Can sunflowers do maths?

Introducing the Fibonacci sequence

The Big Questions

Who was Fibonacci?

What is the Fibonacci sequence?

Where have we seen this sequence before?

Why is it important?

What other mathematical ideas does it link to?

Can sunflowers really do maths?

Who was Fibonacci?

Fibonacci was an Italian mathematician who lived in the late 12th Century.

He published his most famous work in 1202 and wrote about the sequence that is now called the Fibonacci sequence.

He first recognised the famous sequence by studying rabbits!

The Fibonacci sequence

The Fibonacci sequence is particularly special because of the way it grows.

To find the next term in the sequence, you must add together the previous two.

The original sequence started: 1, 1, 2, 3, 5, 8, …

What would the next term be?

Creating your own Fibonacci sequences

Choose two numbers from the board to start your own Fibonacci sequence.

Does changing the order of the starting numbers change the sequence?

How many different sequences can you make?

What do you notice when you choose two even numbers?

What about two odd numbers? Or one odd and one even?

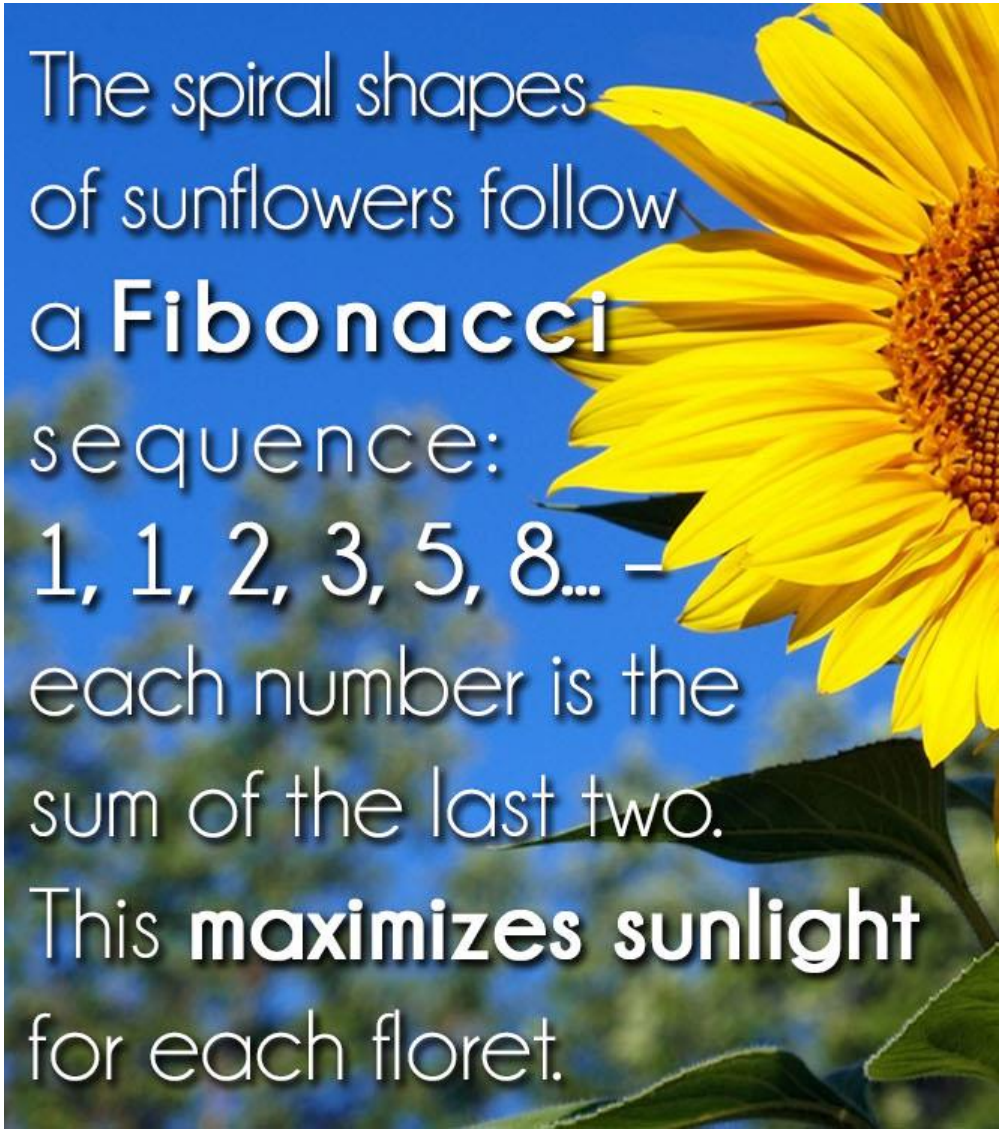
Fibonacci's missing numbers

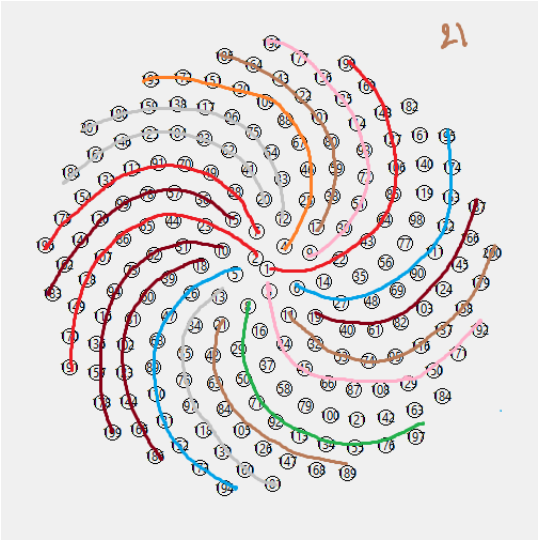
Some of Fibonacci's sequences seem to have gone missing!

Can you help him to work out the numbers that fill in the gaps, to complete his sequences?

You might find it useful to use coloured counters or blocks to help.

If you want an extra challenge you can try the sequences involving algebra.


