry** refers to shapes or designs that are symmetrical around a point. **Another way to think about this is that the shape realigns with itself if you rotate it (less than one full rotation) around a point. Try imagining the shape as it rotates around its center. Rotational symmetry is always described in the degree of the rotation. For example, a regular hexagon has 60 degree rotational symmetry.**

Examples:



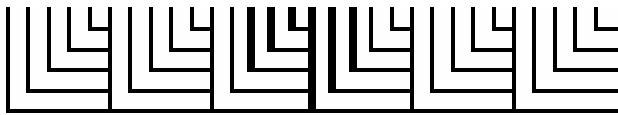
Activity: Which of these shapes or designs have rotational symmetry?

Does a square have rotational symmetry? How many degrees will it rotate around its center before its sides align with the original position?

**Ornament Your Home**

**Translational symmetry** refers to shapes or designs that are repeated without being rotated. Another way to think about this is that the shape aligns with itself if it moves its position in a plane without turning. Try imagining moving the shape in a particular direction.

Examples:



Activity: Which of the following designs have translational symmetry?

Activity: For each of the following shapes or designs, determine which type or types of symmetry are displayed.

## Ornament Your Home

Designing a motif for your own symmetrical ornament

### 1: Basic shapes

Sketch 2 relatively simple geometric shapes freehand. The two shapes you choose will form the basis of your motif. (They will be reproduced many times, so make sure they are not too complicated.) This motif can then become the unit from which your pattern is formed.

Explore interesting juxtapositions of the shapes to form a unit. Will your shapes overlap?

Once you are happy with your unit, draw it neatly using measuring instruments on a blank piece of paper.

### 2: Line Symmetry

On a clean sheet of paper, reproduce your unit. Draw a line that passes near, touches it or intersects your unit.

Measure the elements of the unit in relation to the line.

Now reproduce the unit on the other side of the line, using your measurements to make sure it is a perfect mirror image.

Complete this process two more times using different lines to come up with a total of 3 designs.

### 3: Rotational Symmetry

On a clean piece of paper, reproduce your favorite design from among the 3 you created in the previous step. Mark a point on or near the design to serve as an axis for your next transformation.

Decide how many times the design will be repeated around the axis before it gets back to where it started. This is referred to as the number of folds your rotationally symmetric object has. Choose between 3 and 6 folds.

Draw a line outward from your axis that touches one part of the design. Measure points on the design relative to that line. These measurements will serve as your reference.

name(s)

date

## Ornament Your Home

Work Sheet

At what angle should you draw your next reproduction of the design? This, of course, depends on how many folds you have chosen, (The angle is equal to the number of degrees in a circle, 360, divided by the number of folds you have chosen.)

Repeat this process until you have completed a full rotation.

### 4. Translational Symmetry

Take the new design (with rotational symmetry) and make it into a design that also exhibits translational symmetry? Try this on a clean sheet of paper.

### 5. Color Your Motif!

