

FINDING FIBONACCI IN ARCHITECTURE

GRADE: 4-8

TIME: Three 45-minute sessions

Students will learn about the Fibonacci sequence, its prevalence in nature, and its applications in art, design, and architecture.

INTEGRATED SUBJECTS: Visual Arts, Math

OBJECTIVES

MATERIALS | RESOURCES

Graph paper
Pencils
A straight edge
Compass
Calculator (optional)
Photos showing examples of Fibonacci in nature (included below)
Photos showing examples of the “golden ratio” in art, architecture, & design (included below)
Library or Internet access for independent student research
Paper
Colored pencils (optional)

1. Understand the Fibonacci sequence and its appearance in nature.
2. Construct a “golden rectangle” and define the golden ratio.
3. Analyze the appearance of the golden ratio in art, architecture, and design.
4. Create an original artistic work, utilizing the golden ratio in the design.

ESSENTIAL QUESTIONS

1. How is the Fibonacci sequence found in nature?
2. How do artists (consciously or unconsciously) use the Fibonacci sequence and the golden ratio in art, design, and architecture?

LESSON PROCEDURE

EXPLORE

Session One

- **Introduce students to the concept of the Fibonacci sequence. The sequence begins with the numbers zero and one. To get the next number in the sequence, add the two previous numbers: 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, etc.**
 - Differentiation: Introduce “Pascal’s triangle” and ask students to find Fibonacci by doing mathematical calculations with various rows/columns/diagonals within the triangle.
- **Discuss the appearance of Fibonacci numbers in nature. Display photographs showing examples of Fibonacci numbers in nature such as flowers and pine cones.** (Tip: If you would like a printed resource for students, examples can be found in Appendix A of this lesson plan!)
- **Explain the golden ratio (approximately 1.618) and its relationship to the Fibonacci sequence. Using graph paper, walk students through the process of constructing a golden rectangle.** (Tip: If you would like a printed resource for students, examples can be found in Appendix B of this lesson plan!)
- **Display drawings of the “Fibonacci spiral” within the rectangle. Explain that the golden ratio is used by designers, architects, and artists to create aesthetically pleasing designs.**

ENGAGE

Session One

- **Discuss the appearance of the golden ratio in art, architecture, and design. Display examples such as *The Great Wave off Kanagawa* by Katsushika Hokusai, the Parthenon, and the Twitter logo.** (Tip: If you would like a printed resource for students, examples can be found in Appendix C of this lesson plan!)
 - Differentiation: After engaging with a few examples as a class, have students work in small groups to identify the golden rectangle in other pieces of art, architecture, and design. Some good examples are the *Mona Lisa*, the Great Pyramid of Giza, and the Toyota logo. (Tip: If you would like a printed resource for students, examples can be found in Appendix D of this lesson plan!)

DESIGN

Session Two

- **Introduce two of Frank Lloyd Wright’s designs: the Roloson Row Houses in Chicago, IL and the windows from the Coonley Playhouse in Riverside, IL. Resources can be found at <https://www.teachingbydesign.org/multimedia/>. Ask students to work collaboratively to identify how these buildings are connected to the golden ratio.**
 - Differentiation: Provide a transparency with golden rectangles of various sizes. Have students overlay the rectangles on top of the Wright designs to show the relationship between the golden ratio and his work.
- **Challenge students to work individually or in small groups to create a work of art, company logo, or building facade based on the golden ratio.**
- **Revisit the Fibonacci spiral as it appears in design. Show students images of the Guggenheim Museum and logos for sports teams (L.A. Rams) that use spirals in the design.** (Tip: If you would like a printed resource for students, examples can be found in Appendix E of this lesson plan!)
- **Have students draw designs for their school where the Fibonacci spiral or the golden rectangle could appear. They could consider creating a new school logo, designing new dimensions for an auditorium, or even rearranging desks in the classroom or in other classrooms around the school.**

