Please use our materials!

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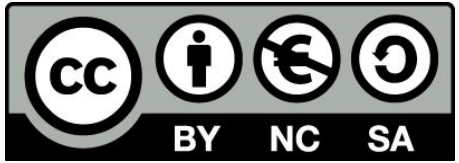
We also humbly request that you email sarah.adams@olin.edu if you use these materials, as we are tracking their impact and how far they travel!



Math and Plants

Math in nature?! You better be-leaf it!

Who We Are...

Riley Zito
they/them
& he/him

Brent Usui
he/him

Mason Grabowski
he/him

Annie Tor
she/her

Before we get started...

- Make sure you have a copy of the handout
- Keep your microphone muted unless you're speaking
- If you get stuck, get lost, or have any questions, feel free to type in the chat or PM any of us (Riley, Brent, Mason, Annie)

Overview (for our reference)

Goals: interactive graphing, understanding connections to other fields, appreciation and observation of nature, math visualization

Day 1:

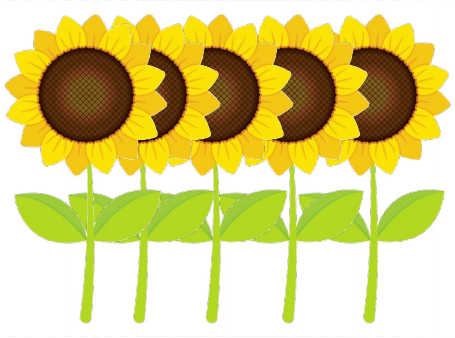
- Introduce why the sunflower needs to optimize for spiral with no gaps (5-10 mins)
- Students to work together and experiment with the rate of curve (20 mins)
    - Interactive website “be the sunflower”
    - ‘Scavenger hunt’ esc where they look for a pattern and share what they got
- Go over the “answer”- the fibonacci sequence and golden ratio (20 mins)

https://www.mathsisfun.com/numbers/nature-golden-ratio-fibonacci.html

What's your favorite plant?

Type your answer in the chat!

Sunflowers



What do sunflowers want in life?

- To spread their seeds and make more sunflowers!

How could they fit the most seeds on its face?

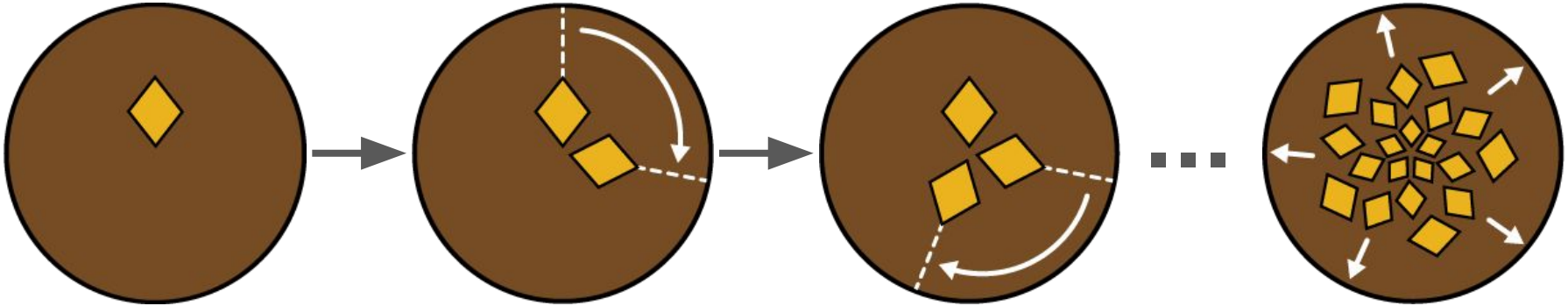
- By packing them as close together as they can!

How do Sunflowers Arrange Their Seeds?

Like many plants, sunflowers grow in spirals caused by two rules they follow when making new cells:

Every cell starts growing near the center, and is pushed outwards.

