The Nature of Math
What makes pollinators interested?

Big Idea: Exploring how math can be found in nature through the Fibonacci Sequence.

Guiding Questions:

1. What is the Fibonacci Sequence?

2. Where do we find the Fibonacci Sequence in nature?

3. Can I find the Fibonacci Sequence in the place I live?

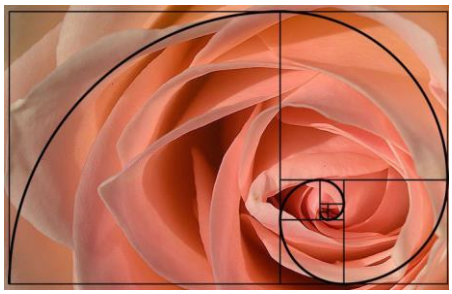
4. How can we use math to find sequences in the natural world?

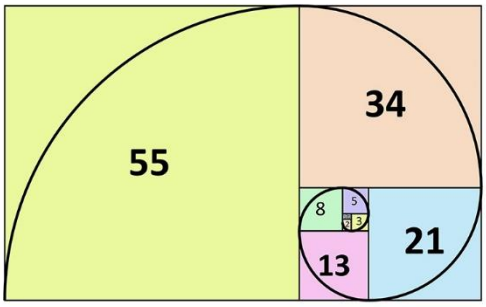
5. How does the Fibonacci sequence interact between flower and pollinator?

Background Information for teachers and parents: In this lesson, students will be able to connect math with nature. The Fibonacci Sequence was discovered/invented by Leonardo Fibonacci. It is one of the most famous formulas in Mathematics. Being able to connect math with the outside world will allow students to draw connections between numbers and shapes.

Materials needed: Colored pencils, graph paper, ruler, handouts from packet, internet capable device

The Fibonacci sequence is a mathmatical curve that we find in nature. We see this in things like flowers, pinecones and shellfish.





Humans, as well as animals, find this sequence beautiful. This is why we pick flowers, or why birds or bees might be drawn to flowers too!

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What is a pollinator and why does it matter what a flower looks like?

A pollinator travels from flower to flower, picking up pollen from one flower and bringing it to another. This allows pollen to be spread among different plants. A hummingbird for example, uses it's long beak to drink the nectar out of flowers. When it does this, sticky pollen grains get stuck on the hummingbirds beak. When it goes to the next flower, that pollen can rub off onto that flower and pollinate it. This is important to maintain diversity among different plants! Pollinators are responsible for plant reproduction. Without pollinators, plants would be in trouble!

This is why it's important to have the pollinators, but there also needs to be a pretty flower to attract that pollinator to it!

The Fibonacci sequence has a natural symmetry to it that the eye of a bird picks up on. The number of petals also is pleasing to the bird's eye.

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Step 1: ~5 minutes

Invitation Journal Prompt: Write or draw a few examples of mathematics or numerical patterns you have observed in nature. Try for 1-2 examples.

Step 2: ~3 minutes

Today you are going to learn about the Fibonacci Sequence. Check out this short video to find out more:

https://www.youtube.com/watch?v=wTlw7fNcO-0

Step 3: ~20 minutes

Let's explore the Fibonacci Sequence by drawing it out! For this activity you will need: colored pencils, a pencil, and a blank piece of graph paper. If you do not have graph paper, you can use the example piece which we have added to this packet.

Using the blank graph paper on the next page, replicate the example piece of Fibonacci's sequence by coloring each number set a different color. You will first start out with a 1x1 square and you will add another 1x1 square below that. Next add a 2x2 square next to the first squares and so on and so forth. You can use the picture on page 1 as a reference. Remember that the sequence is found by adding the previous number to the current number. Example: 1+1 = 2; 2+1 = 3; 3+2 = 5; and so on.

Helpful tip: Use the graph paper horizontally!

