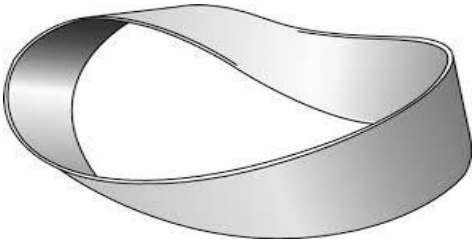
Mathematics at Lister Community School

The Möbius Strip



September 2021

The Möbius Strip

The Möbius strip has only one side. You can travel indefinitely in a loop on the surface of the strip. This mathematics newsletter got its name because of the infinite nature of learning and the resilience required to improve.

Welcome back Lister Community School!

It has been a very strange and challenging two years. Let's hope things continue to improve.

Welcome to our new year 7s too! Let's all make the effort to say "hello", be welcoming and kind to our new recruits when we see them lost (or not) around the school.

And after a bit of a sabbatical, our very own mathematics newsletter, The Möbius Strip, has returned.

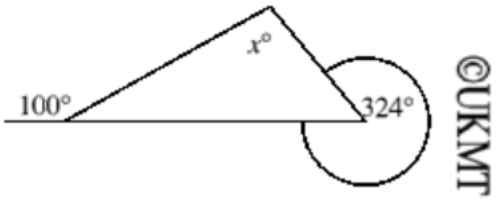
Two puzzles

When asked about his birthday, a man said: "The day before yesterday I was only 25 and next year I will turn 28."
This is true only one day in a year - when was he born?

A man carries his son into the hospital because his son has a nail in his foot. The surgeon then walks in and says, "I cannot operate on this boy as he is my son".

In this diagram, what is the value of x?

A 16 B 36 C 64 D 100 E 144



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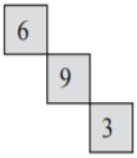
This is a sequence of shapes. Sketch the next shape in the sequence

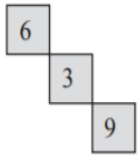
My number is ***Special*** because adding the sum of its digits to the product of its digits gives me my original number. What could my number be? How many ***special*** numbers can you find? Can you find a general solution using algebra?

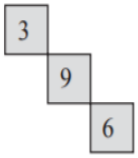
e.g. 24: 2+4 =6 2x4=8 6+8=14. It does NOT equal 24 therefore it is NOT a ***special*** number

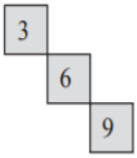
In a magic square, the numbers in each row, each column and the two main diagonals have the same total. This magic square uses the integers 2 to 10. Which of the following are the missing cells? ©UKMT

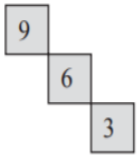
	10	5
8		4
7	2	

A 

B 

C 

D 

E 

I saw my maths teacher with a piece of graph paper yesterday. I think s/he must be plotting something.

The irrational number, *e*

The number ***e*** is a famous irrational number, also called Euler's number, after Leonhard Euler a Swiss Mathematician (1707 – 1783). Number ***e*** is considered to be one of the most important numbers in mathematics.

Jacob Bernoulli (1654-1705) was a minister and loved maths. His work led to the "discovery" of the constant ***e***. Later Euler (famous amongst the world of mathematicians) popularised the number and gave it the symbol ***e*** .

The first few digits are:
2.71828182845904523536028747135 27… It has an infinite number of digits with no recurring pattern. It cannot be written as a simple fraction.

Bernoulli was doing some work on compound interest . He noticed that if you had £1 in a bank account with a 100% interest per annum, the way the interest is paid throughout the year affects the total money you will have at the end of the year.

100% paid once at the end of the year total is 1 x (1+1) = £2 (the 100% of the original plus the 100% interest paid)
25% paid 4 times 1 x $(1+1/4)^4$ = £2.44 to the power of 4 because we need to multiply the £1 by (1+1/4) every 3 months – that is 4 times.
Monthly interest 1 x $(1+1/12)^{12}$ = £2.61
Daily interest 1 x $(1+1/365)^{365}$ = £2.71

Number ***e*** is the limit of $(1 + 1/n)^n$ as n approaches infinity: In other words, as n gets infinitely large (that's big!).