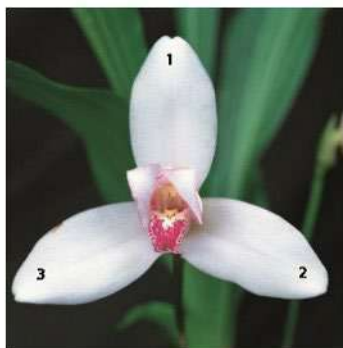
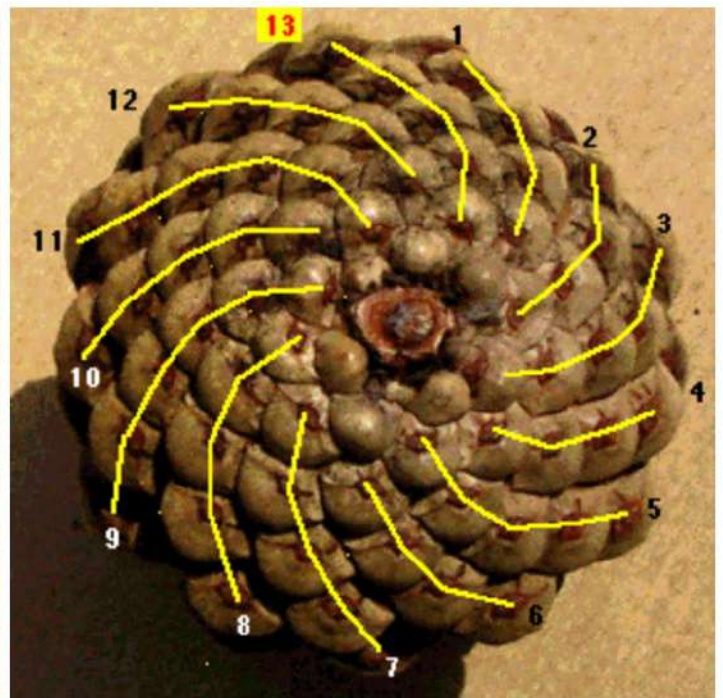
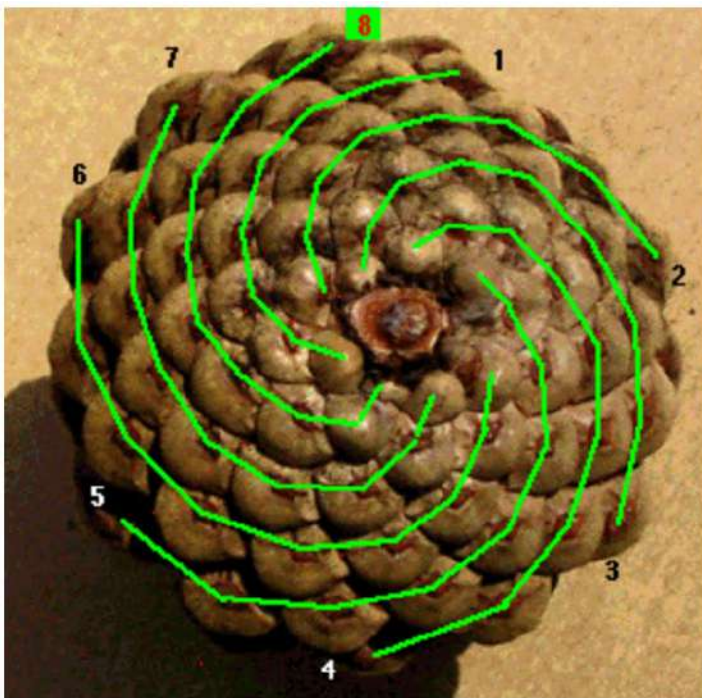
LESSON PROCEDURE (continued)