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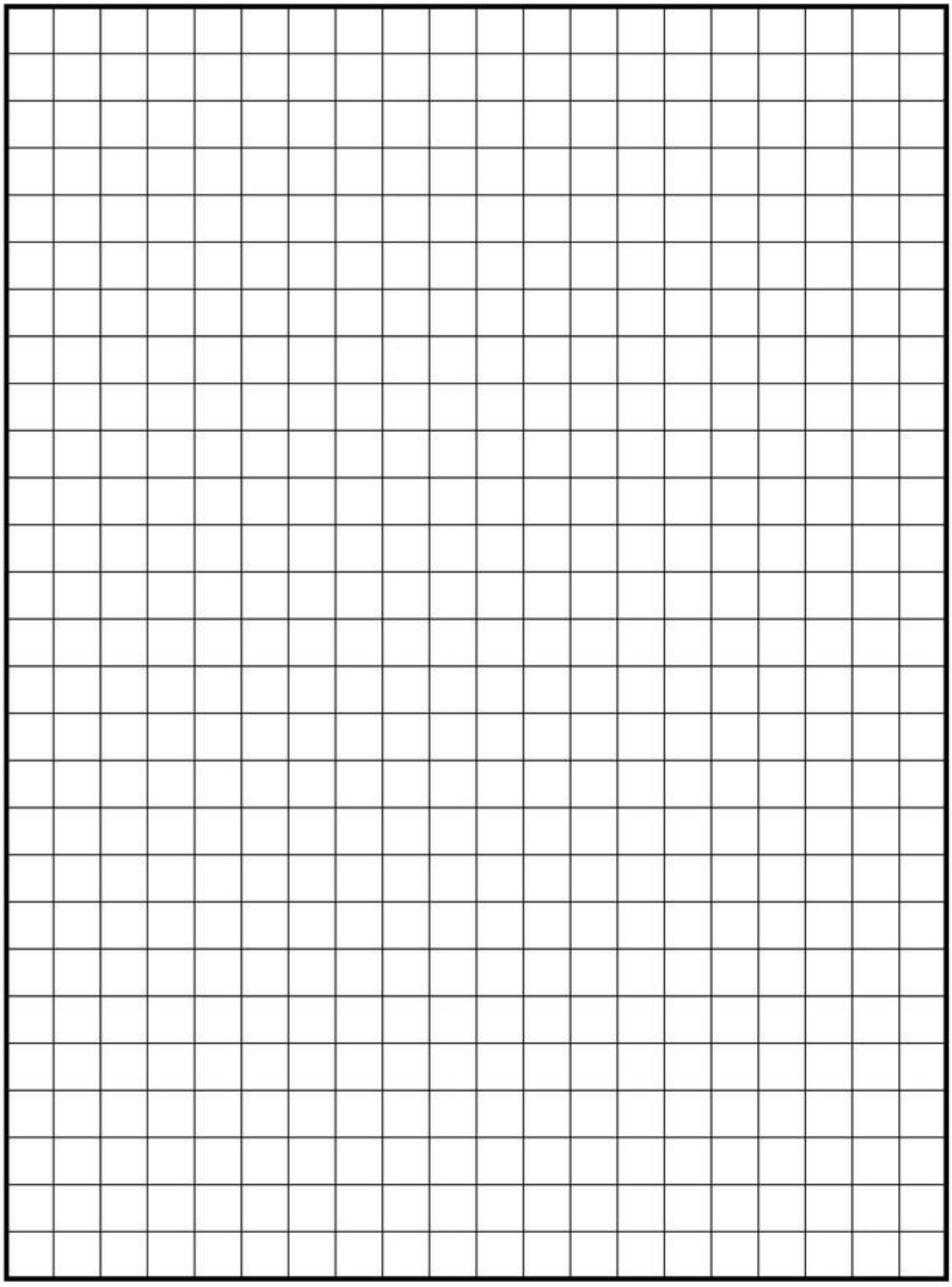