Use a calculator and try substituting the following values of n into the above formula: Try it yourself but you should get answers of:

When: n=1 e=2, n=10 e=2.5937424601 and n=1000 e=2.716923932.

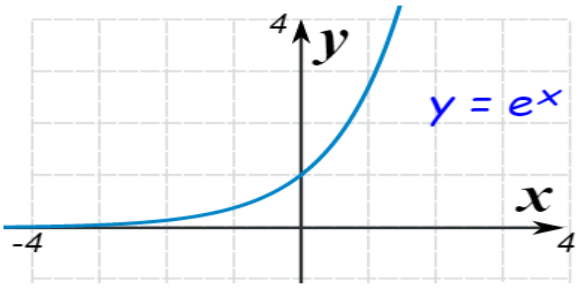
What is happening? Try and find a value of n which gets you as close as possible to the value of ***e*** that I gave you.

e can also be calculated as the sum of the infinite series:

$$e = \sum_{n=0}^{\infty} \frac{1}{n!} = \frac{1}{1} + \frac{1}{1} + \frac{1}{1\times 2} + \frac{1}{1\times 2\times 3} + \cdots$$

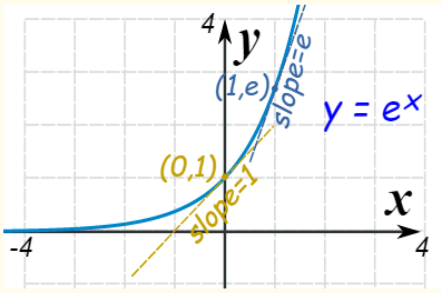
The exclamation mark in mathematics is called ***factorial***. So 4! = 4 x 3 x 2 x 1 = 24
What is 5! ?

What is the point? Why is it important? **e** is used in the "natural" exponetial function (or rule). You may recognise this type of "growth" from something that has been in international news for the last two years…



Graph of **f(x) = e^x**

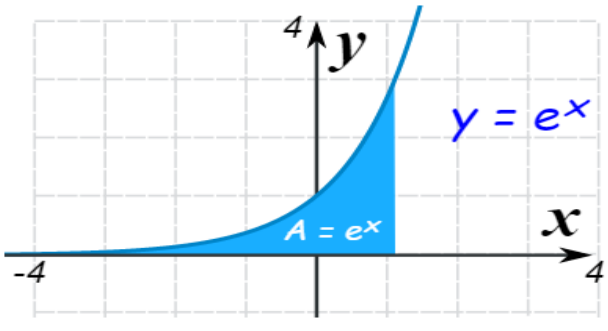
It has a wonderful property:
Its slope (gradient) is its value.
This means that any point the slope of $\mathbf{e^x}$ equals the value $\mathbf{e^x}$. Truly beautiful! See below.



when x=0, the value $\boldsymbol{e^x}$ = ***1***, and the slope = ***1***
when x=1, the value $\boldsymbol{e^x}$ = ***e***, and the slope = ***e***
etc…

It gets even more amazing! The area under the graph, up to any value of **x**, is equal to $\mathbf{e^x}$.

The function or rule $\mathbf{y = e^x}$ is the only function which has these properties.



A big thanks to **mathsisfun.com** and another brilliant website **numberphile.com**. The latter has an incredible number of interesting videos about the strange and beautiful world of mathematics.

Why I like Maths

Here is an article by **Kulsum Siddiqi** in year 9. She is an incredibly hard working, talented, pupil who always wants to improve. She has earned herself a +10 for this excellent article. If you want to write about why you like maths, then just email me.
Mr Sozomenou

"Maths is always that one subject that students have hated at one point or another, or just had a love-hate relationship with. This applies to me as well, but now I have grown to like and enjoy doing it. Here are the reasons why I think Maths is one of the best subjects.

1.Maths is not subjective.
This is probably one of the main reasons why I enjoy doing maths. Every question comes with a clear answer. There is no ambiguity. You can either be wrong or right. There is no grey area (most of the time). It is objective and comes with certainty.

2. Multiple Approaches.
Questions have one answer but more than one way to get that answer. This forces me to find different methods, to learn different methods to see which one works the best for me. To find hidden methods that you may have missed just adds to the challenge.

3. The backbone of science.
Maths plays a huge role in all the 3 subjects within science. It proves the world around us with evidence. Maths is a crucial puzzle piece needed to understand the world around us and Chemistry, Biology and especially Physics need Maths.