CRITIQUE & INTERPRET

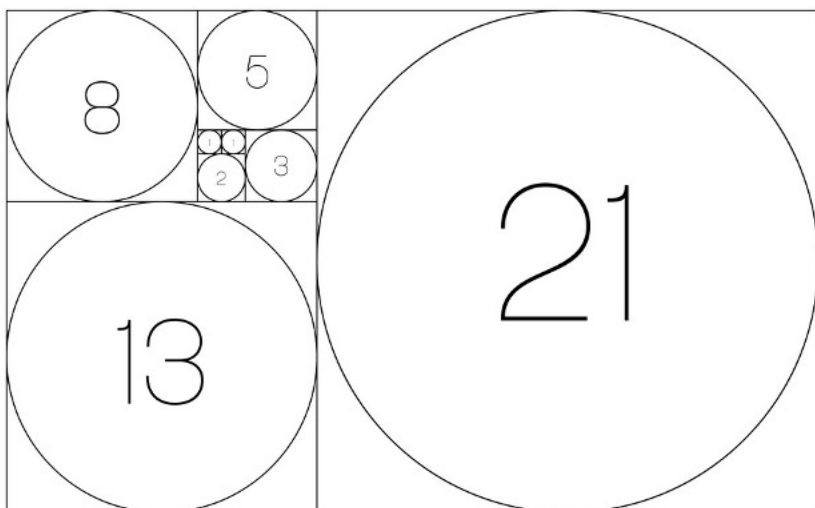
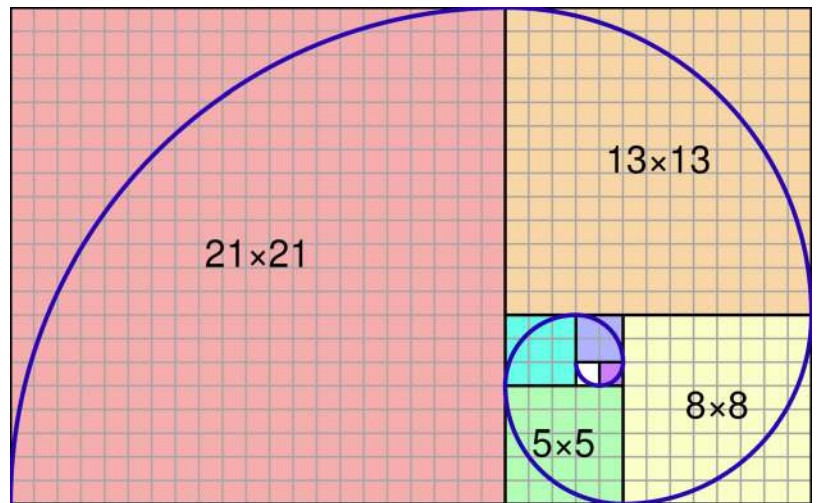
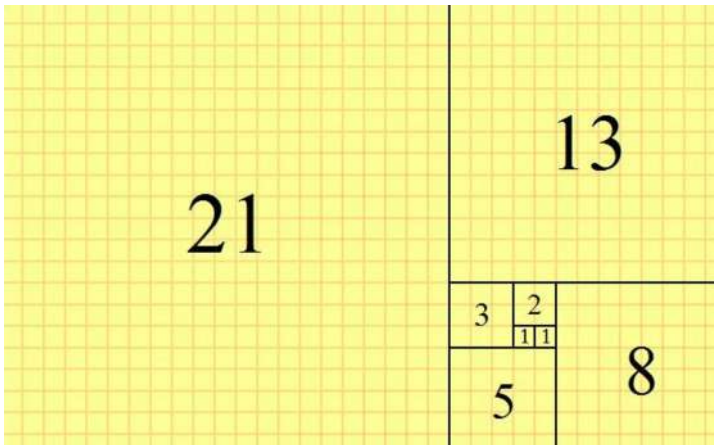
Session Two

- Have students share their art in small groups and provide feedback to each other. Encourage discussions that focus on both the mathematical principle and the aesthetic appeal of the designs.
- Allow time for students to make revisions to their work based on input from their classmates and teacher.
- Ask students to consider how artists, architects, and graphic designers utilize math in their professions.

