Fibonacci Sequence

Overview

We have looked several different kinds of patterns - from repeating elements in loops to creating patterns through dance; and even creating a design without any apparent pattern.

This week we take a look at a very specific and special pattern known as the Fibonacci Sequence. This pattern is quite exciting because we see it all around us in nature. It can be found in such examples as the number of spirals in pine cones, sunflowers, broccoli, pineapples, and even relationships within the human body.

The Fibonacci Sequence is named after the nickname of an Italian mathematician, Leonardo do Pisa, who wrote about this pattern in 1202 - although mathematicians in India had discovered it much earlier.

Here is the Fibonacci Sequence:

0   1   1   2   3   5   8   13   21   34   . . .

Do you see a pattern? What is it?

To create the Fibonacci Sequence, each number in the sequence is the sum of the previous 2 numbers -

So that 0 + 1 = 1; and 1 + 1 = 2, and 1 + 2 = 3, and 2 + 3 = 5, and so on.

We see this pattern occurring in nature as well as art and design. Within this pattern, the numbers have a special relationship to each other. For these activities, we explore this number sequence through counting words in poetry, and using straight lines to create a Fibonacci spiral.

Fibonacci Sequence

Activity 1: Write a Fibonacci Poem

Setting Up
paper
pencil, pen

Steps
1. Introduce the Fibonacci Sequence, using the overview as a guide.
Today we are going to learn about a very special and unique pattern that we can find all around us in nature and in art. We call this pattern the Fibonacci Sequence - and it is named after an Italian mathematician who wrote about this pattern in 1202.

Let's write this pattern on a piece of paper and look at it closely...

2. Write the pattern down on a piece of paper, saying the numbers aloud.

0   1   1   2   3   5   8   13   21   34   . . .

3. Depending on the age of the child, observe the numbers together, and ask - *do you see a pattern? What is it?*

4. Review the pattern of the sequence - each number is the sum of the previous two numbers. And we start with 0 and 1.

5. Now that you know the pattern, let's use this sequence of numbers to write a poem!

What is a poem?
A poem is a kind of artistic writing that uses words for their sounds and emotions, and arranges them in creative structures. Poems can have multiple meanings, with open-ended interpretations. Poems can use words in creative ways, just like a painter may choose certain colors to evoke emotions. Poems can allow us to share how we feel and how we see the world around us.

To create a Fibonacci poem, each line will have a certain number of words. And this number of words corresponds to the Fibonacci Sequence.

So our first line will have 0 words - nothing there! Nothing is still important. We can think of this nothing, or zero, words as a space for a pause. *What can you do with a pause?*

The second line will have 1 word.
And the next will have 1 word.
And then 2,
And then 3,
And then 5...8...13...
and so on.

Here is the sequence, but you can go much higher!

0   1   1   2   3   5   8   13   21   34

Here is an example:

0	
1	soft
1	fluffy
2	billowing, stretching
3	like marshmallow pillows
5	They float and sail, gently.
8	See their forms, twisting and changing in time
13	becoming something new each moment, as they dance across their infinite blue sky.

What do you think this poem is about?
How do you know?

So, you may ask, what do I write about? This is a very good question! You can write about anything!

Here are some ideas:

a. Take a walk and write about something you see

b. Write a poem about your family

c. Write a poem about how you are feeling, right now

d. Write a poem about your pet

e. Write a poem about your favorite food

f. Write a poem about an imaginary place

Variations
a. Each line has one word, but with the corresponding number of letters from the Fibonacci Sequence
b. Each line can contain multiple words, but use the corresponding number of letters from the Fibonacci Sequence.

Fibonacci Sequence

Activity 2: Fibonacci Rectangles

Setting Up
paper
pencil, pen
print off the dotted grid from the Fibonacci Sequence Template PDF
ruler (optional)

Steps
We can use this same pattern to create rectangles based on those numbers. This will show us how these numbers relate to one another. For example, we will create squares whose dimensions are based on the Fibonacci sequence; and when we arrange them next to each other, we can see their relationships.

1. Take the dotted grid. With a piece of paper, review the Fibonacci sequence by writing it down together:

0   1   1   2   3   5   8   13   21   34

What is the pattern? How do you know what number will come next? Each number is the sum of the previous 2 numbers, and we start with 0 and 1.

We will use these numbers to create squares, and the dimensions of the squares will be based on these numbers.

2. Using the following pages as a guide, draw the first square on your dotted grid, the same size and location as the guide.