The spiral shapes of sunflowers follow a **Fibonacci** sequence:
1, 1, 2, 3, 5, 8... –
each number is the sum of the last two.
This **maximizes sunlight** for each floret.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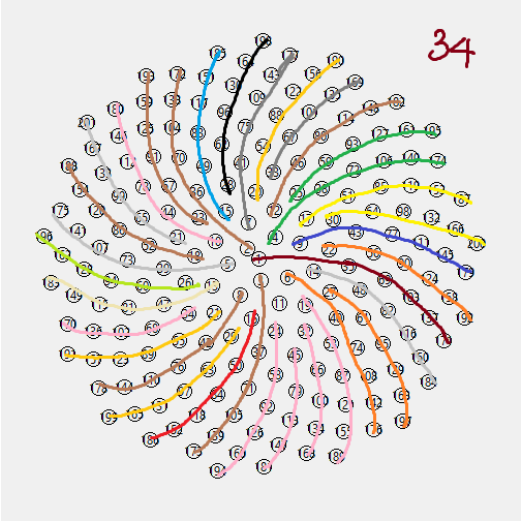
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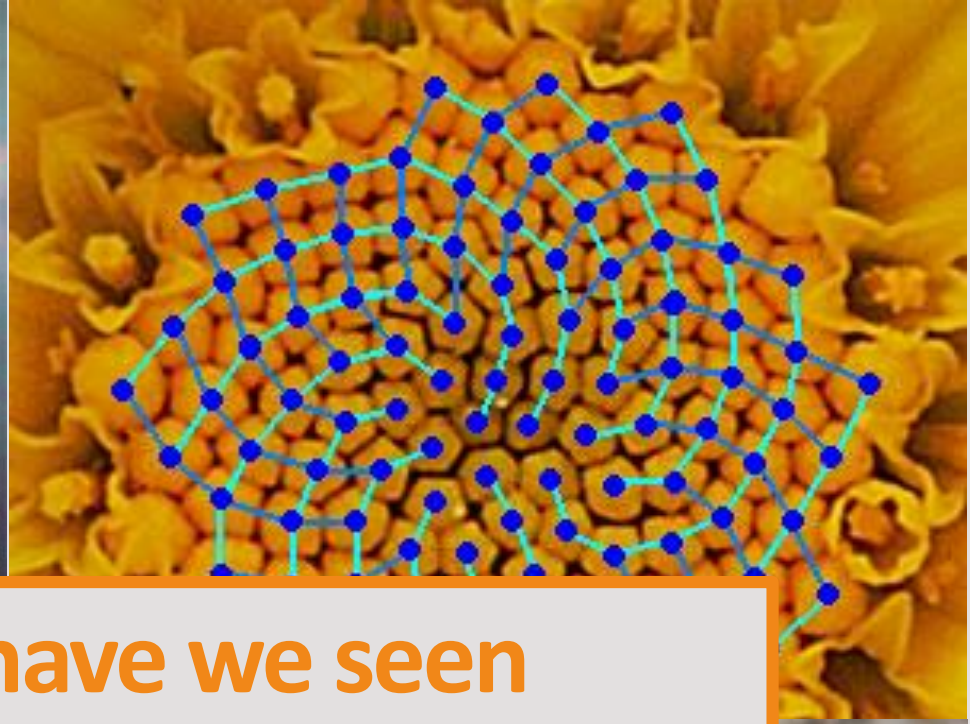
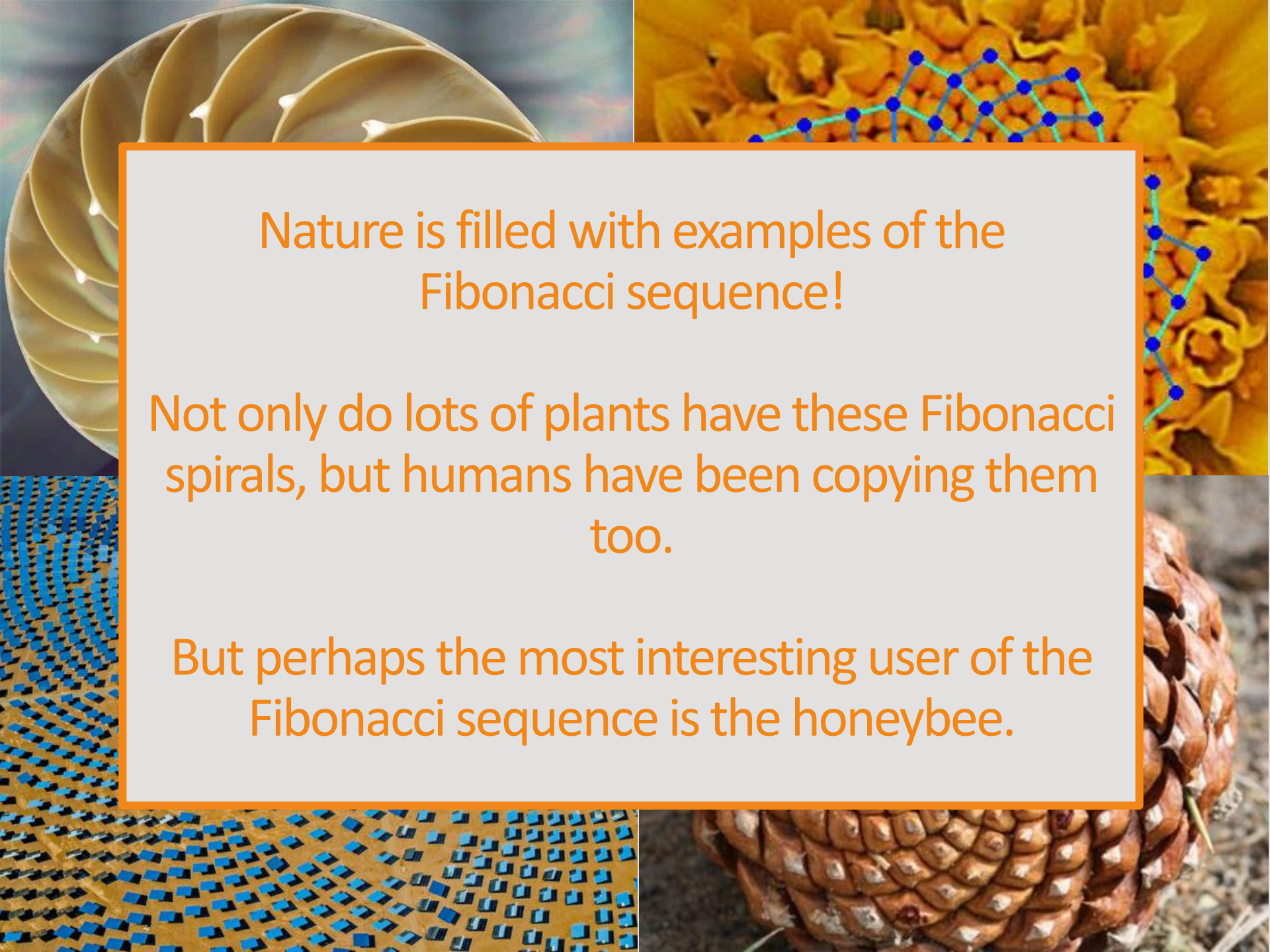


