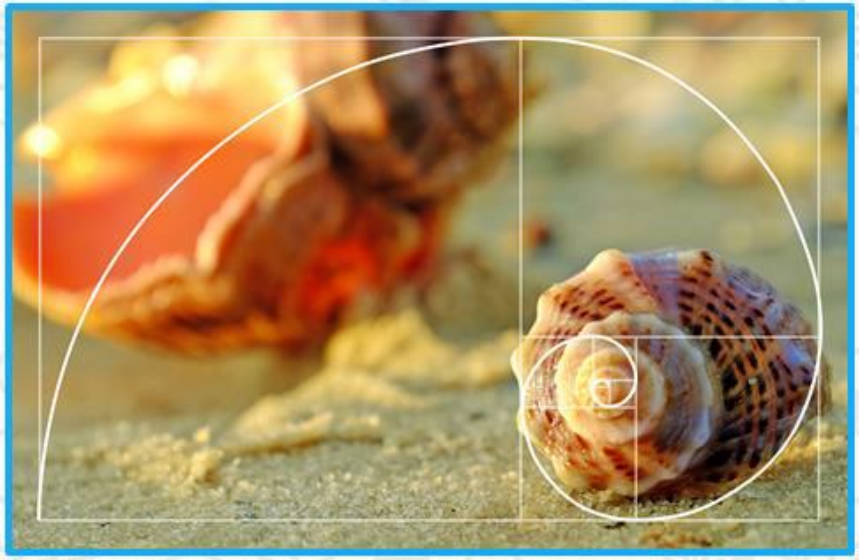
CAMBRIDGE SCIENCE CENTRE

OpenUpScience

Issue 10

Welcome to OpenUpScience, the weekly magazine from Cambridge Science Centre. In this issue, we're thinking about Maths. Inside we have some amazing tricks, baffling shapes and intriguing puzzles for you to explore the fun side of maths!



You may not realise it, but maths is everywhere! Maths isn't just to do with numbers and your times-tables – we use maths to understand shapes, surfaces, patterns and even card tricks. All areas of science use maths to describe the world around them. We also see maths patterns all around us in nature, from shells to honeycombs!

Spark, Ignite, Fuel, Illuminate

Going loopy!

Have a go and discover the mind-blowing maths behind Möbius loops!

A Möbius loop is a mathematical surface with only one side. It sounds rather strange, but follow these simple steps to make one and discover some of its weird properties.

What you'll need

- A piece of A4 paper
- Sellotape
- Scissors
- A pen

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Ever noticed that the recycling logo is a Möbius loop?

What to do:

1.

Cut a strip of paper from your A4 sheet. It can be about 5cm wide and the length of the paper but it doesn't need to be too precise.

2.

Make one twist in your strip of paper.

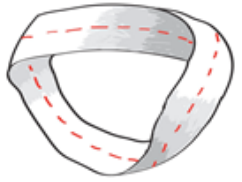
3.

Bend this twisted strip into a loop and secure with sellotape. This is a Möbius loop!

Möbius loops only have one side!

Take your pen and follow it along the inside of your loop. What happens?

Cutting them in half doesn't make two separate loops!



Cut along your pen line. Instead of two separate halves, it will form a large connected Möbius loop with two twists.

Two hoops make a square

Ask your friends if its possible to turn two circles into one square. When they say "no" prove them wrong with this clever little trick.

What to do:

1. Cut two stripes from your A4 paper, about 5cm wide.
2. Make them into two hoops and secure with Sellotape.
3. Stick your two hoops together at right angles to each other. (Make sure you use plenty of Sellotape for this step!)
4. Cut each circle in half lengthways and see the square appear!

What you'll need

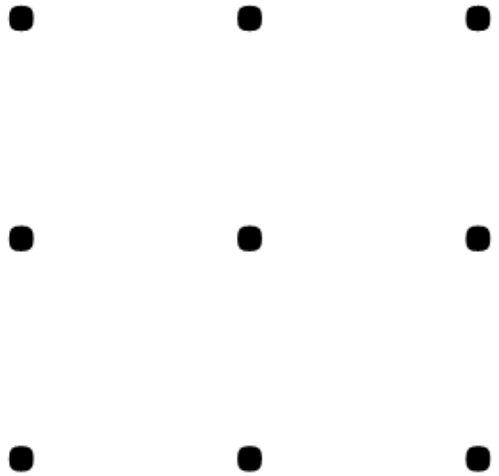
- A piece of A4 paper
- Sellotape
- Scissors

Did you know...?

The inside structure of honeycomb is hexagonal, which is a 6 sided shape with equal sides. This is the perfect shape not just because it tessellates (fits together without gaps), but because it's the shape that uses the least possible amount of wax to make while maximising the amount of honey it can hold and still tessellate.

Can you connect the dots?

Connect the dots – but there's a twist. Join all nine dots with four straight lines without taking your pencil off the paper and without going over any line twice. This needs some imaginative thinking, but it is possible!



Hint: Think big!

This Week's Challenge

Natural Circles!

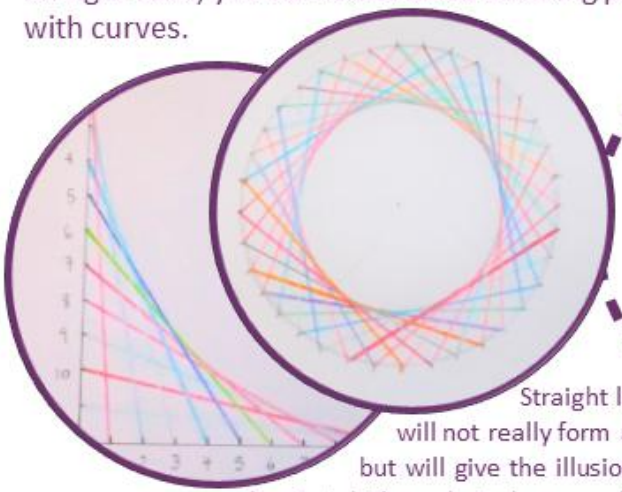
Can you find examples of circles or spheres in nature. This could be in water droplets, flowers or even your eyes!

