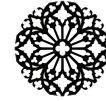


Geometry:

Visiting The Cathedral of St. John the Divine



The Cathedral
Church of **Saint John**
the Divine

Program Objectives

During this program, students will learn how geometry is incorporated into the architecture and engineering of the Cathedral, which serves a structural, decorative, and symbolic purpose. Students will have the opportunity to:

- ❖ Discover how shapes, numbers, and measurements influence the built environment.
- ❖ Learn what makes the Cathedral stand up.
- ❖ Find a variety of shapes, patterns, and symmetry throughout the Cathedral.
- ❖ Examine how number symbolism is integrated into a sacred space.
- ❖ Use knowledge of units of measurements to make estimations regarding scale and proportions.

What is Geometry?

The word geometry comes from the Greek word, “geometria,” and means “measure of earth.” Technically, that means it is the study of spatial order through measure and relationships of forms. Nowadays, it is the branch of mathematics that studies the properties of shapes and spatial relationships.

How is Geometry Used in Art?

For thousands of years, people have observed the geometric patterns in nature and have incorporated those patterns in a variety of art forms. Shapes have also been given symbolic meaning. A circle which has no beginning and no end, means eternal life. Often, circles are incorporated in a Cathedral’s Rose Window. For example, circles are used by Hindus in their mandalas for meditation and by Aztecs in their calendar stone. The knot design is a geometric design that appears to weave or interlace and was used earliest by the Celts. In the Renaissance, Michelangelo and Leonardo used knot designs in their artwork and in perspective drawing. Shapes and geometry are also found in the art from Egypt, Greece, Persia, China and Japan.

How is Geometry Connected to Architecture?

Architecture is the science and profession of designing and constructing buildings. When architects design a building, they have to incorporate the 3 principles of architecture as defined by the Roman writer, Vitruvius: strength, utility, and beauty. Architects must insure that the building they build will stand up – so they need to consider what shapes have the strength to do so. In addition, geometric shapes and lines of symmetry can be used in patterns and decoration to create a building that is aesthetically pleasing.

What is Sacred Geometry?

Sacred Geometry is the belief that numbers and patterns have holy significance. Architects sometimes draw upon these concepts when they choose a particular geometric form to create pleasing spiritual spaces. Number Symbolism can be incorporated as well. Therefore, in many cathedrals, this one included, it is embedded in the design. For example, the number seven is considered to be a significant, spiritual number in many religions and cultures. When you visit you will learn about the special ways in which the number 7 was used in the design of the Cathedral.

Suggested Classroom Activities

- ❖ To demonstrate the strength of shapes, do the following demonstration with your class: Take some strips of cardboard of equal length and punch holes near the ends. Use 4 equal strips to make a square. Attach the strips together with paper fasteners. Do the same with 3 equal strips to make a triangle. Try pressing down on the corners of the square and then the triangle – what happens? Which is the stronger shape?



❖Go on a Shape Hunt around your school or neighborhood. Give students a chart to check off the shapes they see and then choose a few objects or building parts to sketch. If you can, bring along a digital or some disposable cameras to take pictures of buildings. Be sure to represent a variety of shapes. Make a slide show of them when you get back to school. Each student can print out a picture and then write about the elements of geometry they notice including lines of symmetry that might exist in the building.

❖Go on a pattern hunt around the school or neighborhood. Look for tile patterns or mosaics. Have children choose a few patterns to sketch. When you come back to the classroom, have them make a collage of one of the patterns they found using paper squares (or other appropriate shapes).

❖Take pictures or cut out images from magazines of buildings, rooms, houses or structures. Use markers to highlight the shapes within each space and a different color to highlight lines of symmetry. You can also have students use mirrors to find lines of symmetry.

❖Using toothpicks and small clay balls (or any other adhesive solid such as gumdrops, mini marshmallows, etc) – have children try to build a dome using triangles OR use the same materials to make a cube. Press on it – does it collapse? Now try to make a structure that incorporates triangles. Is it more or less stable? Finally, have students try to build a 3-D structure or room using the above shapes and materials. What do you discover?

Children's Literature

Anno, Mitsumasa. *Anno's Math Games III*. (Putnam Juvenile, 1997)

Burns, Marilyn. *The Greedy Triangle* (Scholastic Press, 1995)

Ernst, Lisa Campbell and Lee Ernst. *The Tangram Magician* (Harry N. Abrams, 1990)

Kroll, Virginia. *Pink Paper Swans*. (William B. Eerdmans Publishing Co., 1994)

Neuschwander, Cindy. *Sir Cumference and the First Round Table* and others in the series, (Charlesbridge Publishing, 1997)

Tompert, Ann. *Grandfather Tang's Story*. (Dragonfly Books, 1997)

Wells, Rosemary. *Yoko's Paper Cranes* (Hyperion Books for Children, 2001)

Teacher Resources

Confer, Chris. *Math by All Means Geometry – Grade 2*. (Math Solutions Publications, 1994)

Macaulay, David. *Cathedral: The Story of Its Construction*. (New York: Houghton Mifflin Company, 1981)

MacDonald, Fiona. *A Medieval Cathedral*. (New York: Peter Bedrick Books, 2001)

Morin, John. *The Ultimate Origami Book: The Complete Step-by-Step Guide to the Art of Paper Folding* (Courage Books, 1998)

Pearl, Barbara. *Math in Motion – Origami in the Classroom*. (Crane Books, 1999)

Rectanus, Cheryl. *Math by All Means Geometry – Grade 3*. (Math Solutions Publications, 1994)

Wilson, Forrest. *What It Feels Like To Be A Building*. (Washington DC: The Preservation Press, 1995)

Selected Websites

www.newyorkcarver.com/geometry/rose.htm
"Tips & Tricks to Gothic Geometry" demonstrates how to create a rose window, ogee arch, trefoil, etc. using a straight edge and a compass.

www.constructingtheuniverse.com/Chartres%20Window.html
Information on the Rose Window of Chartres in France and how to draw it.

www.math-kitecture.com/geometry.htm
Ideas about finding shapes in architecture.

<http://www.dartmouth.edu/~matc/math5.geometry/unit1/INTRO.html>
Information on Number Symbolism, symbolism of a circle and more information about Geometry in Art and Architecture.

READ ON!

