

Mathematical investigation (1)

Investigating is a great way to learn to think mathematically, apply logic, spot patterns and improve our perseverance.

Playing with Fibonacci Sequences



800 years ago, a mathematician from Pisa in Italy wrote about a rather special sequence of numbers. We call it the **Fibonacci Sequence**.

These numbers turn out to be very special.

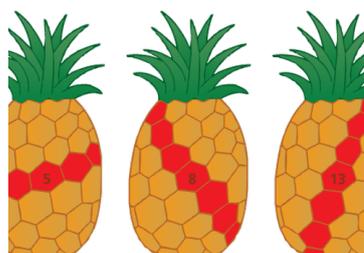
Petals on flowers

3 petals



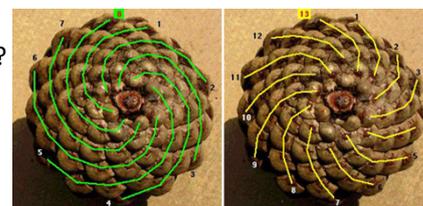
5 petals

Pinecones & Pineapples



Pineapple 'scales' can be viewed as three distinct sets of spirals. The three orientations are comprised of 5, 8 or 13 spirals - three consecutive Fibonacci numbers. [from <https://ya-webdesign.com/>]

How many spirals go in the clockwise direction? (green lines) How many spirals go in the anti-clockwise direction? (yellow lines) Isn't that strange? Wouldn't you expect them to be the same....? (image from www.mensaforkids.org)



Draw a box around a group of 4 adjacent (next-door) numbers in the sequence.
e.g.

3, 5, 8, 13



You may use a calculator for the next bit if you want to, or you can do it yourself! Follow these instructions:

$$\begin{array}{r} 13 \times 3 \\ 13 \\ \hline 30 + 9 \\ \hline 39 \end{array}$$

1. Multiply the 'outside' numbers in the group: $3 \times 13 = 39$
2. Multiply the 'inside' numbers in the group: 5×8 (which is 8 lots of 5) = 40
3. Draw a box around another set of four numbers.
Repeat instructions 1 and 2.
4. Draw five different boxes around groups of four numbers.
Follow the same instructions each time.

1, 2, 3, 5

What do you notice about the pairs of numbers?

More play with Fibonacci Sequences



1. Draw a box around three adjacent numbers, e.g. 3, 5, 8
2. Multiply the 'outside' numbers: $3 \times 8 = 24$
3. Multiply the 'middle' number by itself: $5 \times 5 = 25$
4. Repeat five times.

What do you notice about each pair of numbers?

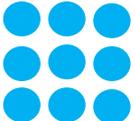
Challenge!

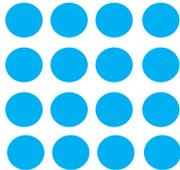
Here, you need to know a bit about **square** numbers...

When we multiply numbers by themselves, they make squares. So, we call the answers **square numbers**.

 $1 \times 1 = 1$

 $2 \times 2 = 4$

 $3 \times 3 = 9$

 $4 \times 4 = 16$

Use each number in the Fibonacci sequence to give a sequence of square numbers:

Fibonacci numbers	1	1	2	3	5	8	13
Square numbers	$1 \times 1 =$ 1	$1 \times 1 =$ 1	$2 \times 2 =$ 4	$3 \times 3 =$ 9	$5 \times 5 =$ 25	$8 \times 8 =$ 64	$13 \times 13 =$ 169

Add each pair of next-door numbers in this sequence: $1 + 1 = 2$, $1 + 4 = 5$, etc.

Write down your answers, 2, 5, ...

What do you notice about this new sequence of numbers?

These Fibonacci numbers seem to be everywhere!