Patterns and numbers: Understanding nature

There is a fascinating connection between nature and numbers. Certain numbers and sequences appear everywhere.

The Fibonacci sequence

Some things in nature repeat in a certain sequence. The Italian mathematician Fibonacci, one of the greatest mathematicians to have lived, came across the Hindu-Arabic numerals while visiting Algeria.

Using the numbers from 0 to 9 allowed Fibonacci to explore math in a whole new way. He is most famous for this sequence of numbers that bears his name: 0, 1, 1, 2, 3, 5, 8, 13, 21, 34 ...

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

Each new number in the sequence is found by adding the two numbers before it–so 0+1=1, 1+1=2, 1+2=3, 2+3=5, and so on. Fibonacci developed the sequence while trying to work out how many rabbits could be born in a year if a rabbit breeder started with a single pair of rabbits. Although rabbit breeding doesn't actually follow Fibonacci's rule, the number pattern he discovered does pop up everywhere in nature.

∞

Infinity (∞) is not a number. It's used to represent the idea of something that never ends or has no limits. This is useful in math, for example, for describing how you could go on counting forever or cutting something in half forever! It's also used in physics, to describe the idea that both time and space go on forever.

φ (phi) and the golden ratio

The golden ratio is a mathematical proportion that appears throughout nature, such as in the spirals of snail shells and the pattern of seeds in a sunflower, and has inspired many famous works of art and design, including the Great Pyramid of Giza. This mathematical proportion is defined by a special number: phi (**φ**), or 1.618034.

You can see this in the rectangle on the right. Draw a line through that rectangle to create a square inside it (a). The space left over (b) beside that square will also be rectangle in the exact same ratio as the original rectangle you started with. You achieve the perfect harmony between both lines when a÷b=phi.

$$\frac{c}{d} = \pi$$

3.1415926535

π (pi)

If you take any circle and divide its circumference (the distance around the outside) by its diameter (the distance across the circle), the answer will always be the same: 3.1415926535 ... –pi (π) for short. The digits after the decimal place seem to go on forever. Powerful computer programs have worked out more than 31 trillion digits, but have found no repeating pattern. Circles are all around us in nature, so π helps to describe how the world works.

$$= \frac{a+b}{a} = \frac{a}{b}$$