Every cell is made a partial turn away from the previous cell.



Our Goal

https://nurturestore.co.uk/sunflower-seed-sensory-play-and-investigation
https://metroflowermarket.com/product/sunflower-large/

Gallery

Let’s share out our progress here during the upcoming activity!

Be the Sunflower Share-out Slides (Replace the above URL with the URL for the copy that you, the new teacher, makes for the share-out slides. If your students all use this link, they will make their own copies and you will not be able to go through the class’s results together!)

“Be the Sunflower”

Go to this website:

tinyurl.com/plantsandmath

- Change the rotation and try to minimize gaps
  - You want less black space between the lines
- Don’t scroll too far! Only do the activity shown in the gif

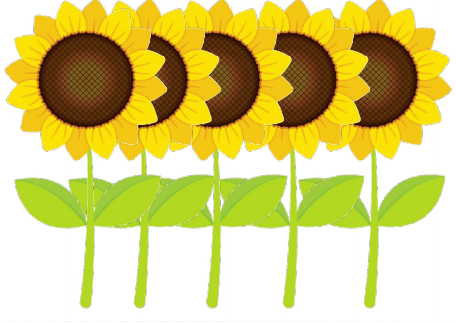
https://www.mathsisfun.com/numbers/nature-golden-ratio-fibonacci.html

Next step (notes for interactive website speaker)

At this point, go to the sunflower website and step by step show how to edit the numbers, copy the image into the slide deck, point out the numbers at the top of the website. After a moment, point out that simple fractions vs. repeating numbers may show different patterns

Go over .5, .25, .33, in order and describe how this corresponds to the image shown, as it goes that percentage of rotation and then lays down a row of seeds. Number corresponds to fractional rotation

Sunflower Discussion



Let’s look at the share out slides together.

What did you find? Type in chat some patterns you found, things that were surprising, interesting, funny, etc!

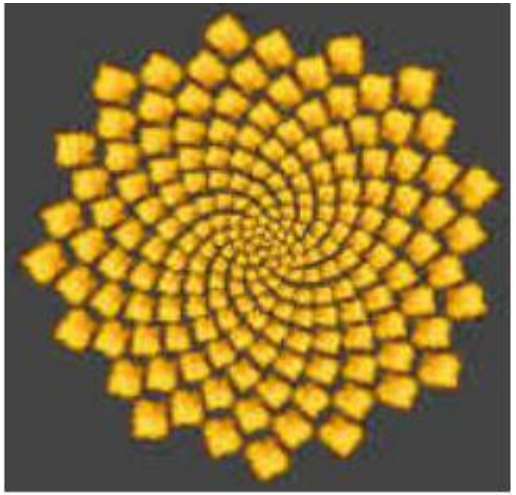
Did anyone get close to **no** gaps? What was your percent of rotation?

The Golden Ratio

It is an irrational number that is an **expert at not being a fraction**

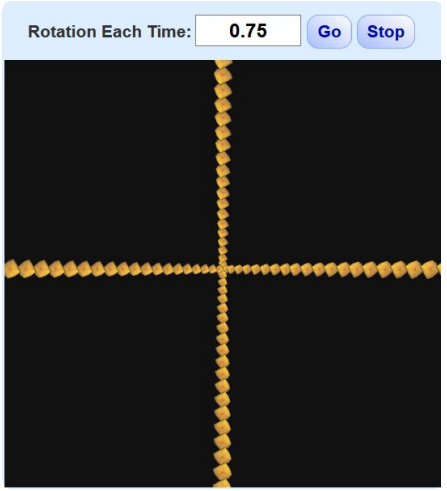
- Not a simple fraction such as 0.75 (3/4) or 0.90 (9/10)
- Not exactly like other irrational numbers either, such as Pi (3.1416...)