Where else have we seen these sequences before?



Nature is filled with examples of the Fibonacci sequence!

Not only do lots of plants have these Fibonacci spirals, but humans have been copying them too.

But perhaps the most interesting user of the Fibonacci sequence is the honeybee.

The honeybee family tree

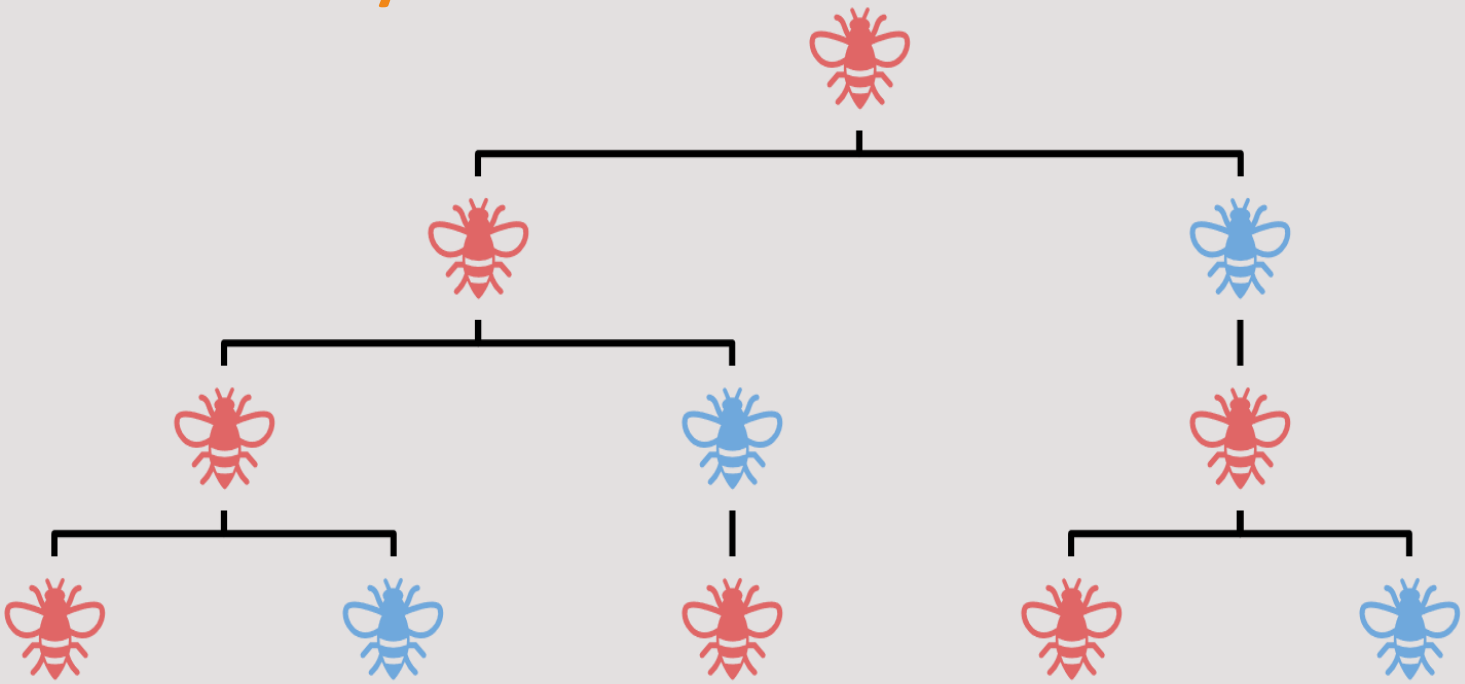
Honeybees are quite incredible!