3. Continue to draw the next squares by connecting the dots, following the guide.
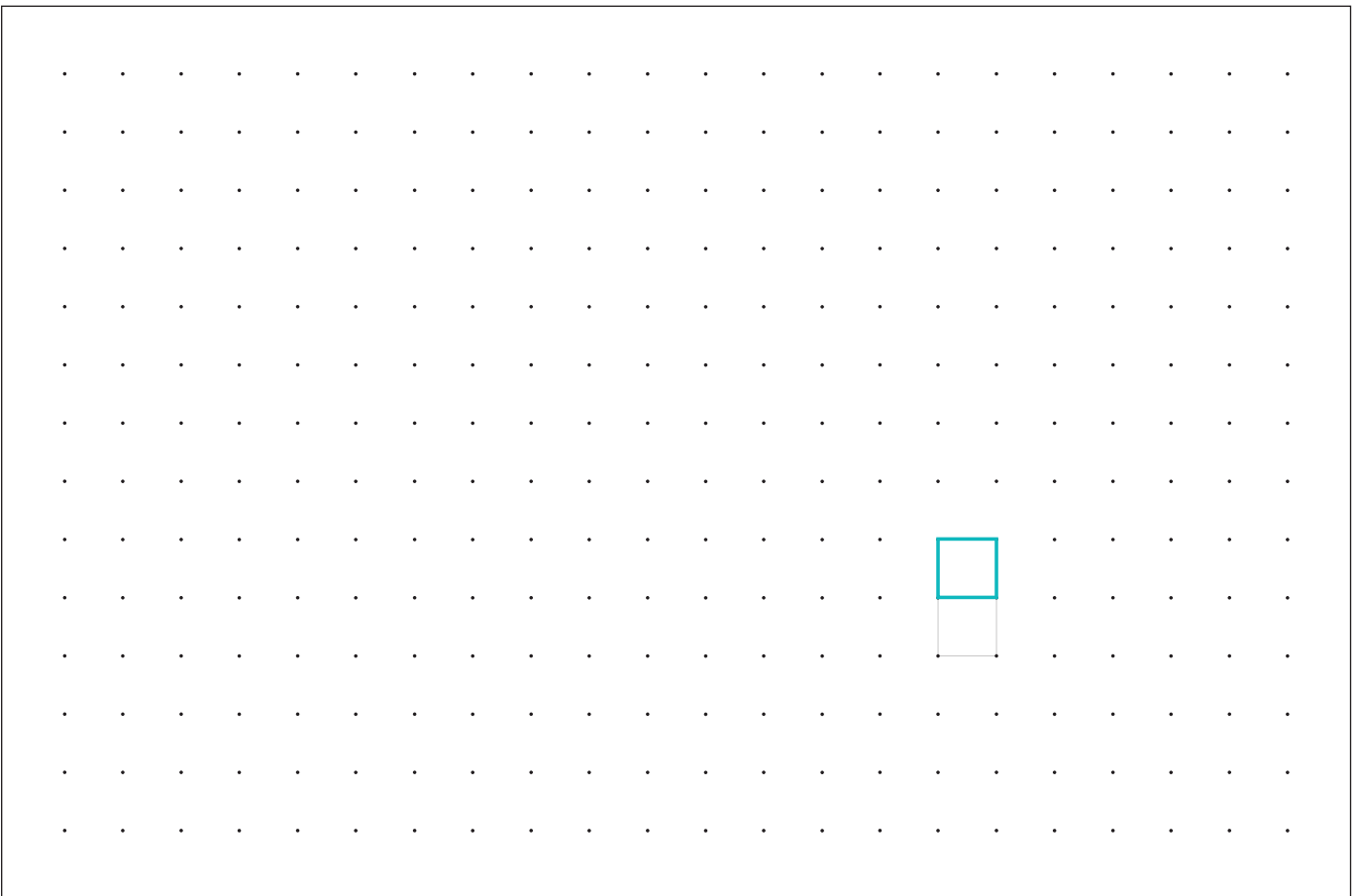
As you draw each square, count the number of spaces for the dimensions of each square. You will see the same pattern.

