The Golden Mean: Fibonacci and the Golden Ratio

What if someone told you that beauty is simply a mathematical equation? Leonardo of Pisa, who was known as Fibonacci, introduced a sequence of numbers to Western civilization in 1202. This sequence, called the Fibonacci sequence, reveals a series of relationships that reflects much of the physical structure of nature. Starting with 0 and 1, each new number in the series is simply the sum of the two before it:

0+1=1+2=3+5=8+13=21 and so on. The sequence looks like this: 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89...

Now the beauty part. When you divide a number in the sequence by the number before it, the ratio approximates the number $\phi$ (1.618...) (Ignore the 0, 1 and 2). As 5 divided by 3 is 1.666..., and 8 divided by 5 is 1.60.

The Golden Ratio, which is a ratio based on $\phi$, was used by the Egyptians to create their glorious pyramids, by the Greeks to design the famed Parthenon and by artists in the Renaissance as the measurement of all beauty. The Golden Ratio is also known as the Golden Mean, Golden Section and Divine Proportion. The Golden Ratio is seen in the proportions of the human body, animals, plants, DNA, the solar system and in the proportions of Art and Architecture. And that's just the beginning!

In this activity, your child will develop her mathematical thinking and expand her intellectual horizons as she builds a growth spiral - a spiral found in nature that can be predicted by the Fibonacci sequence.

**What You Need:**

- Straight edge
- Graph paper
- Pencil

**What You Do:**

1. Tape graph paper together so that you have at least 56 squares across and 38 up and down. Plus, make sure to leave a two-square border all around.
2. From the left border, count 36 squares in. Then count 8 squares up from the bottom border. Draw a rectangle on the 8th square up (36 in) that is 1 square wide and 2 squares tall. Outline each square of the rectangle so that you have two squares, 1 by 1, stacked on top of each other.
3. Directly to the right of this stack make a square that is 2 blocks wide by 2 blocks tall. You don't need to outline the squares for this shape or any of the other shapes you make from this point on. Make sure the ends of both the rectangle (that you first drew) and the square line up with one another. You don't want the shapes to be staggered.
4. On top of the 1x1 block and the 2x2 block draw a block that is 3 squares wide by 3 squares tall so that this new block fits exactly over the two other blocks together.
5. Directly to the left of these stacks draw a block that is 5 squares wide by 5 squares tall. It should be as tall as all of your stacks of blocks and all of the boarders of your blocks should be touching one another.
6. Beneath this group of blocks, draw a block that is 8 squares wide by 8 squares tall. If you followed the first steps correctly, your 8 block square should just fit exactly in the space under the group of blocks.
7. To the right draw a square that is 13 blocks by 13 blocks.
8. In the space in the upper right corner, directly above your other blocks, draw a square that is 21 blocks by 21 blocks. This block should fit exactly over the group of blocks beneath it.
9. Draw a square to the left that is 34 blocks by 34 blocks. Your paper should look like this:
10. Now it's time connect the blocks starting with your first two 1 by 1 squares. Begin with the bottom block. Draw a curving line from the upper left corner of that block to its lower right corner. In the 2 by 2 block on the right, continue the curving line from the lower left corner to the upper right corner. As you move onto the 3 by 3 block, connect your curve from the lower right corner to the upper left corner. Can you see the spiral? Continue the line connecting the corner you enter the box through to the opposite diagonal corner. Make your line as even and smooth as possible. Continue through each box until you exit the frame at the lower left corner of the picture. It should look like this:

When you're done, you'll have made one of the most beautiful mathematical expressions in nature! This spiral represents much of the structure of the world in which we think and live. With this project you'll connect with the past and the future, while exploring the fascinating world of mathematics and expanding your mental horizons!

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