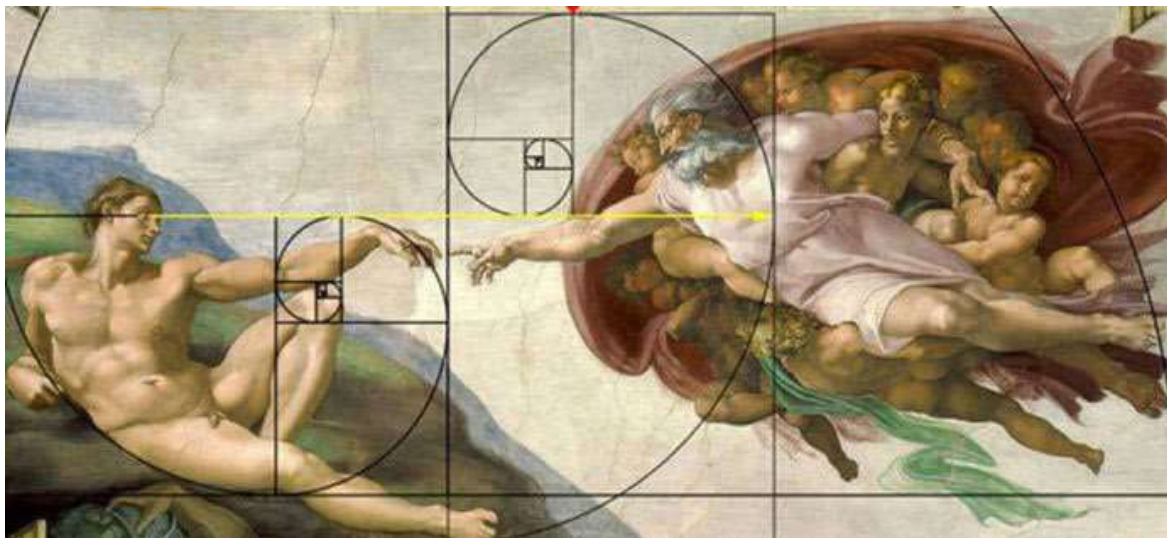
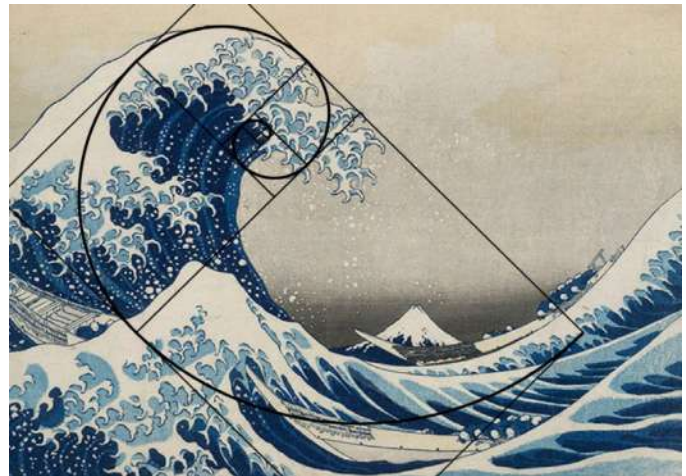
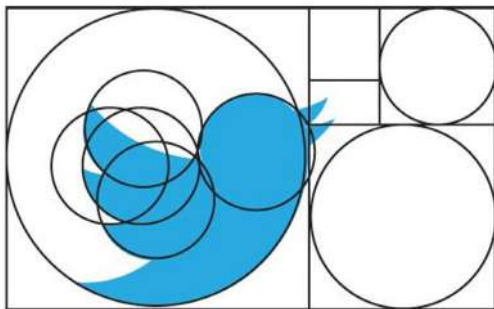
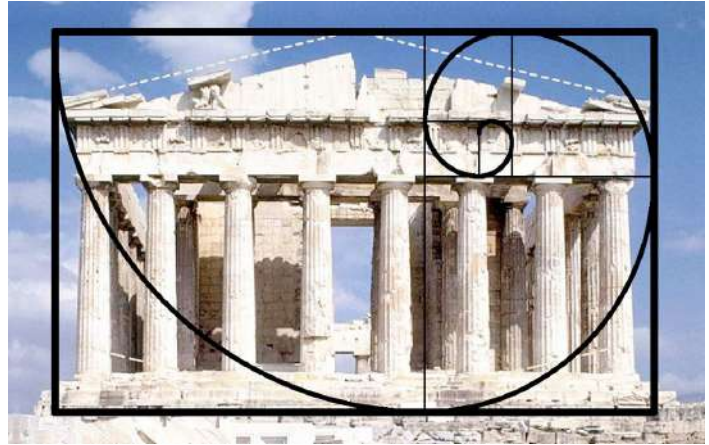
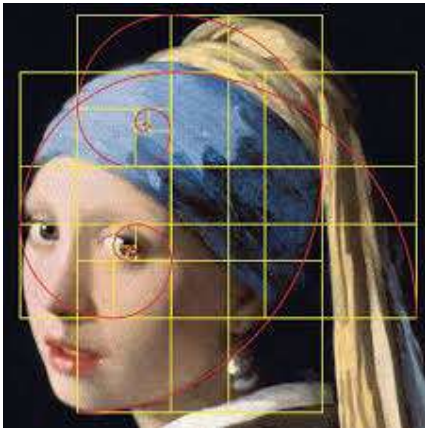
EXAMPLES OF FIBONACCI NUMBERS IN NATURE



GOLDEN RECTANGLE CONSTRUCTION



EXAMPLES OF THE GOLDEN RATIO IN ART & DESIGN



FIND THE GOLDEN RATIO IN THESE DESIGNS!



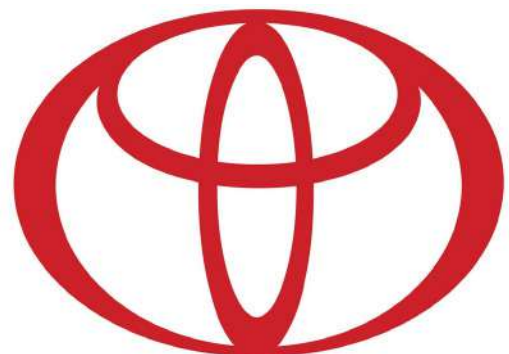
"Quilt, Log Cabin pattern, Light and Dark variation,"
c. 1865



Leonardo da Vinci, *Portrait of Lisa Gherardini, Wife of Francesco del Giocondo, known as the Mona Lisa*, 1503-1519



The Great Pyramids, Giza, Fourth Dynasty
(c. 2575-2450 BCE)



Toyota logo, 1989

EXAMPLES OF THE FIBONACCI SPIRAL IN ART & DESIGN