And as you draw each square, notice where it is on the grid - it will always be touching the previous square(s), so that the sum of the previous 2 squares creates the dimension for the next.
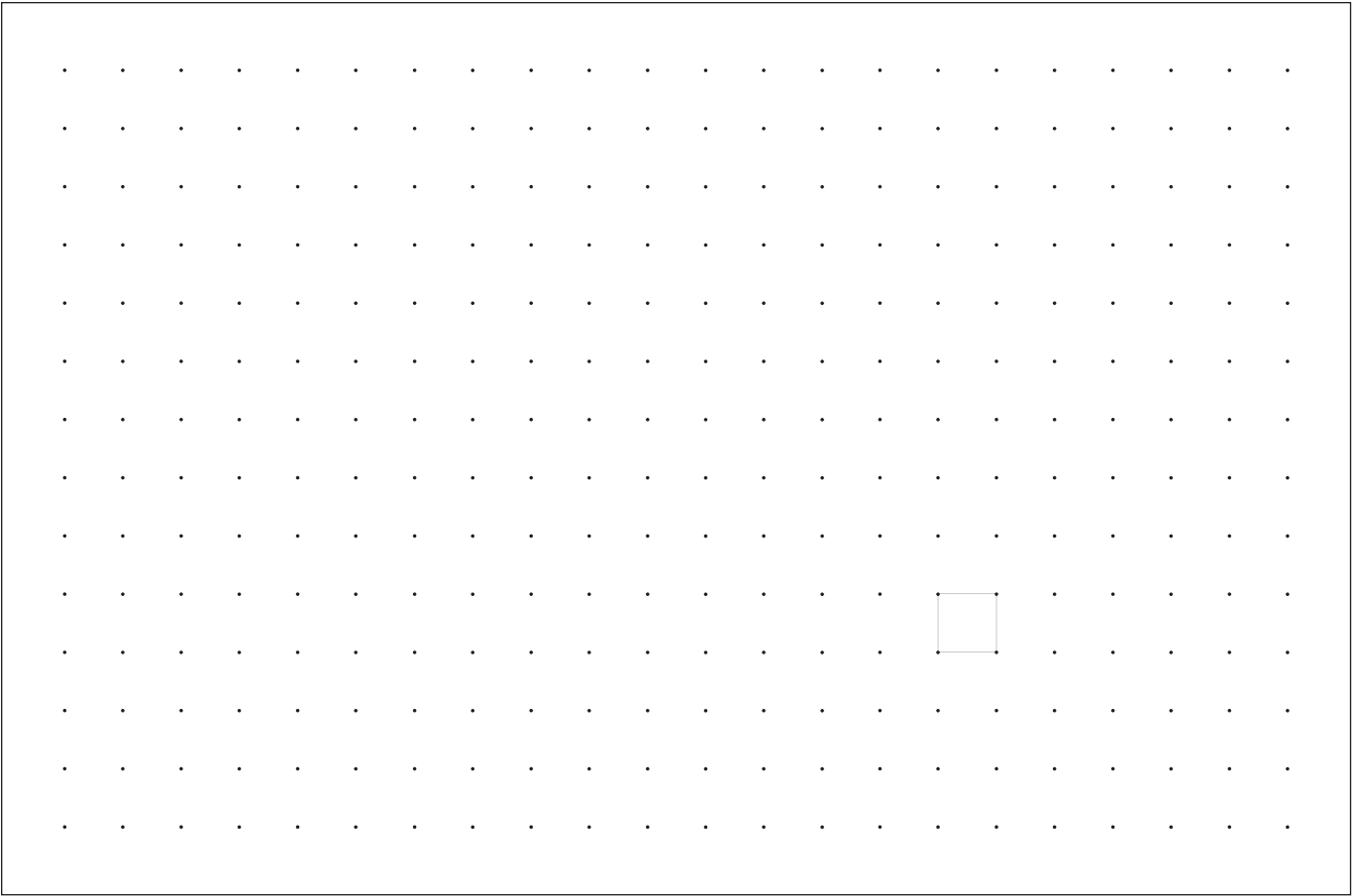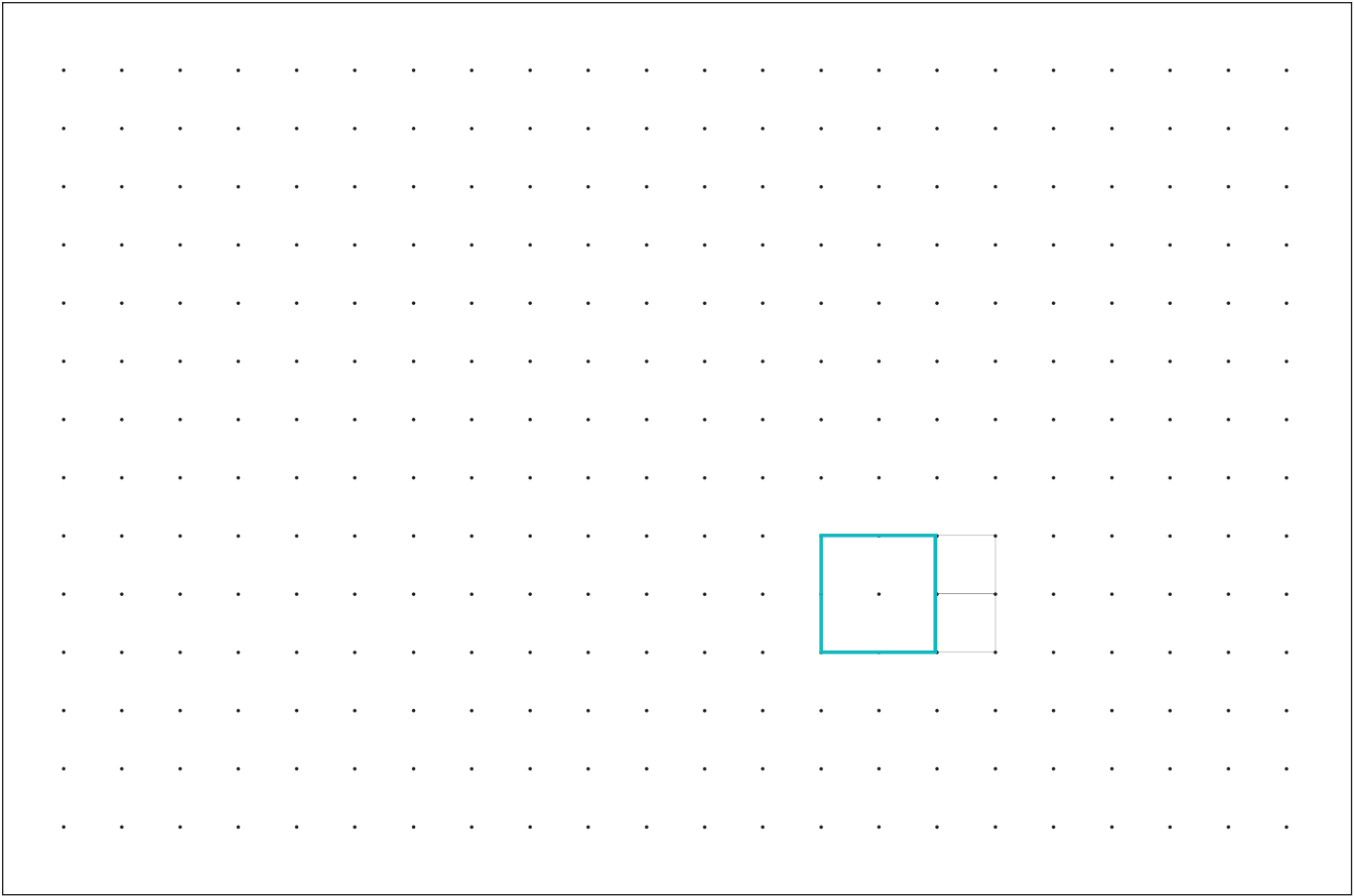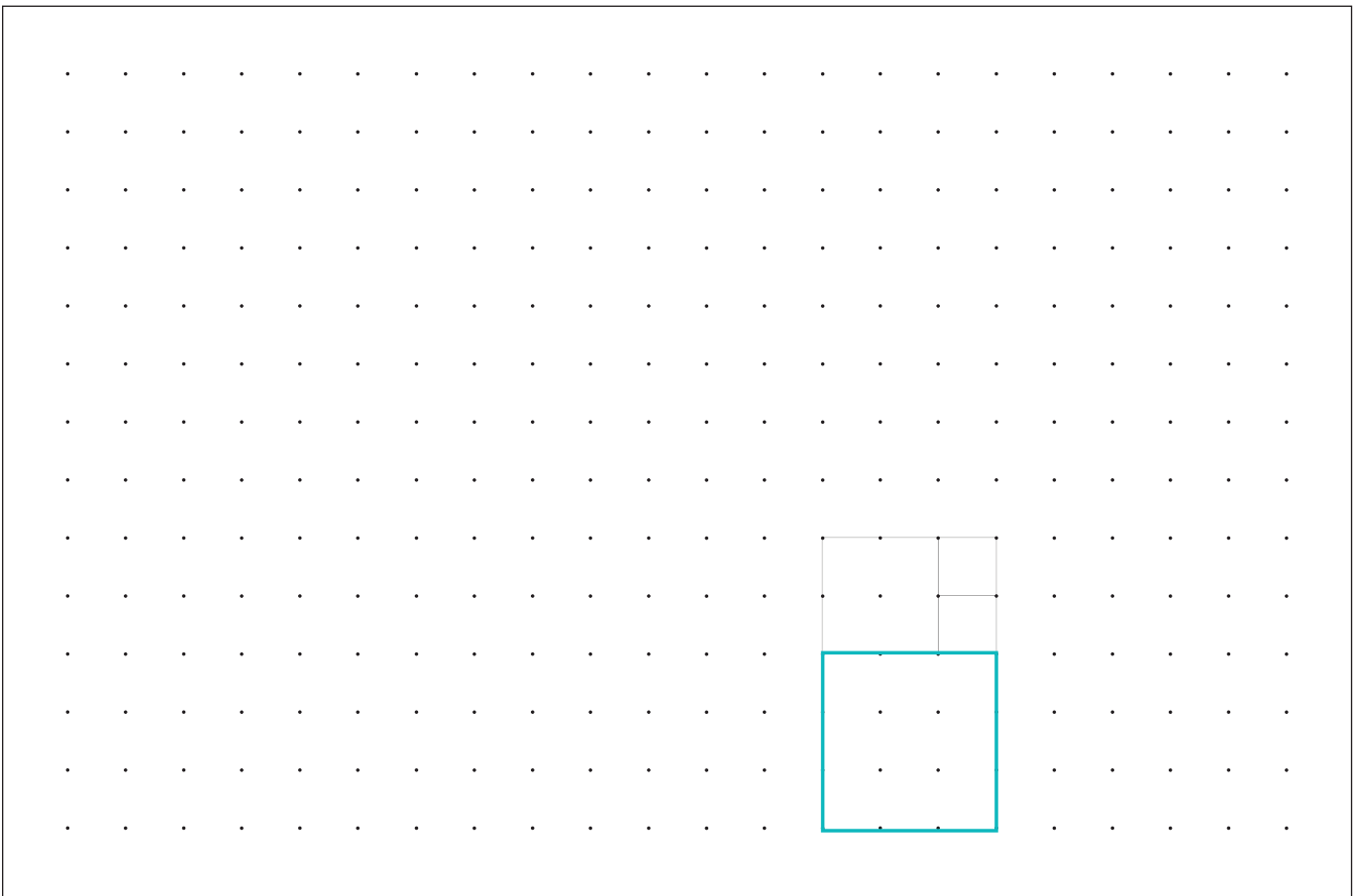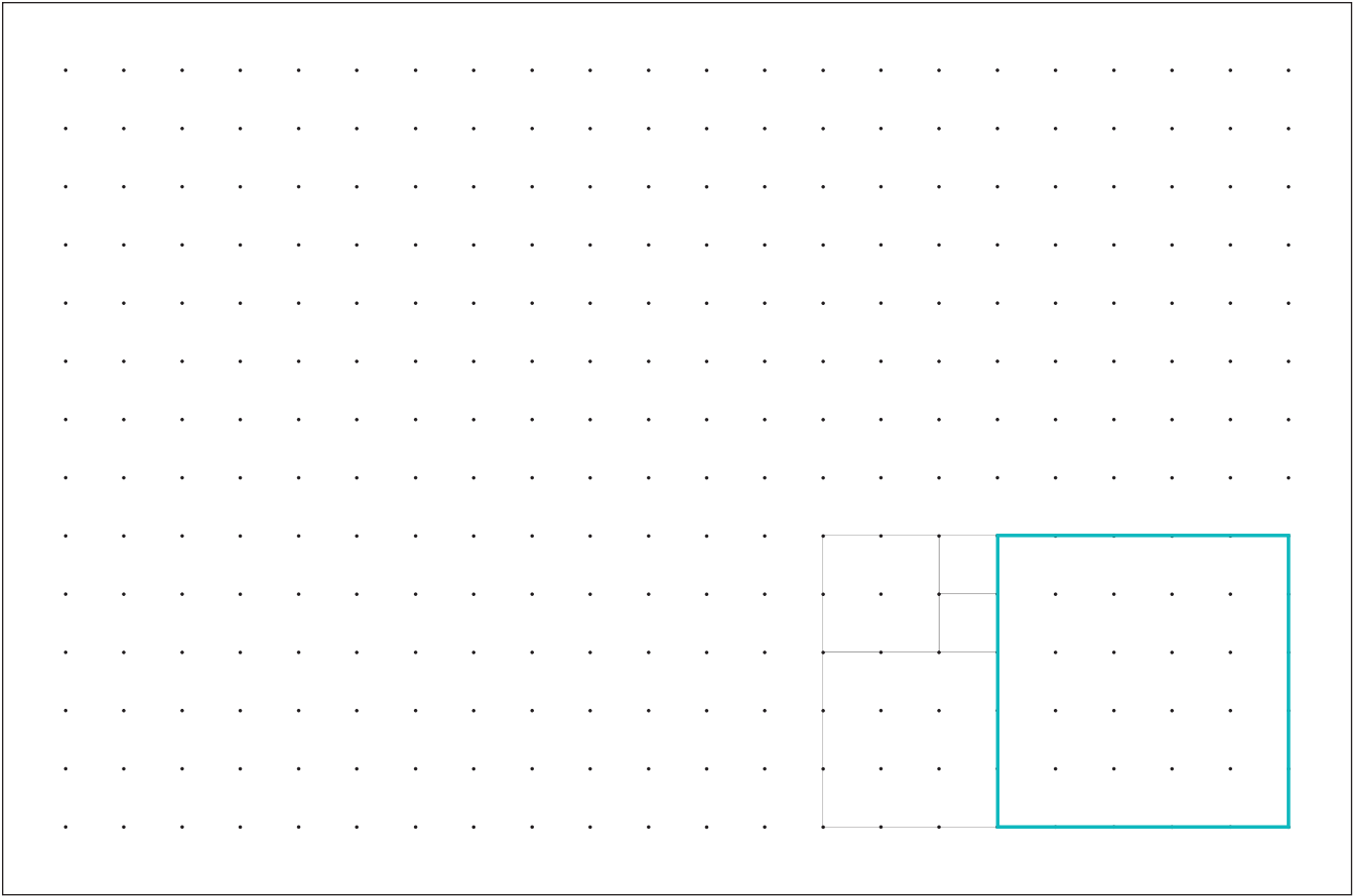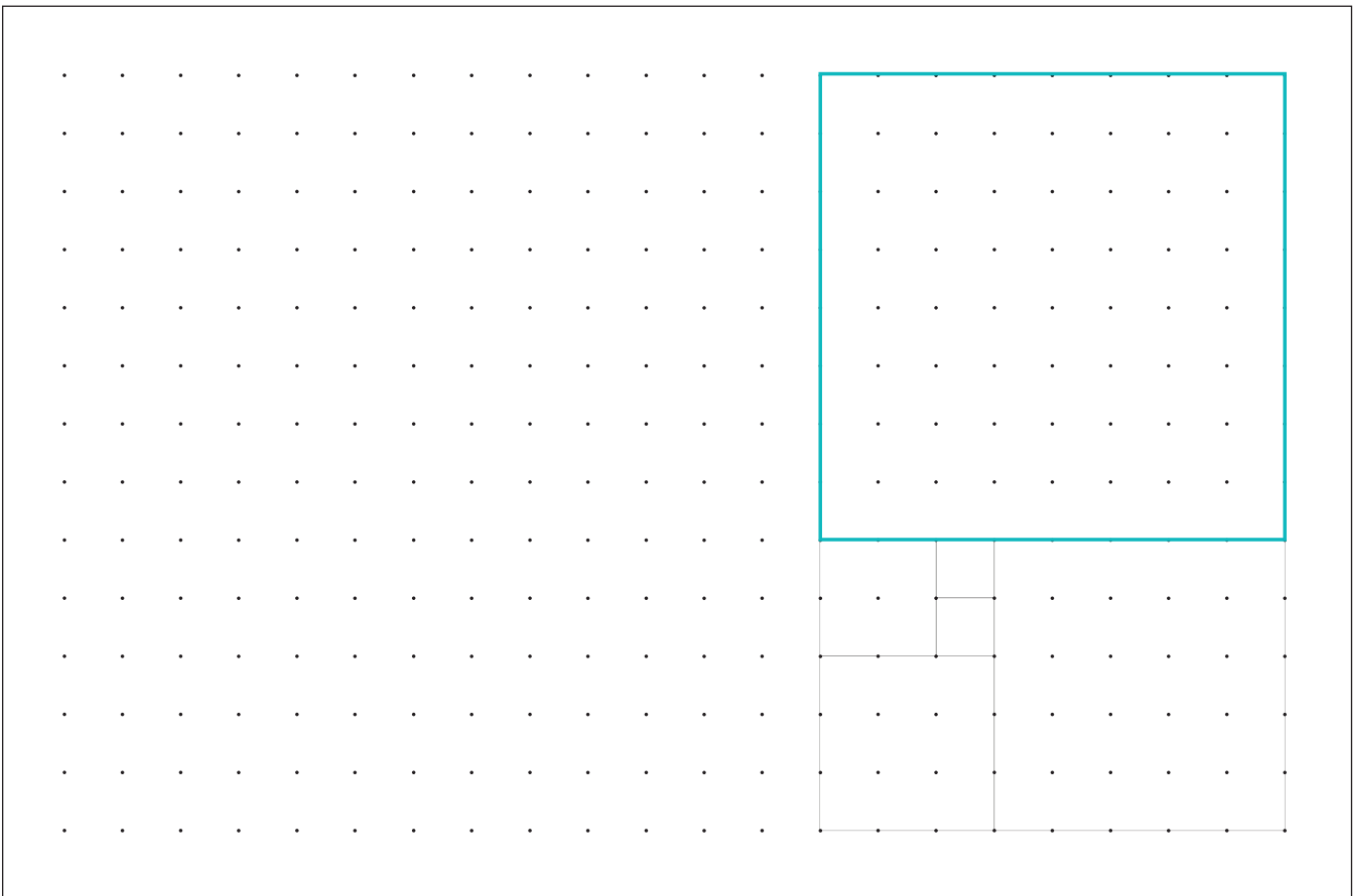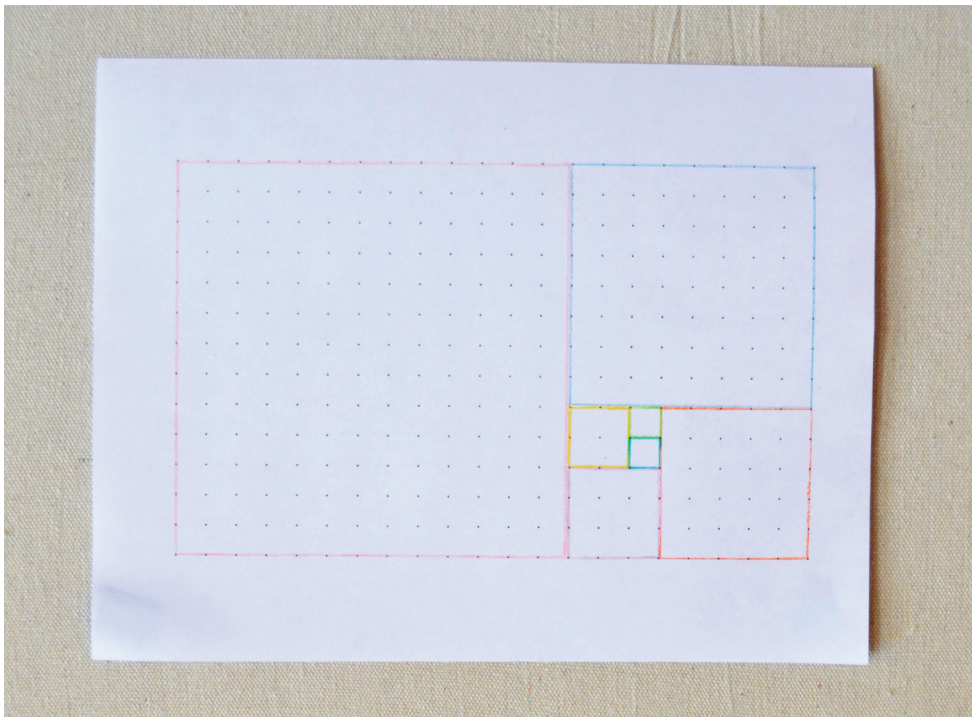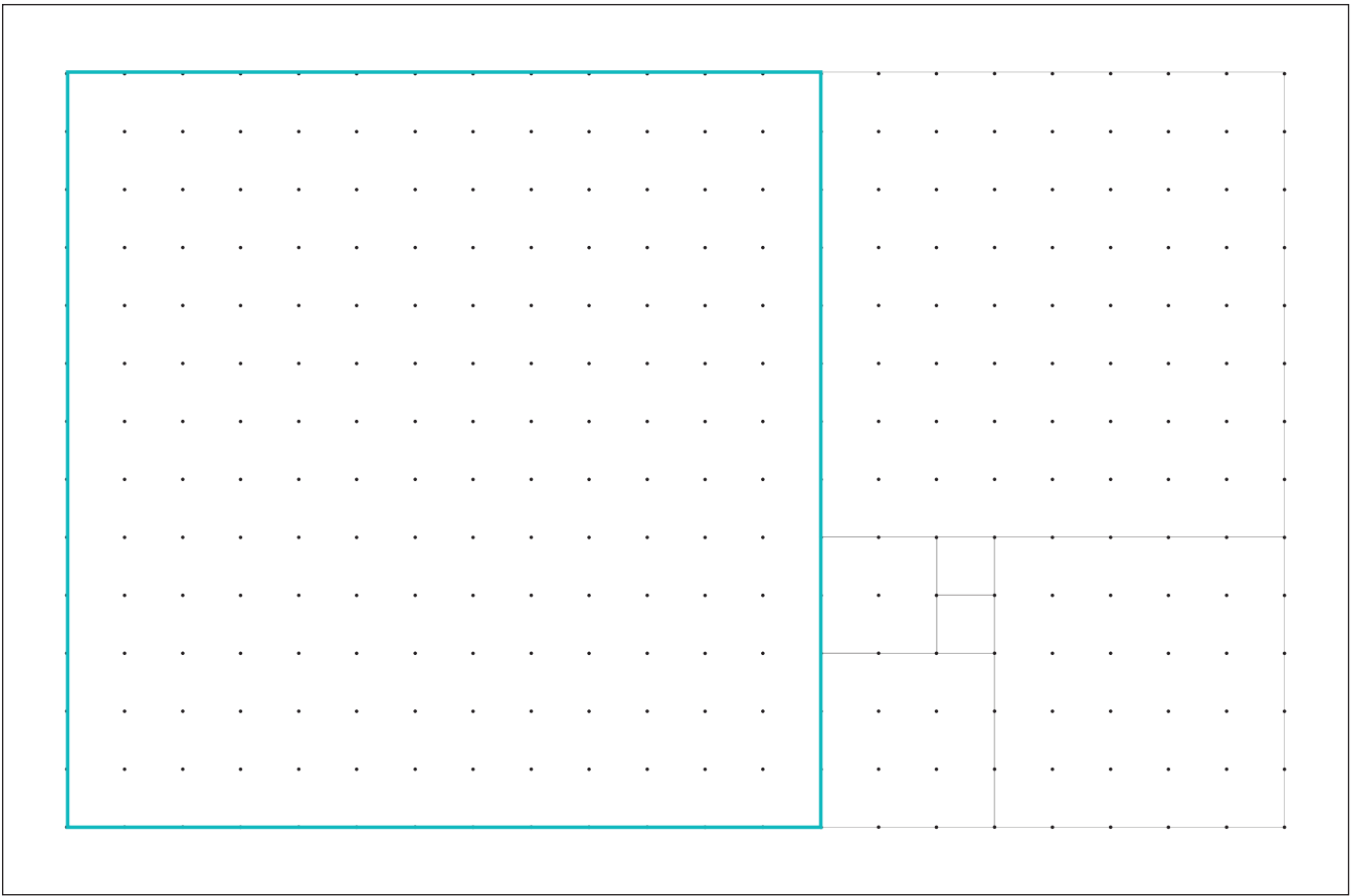
Fibonacci Sequence

Activity 2: Fibonacci Spirals

Setting Up
paper
pencil, pen
colored pencils
print off the dotted grid from the Fibonacci Sequence Template PDF
ruler

Steps
After you have created the Fibonacci rectangles, we can add lines to create a spiral that starts from the center, and spins outward as it gets bigger.

Take a look at the following page as a guide. Notice how you see a curve that spirals around. If you look closely, you will see that this curve is created by straight lines.

Start in the middle, with the first square that was drawn. Using the following page as a guide, connect the dots in each square, starting with the smallest squares first, and progressing to the largest.

What do you notice about these lines? In each square, how many lines do you count? Notice that the more lines you have, the smoother the curve will appear.