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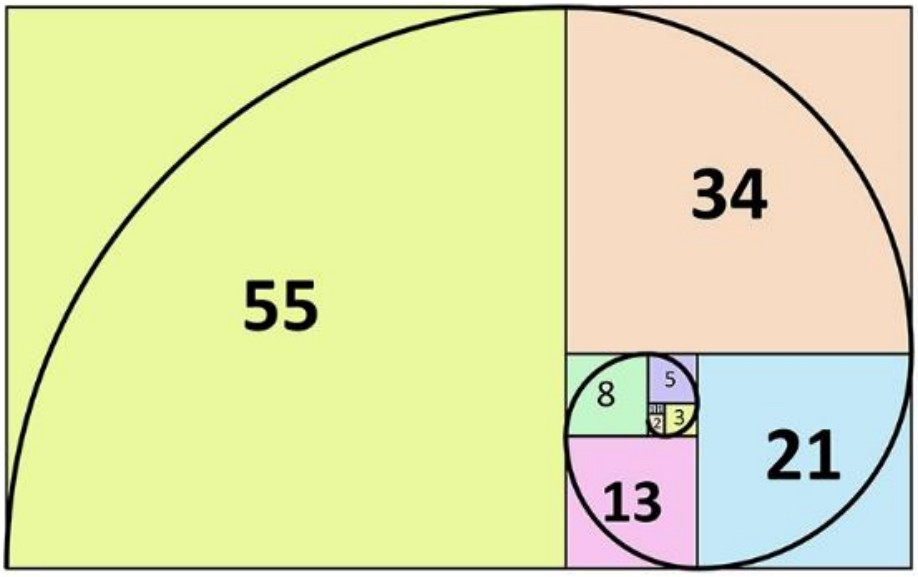
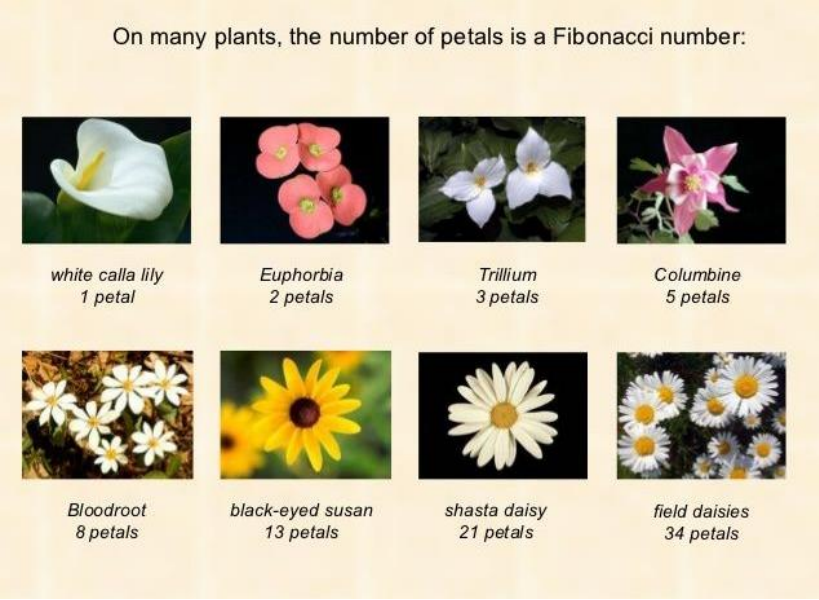
Now that you have created the Fibonacci Sequence on your graph paper, let's connect all the squares within the sequence. This is where the Fibonacci spiral comes in. This spiral can be seen throughout the natural world! Use the example below to connect your sequence.



Notice: The number of petals on a flower is always a Fibonacci number!