A female honeybee can reproduce with a male honeybee to create a new female honeybee.

A female honeybee can also reproduce on its own, to create a male honeybee called a drone.

So female honeybees have two parents, but a male honeybee only has one.

The family tree



Child

Parent

Grand parent

Great Grand parent

What do you notice about the number of bees in each generation?

Can you predict how many bees would be in the next layer? How do you know?

Why is it so important?

Without the Fibonacci sequence, plants would not grow properly, bees would become extinct, the world would not be the way it is today!

Many of the famous buildings and artworks we have would also not exist as the architects, engineers and artists have been inspired by this famous pattern hiding all around us!

Links to other areas in maths

The numbers in a Fibonacci sequence have another mathematical mystery hidden within them.

We need to use our knowledge of ratio to help us this time.

We can look at the ratio of two consecutive terms.

What is a term?

What does consecutive mean?

Finding the ratio

A ratio is a comparison between two parts.

We could write the ratio as the number of times bigger the next term in the sequence is.

This would be a ratio in the form $1:n$.

To do this we find fractions, where the next term is the numerator and the current term is the denominator.

Example

The original sequence: 1, 1, 2, 3, 5, 8, 13, …

Working	$\frac{1}{1}$	$\frac{2}{1}$	$\frac{3}{2}$	$\frac{5}{3}$	$\frac{8}{5}$	$\frac{13}{8}$
Ratio	1	2	1.5	1.666 …	1.6	1.625

Will the next ratio be bigger or smaller than 1.625?

What about the one after that?

What do you think is happening?

Your turn

Choose any two positive whole numbers between 1 and 5.

Write down the first 10 terms of your sequence.

Find the ratio between consecutive terms
(you may need a calculator to help!)

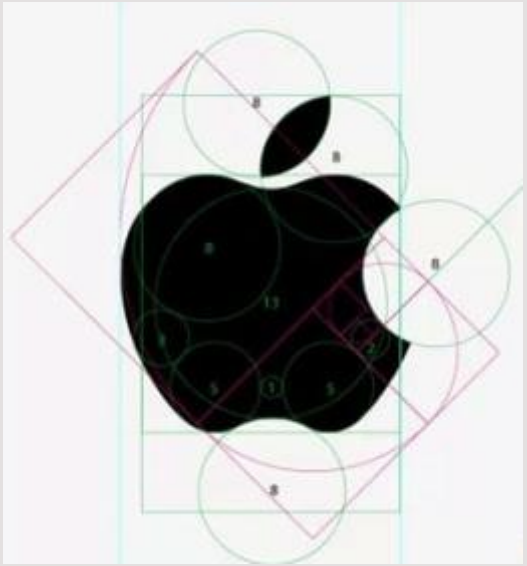
What number did you get in the final box?
Was this the same, similar or very different to the example?