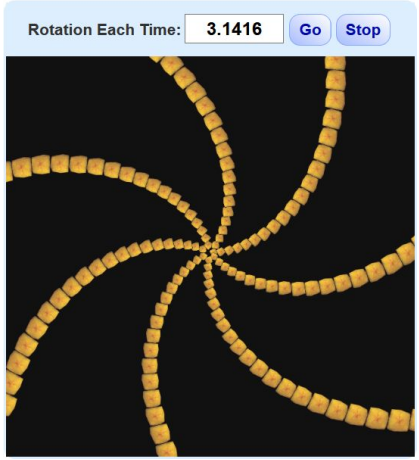
Golden Ratio (**1.61803**...)



Why the Golden Ratio?

- Simple fractions create a pattern of lines stacking up, where lines stretch out straight
- Most irrational numbers are close to other fractions and create distinct arms with gaps
  - Pi (3.1416…) is close to 1/7 or 0.1428
- The golden ratio (1.618...) is not close to any other fraction, thus infinitely spiraling





Taking A Closer Look

The **Fibonacci sequence** is a series of numbers that build upon each other.

Starting from 0 and 1, you can find the next number in the sequence by adding up the previous two numbers.

0, 1,

What's the next number in the sequence? What are the next 5 numbers?
Type in the chat!

"21, 34, 55, 89, 144"

Behind the Numbers

Here's are the first 29 numbers from the Fibonacci sequence:

0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55,

89, 144, 233, 377, 610, 987, 1597,

2584, 4181, 6765, 10946, 17711, 28657,

46368, 75025, 121393, 196418, 317811...

610 / 377 =
1.61803713528

The Golden Ratio!

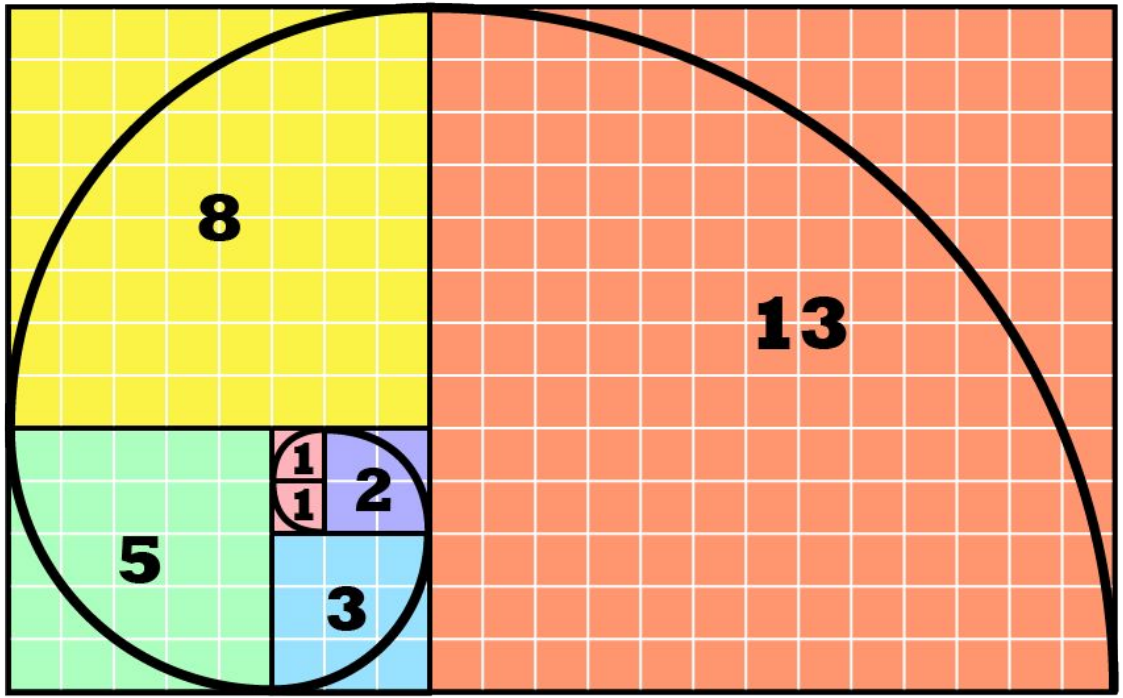
1.6180339887499894

8482...