Send your photos to:

OpenUpScience@cambridgesciencecentre.org

Curves from straight lines

Using some geometric shapes and drawing only straight lines, you can make some amazing pictures with curves.



What you'll need

- Paper
- Pencil
- Sharpener
- Eraser
- Set square
- Ruler
- Coloured pencils

Straight lines will not really form a curve, but will give the illusion of one. Your eyes see all the straight lines, but when your brain puts that information together to make sense of it, it comes up with something it is familiar with- a curve. So you imagine you see a curved line, even though it's not really there!

What to do

1. Using the set square, draw a right angle in the middle of your paper making sure both lines are the same length. With the ruler mark even divisions along the line with a pencil every 1cm.
2. Number the divisions starting with 1 at the left corner of the horizontal line, but starting with 1 at the top of the vertical line. Do it in pencil so that you can rub them out later if you want to.
3. Join the number 1s with a straight pencil line. Then join the number 2s, and so on - use different coloured pencils for a fun effect!
4. See how the straight lines slowly form a curve! Once you've got the idea, you can try different angles, or maybe a cross shape and make 4 curves at once.

Mind-reading maths magic

Follow some simple rules and it will look like you're a mind reading magician, when really it's all down to the maths!

What you'll need

- A deck of cards (you'll only need 21 cards)
- A friend to impress

What to do

Select 21 random cards from the deck and ask your friend to shuffle them to make sure you're not cheating!

Lay out the 21 cards face up in 3 columns

Ask your friend to choose a card, and to tell you which column their card is in

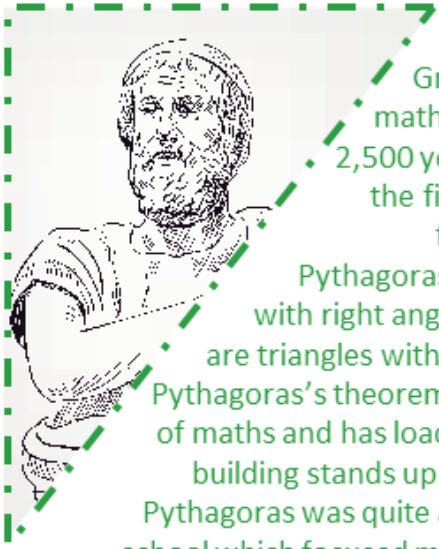
Gather the cards from each column together (3 piles) and add the three piles together into one big pile. Make sure that the column pile containing the chosen card is in the middle of the big pile. Do not shuffle!

Lay out the cards in 3 columns again and ask your friend to point to the column their card is in. Gather the cards from each column together into a pile, again making sure that the column with the chosen card is in the middle.

Lay out the cards in 3 columns once again and ask your friend to point to the column their card is in this time.
Their card is in the middle of the column they point to. Your friend will be amazed and think you're magic!

The first pure mathematician

(Answers on back page.)



Pythagoras was a Greek philosopher and mathematician who lived around 2,500 years ago and he is sometimes called the first pure mathematician. He is most famous for 'Pythagoras's theorem'. Pythagoras's theorem is a maths rule all to do with right angled triangles. Right angled triangles are triangles with one inside angle being 90 degrees. Pythagoras's theorem is one of the most important rules of maths and has loads of uses still – from making sure a building stands up to finding the position of satellites! Pythagoras was quite a mysterious man. He established a school which focused mostly on maths, but it also had very strange rules. For example, it's said all members had to be vegetarians, they couldn't own any possessions and could never touch a fava bean!

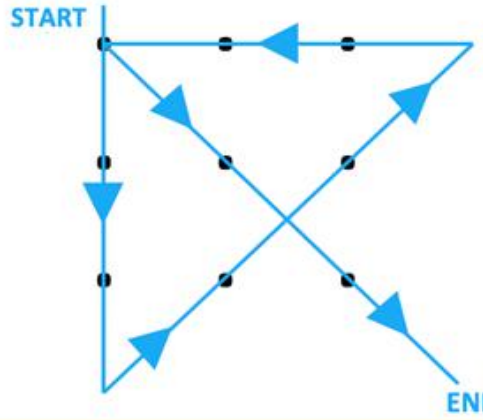
1. How long ago did Pythagoras live?
   - A. 100 years
   - B. 2,500 years
   - C. 250 years
   - D. 1,500 years

2. As well as being a mathematician, what else was Pythagoras?
   - A. A philosopher
   - B. A shop assistant
   - C. A mechanic
   - D. A dancer

3. How many degrees must one of the inside angles of a right angled triangle be?
   - A. 180
   - B. 45
   - C. 25
   - D. 90

4. What were members of Pythagoras's school not allowed to do?
   - A. Speak in class
   - B. Own a donkey
   - C. Touch a fava bean
   - D. Perform cartwheels

Puzzle Solution



Next Issue: Biodiversity

Find out about the massive variety of life on Earth

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Send us your questions! Look out for the answers on: Science@6 - YouTube, Monday, 6pm

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Quiz Answers: Q1 – B, Q2 – A, Q3 – D, Q4 – C