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You can divide each number by the previous number and get the Golden Ratio (Phi). For example:

3/2 = 1.5

5/3 = 1.6667

8/5 = 1.6

13/8 = 1.625

21/13 = 1.6154

32/21 = 1.6191

55/34 = 1.6176

89/55 = 1.6182

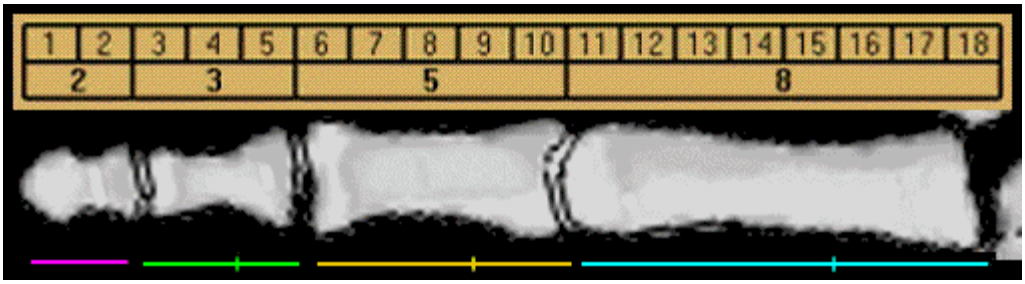
144/89 = 1.618

The Golden Ratio is Phi, 1.618.

The human hand shows Phi and the Fibonacci Sequence: Let's dive in deeper to the Fibonacci Sequence by starting with something simple. For this activity, you will need a ruler and your index finger (pointer finger).

Each section of your index finger, from the tip to the base of the wrist, is larger than the preceding one by about 1.618 which is the same number as the Golden Ratio, also fitting the Fibonacci numbers 2, 3, 5 and 8. By this scale, your fingernail is 1 unit in length.

Take your fingernail and see if it matches the Fibonacci sequence as shown in the picture below.



Use this space to write down your measurements

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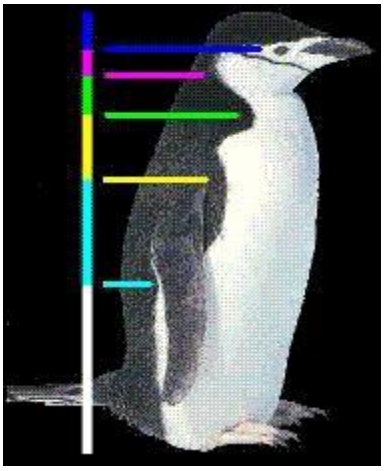
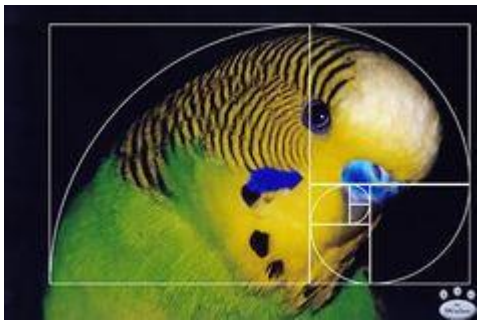
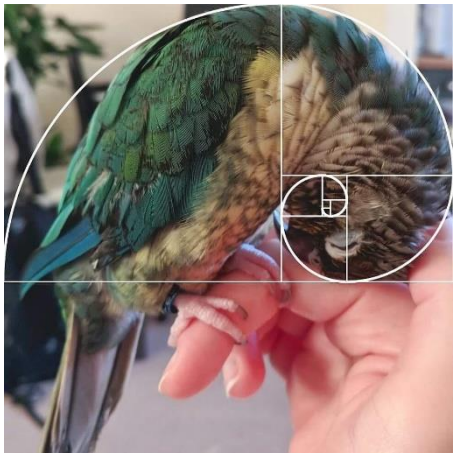
We see the law of mathematics and the Fibonacci sequence present in so many birds:







We have drawn the sequence on graph paper and discovered some different places that the Fibonacci Sequence naturally occurs.

Draw a flower that you think a hummingbird might be attracted to drink nectar from that contains a number of petals you can find in the Fibonacci sequence (1,2,3,5,8,13,21…).