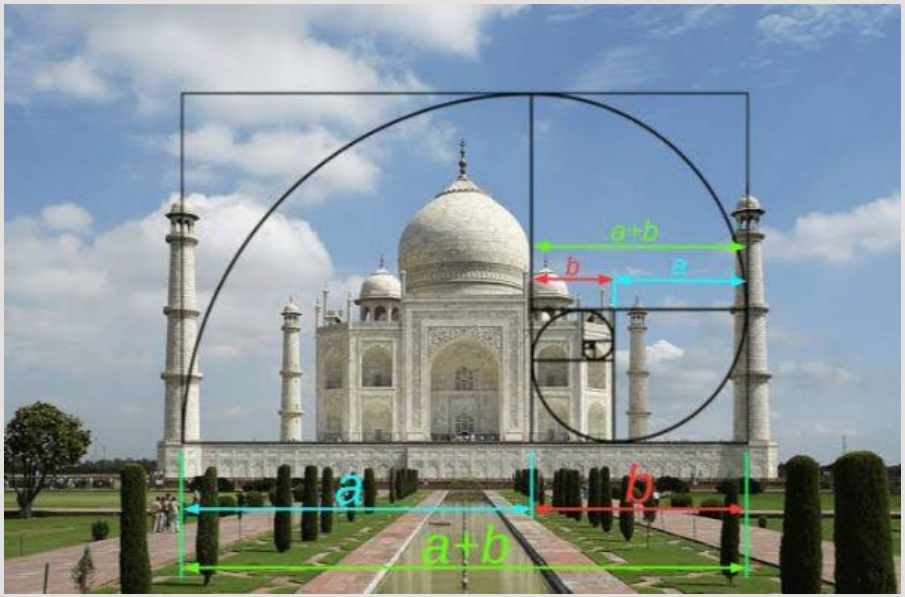
The Golden Ratio

You have just found one of the most beautiful secrets in mathematics.

The golden ratio is a number that is approximately 1.618.

This number has incredible properties and is seen in nature and design and you probably never even noticed!

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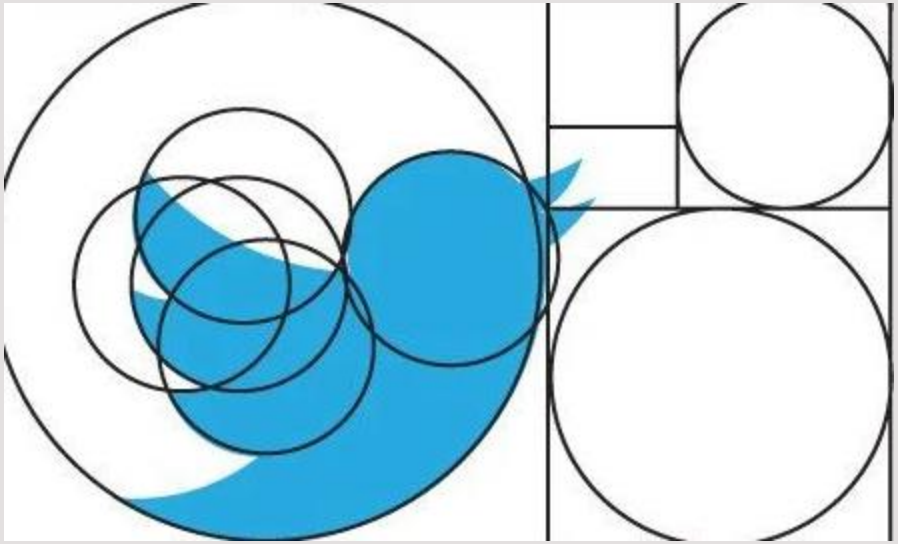

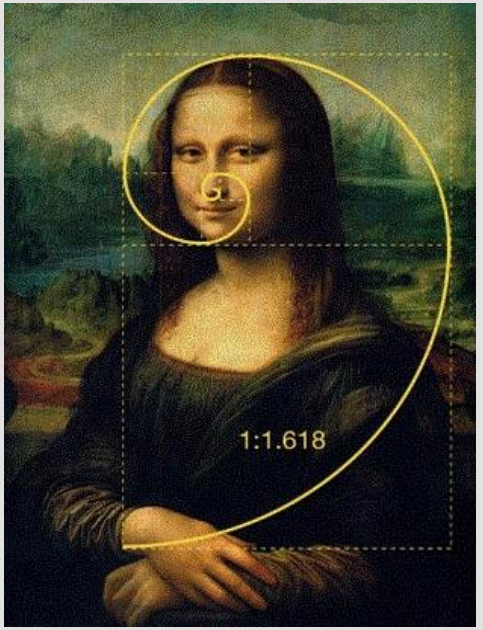
1:1.618

What do you think…

Can sunflowers do maths?

What about honeybees?

Capture your learning

Try to summarise the key things you have learned about Fibonacci, the sequences and how they link to nature and other parts of mathematics.

You could create a leaflet, a poster or even your own presentation.

You could even add some Fibonacci art.
The BBC Bitesize link has a video and step by step guide.