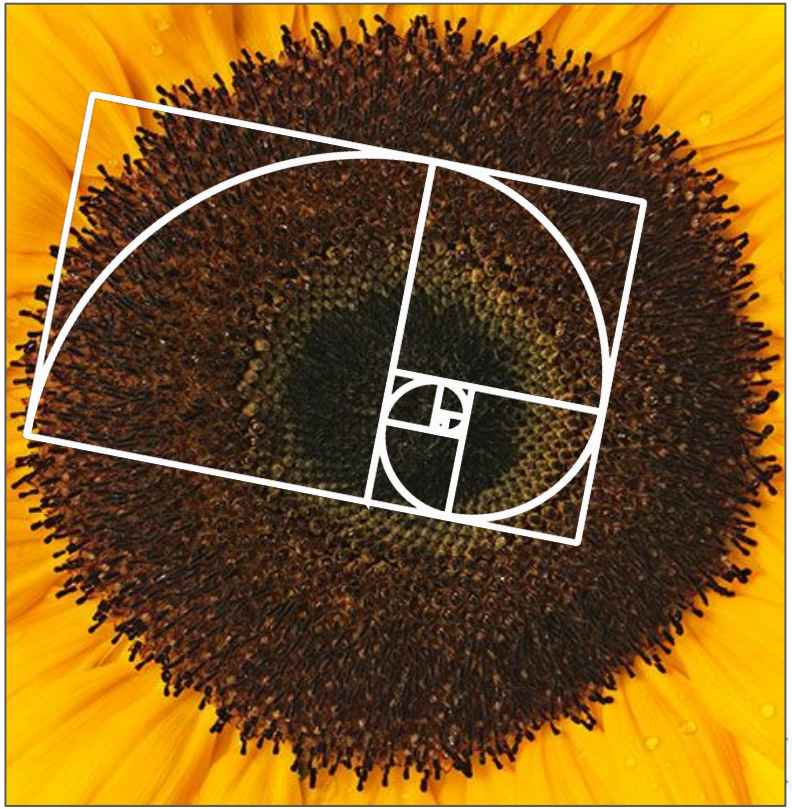
Pick any number and divide it by the one before it!

Fibonacci Sequence & Golden Spiral

The Fibonacci sequence: 0, 1, 1, 2, 3, 5, 8, 13...



The Golden Spiral



1.61803…

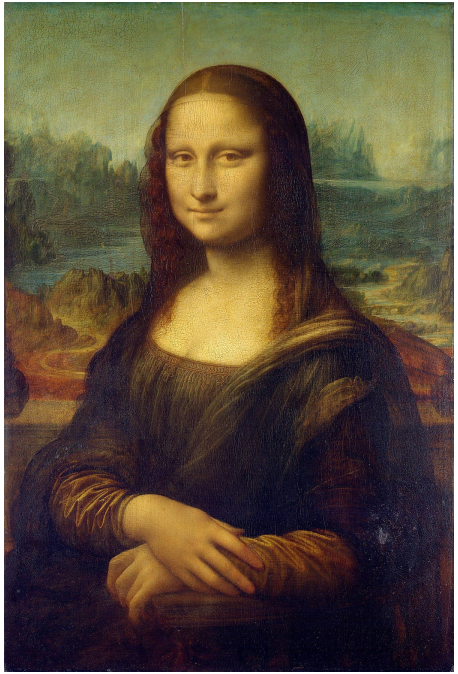
“Remember me?”

https://metroflowermarket.com/product/sunflower-large/

Other Examples In Nature

https://clevelanddesign.com/insights/the-nature-of-design-the-fibonacci-sequence-and-the-golden-ratio/

How did today go for you?

Type your thoughts in the chat!

We see the golden ratio in nature, but where else do we see it?