

Lesson Plan: Middle School Mathematics

Lesson Title: Fibonacci and the Golden Ratio

Summary: In this lesson, students will learn about the Fibonacci Sequence and the Golden Ratio. Students will observe how these two proofs appear both in the natural world, as well as in man's creations. Following instruction, students will read passages from the Bible as evidence and discuss how God designed the golden ratio — how he designed each part of His creation with infinite care and wisdom. We will see how our own minds have the ability to appreciate the ratio as beautiful and how we can use it in our own creations, magnifying God's goodness. Students will summarize their learning in a short, informal written response.

Standards:

Catholic Curriculum Standards:

General Standards:

CS M.712 GS1 Demonstrate the mental habits of precise, determined, careful, and accurate questioning, inquiry, and reasoning in the pursuit of transcendent truths.

CS M.712 GS3 Have faith in the glory and dignity of human reason as both a gift from God and a reflection of Him in whose image and likeness we are made.

CS M.712 GS4 Explain how mathematics in its reflection of the good, true, and beautiful reveals qualities of being and the presence of God.

Intellectual Standards:

CS M.712 IS3 Recognize how mathematical arguments and processes can be extrapolated to other areas of study, including theology and philosophy.

CS M.712 IS4 Explain how it is possible to mentally abstract and construct mathematical objects from direct observations of reality and how one's perception of that reality is important to what one is doing

Dispositional Standards

CS M.712 DS1 Display a sense of wonder about mathematical relationships, especially mathematical certitude which is independent of human opinion.

CS M.712 DS2 Share with others the beauty, harmony, proportion, radiance, and wholeness present in mathematics.

CS M.712 DS5 Exhibit habits of thinking quantitatively and in an orderly manner, especially through immersion in mathematical observations found within creation.

CS M.712 DS6 Propose how mathematical objects or proofs (such as the golden mean, the Fibonacci numbers, the musical scale, and geometric proofs) suggest divine origin.

CS M.712 DS7 Exhibit appreciation for the process of discovering meanings and truths existing within the solution of the problem and not just arriving at an answer.

CS M.712 DS8 Exhibit humility at knowing that as a human being man can only grasp a portion of the truths of the universe.

Diocese of Arlington Academic Standards:

M.7.3 Round, compare, order, and graph (on a number line) positive and negative rational numbers (integers, fractions, mixed numbers, terminating and repeating decimals, numbers written in scientific notation).

M.7.4 Add, subtract, multiply, and divide positive rational numbers (whole numbers, fractions, mixed numbers, decimals), expressing answer in either simplest form or rounded to the nearest given place value; solve real world context problems involving positive rational numbers (decimals, fractions, mixed numbers) using a variety of problem-solving strategies.

M.7.24 Find, interpret, and apply the unit rate of a given real-world context, ratio table, or graph that represents a proportional relationship between two quantities (ex. unit conversion, speed, percents, prices).

Objectives: 1) Students will understand the Fibonacci Sequence 2) Students will understand how the Golden Ratio relates to the Fibonacci sequence 3) Students will recognize both the Fibonacci Sequence and Golden Ratio in nature and art and relate it to God's beauty and goodness.

Learning Plan:

Initiation: (15 min)

1) The teacher will introduce the lesson.

a) Recall previous discussions on the definition of Beauty and Goodness.

b) Mini-lesson and notes on Leonardo Fibonacci and his investigation of rabbits breeding. What it is and how to calculate it.

Development: (30 min)

Demonstrate the Fibonacci Sequence and Golden Ratio. What they are and how to calculate them. Students will view various images from nature, art, and architecture, which use the Golden Ratio/Fibonacci sequence.

Students will identify the ratio/sequence in each image.

Students will discuss the beauty of each image, taking into account the presence of the ratio/sequence. Would it be as beautiful without the ratio? Provide examples of things without the ratio.

Students will read Exodus 25:10, 27:1-2, and Genesis 6:15.

All of these passages feature God instructing Moses/Noah to build something, following certain measurements. Students will calculate the ratios of these directions, to discover that they feature the Fibonacci Sequence/Golden Ratio!

Closure: (*remainder of class or homework*)

Students will discuss the connections that exist between the sequence/ratio observed in nature, mathematics and the human mind, and the way in which they exemplify beauty. Specifically, students will recognize that they make things beautiful because they are products of God, the Master Designer.

Assessment:

Formative: Students will engage in informal whole group discussion, with focused teacher observation, guidance, and intervention.

Summative: Students will complete an informal 1-2 paragraph written assignment, that is grammatically and mechanically sound, describing the Fibonacci sequence and the Golden Ratio and how it relates to God's beauty and goodness.

Differentiation This lesson begins with a low-stake, informal discussion. Students can engage with and build from one another's observations/insights, allowing struggling students to learn from their peers. Teacher initiation and clarification, as well as peer support, scaffold learning, ensuring that students successfully arrive at the learning goals. The use of an informal written response ensures that students who struggle with whole class discussion/participation are still able to demonstrate their understanding and learning.

Resources: https://www.youtube.com/watch?v=c8ccsE_lumM
<https://www.mathsisfun.com/numbers/nature-golden-ratio-fibonacci.html>