4. It is challenging.
Finally, Maths is challenging. It gives you the push to try harder and spot patterns. Solving a particularly difficult problem gives satisfaction like no other. Maths has such a broad range of topics, letting you explore which one is the most interesting and satisfying to solve.

Maths has grown on me and I continually want to learn and explore Maths despite some bumps on the road."

Kulsum Siddiqi

Christian Goldbach (1690-1764)

Christian Goldbach was a Russian mathematician born in (what was called Konigsberg, Prussia—now it is called Kaliningrad, Russia. He is famous for what is called the Goldbach Conjecture.

*From Brilliant.org "A **conjecture** is a mathematical statement that has not yet been rigorously proved. Conjectures arise when one notices a pattern that holds true for many cases. However, just because a pattern holds true for many cases does not mean that the pattern will hold true for all cases. Conjectures must be proved for the mathematical observation to be fully accepted. When a conjecture is rigorously proved, it becomes a theorem".*

In 1725 Goldbach became professor of mathematics and historian of the Imperial Academy at St. Petersburg. Three years later he went to Moscow as tutor to Tsar Peter II, and from 1742 he served as a staff member of the Russian Ministry of Foreign Affairs. Goldbach first proposed the conjecture that bears his name in a letter to the Swiss mathematician Leonhard Euler in 1742. He claimed that "every number greater than 2 is an aggregate of three prime numbers." Because mathematicians in Goldbach's day considered 1 a prime number (prime numbers are now defined as those positive integers greater than 1 that are divisible only by 1 and themselves), Goldbach's conjecture is usually restated in modern terms as:
Every even natural number greater than 2 is equal to the sum of two prime numbers.
For example,
3+5=10, 11+5=16, 7+7=14, 3+17=20
Can you make all the even numbers to 40 using the sum of two prime numbers?

It has yet to be proven, although it surely must be true.

Mathematicians Read 2

Fame is a bee

By Emily Dickinson (1788)

Fame is a bee.
It has a song—
It has a sting—
Ah, too, it has a wing.

In the Same Space

By C.P. Cavafy

Translated from Greek by Edmund Keeley

The setting of houses, cafés, the neighbourhood that I've seen and walked through years on end:

I created you while I was happy, while I was sad, with so many incidents, so many details.

And, for me, the whole of you has been transformed into feeling.

Thank you **poetryfoundation.org**
If you want to share a poem that you like let me know, Mr Sozomenou

An extract from the novel …

Moby Dick

by Hermann Melville (1851)

We felt very nice and snug, the more so since it was so chilly out of doors; indeed out of bed-clothes too, seeing that there was no fire in the room. The more so, I say, because truly to enjoy bodily warmth, some small part of you must be cold, for there is no quality in this world that is not what it is merely by contrast. Nothing exists in itself. If you flatter yourself that you are all over comfortable, and have been so a long time, then you cannot be said to be comfortable any more. But if, like Queequeg and me in the bed, the tip of your nose or the crown of your head be slightly chilled, why then, indeed, in the general consciousness you feel most delightfully and unmistakably warm. For this reason a sleeping apartment should never be furnished with a fire, which is one of the luxurious discomforts of the rich. For the height of this sort of deliciousness is to have nothing but the blanket between you and your snugness and the cold of the outer air. Then there you lie like the one warm spark in the heart of an arctic crystal.

Solutions

He was born on December 31st and spoke about it on January 31st.

"The day before yesterday I was only 25" – Dec 30: 25, Dec 31: 26, Jan 1 (this year) 26.

"…next year I will turn 28" – Dec 31 (this year): 27 Dec 31 (next year): 28

The surgeon is the boy's mother. How many of you assumed otherwise?

C The unmarked interior angle on the right of the triangle = $(360 - 324)° = 36°$.
So, by the exterior angle theorem, $x = 100 - 36 = 64$.

Because they are the numbers 1 to 6 reflected

D Let the total of each row, column and both diagonals be T.
Note that $2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10 = 54$. Therefore $3T = 54$, that is $T = 18$. It is clear that option D is the only option which makes each row, each column and both diagonals sum to 18.

x	10	5
8	y	4
7	2	z

Special numbers: Try some different numbers to get a feel for the problem.
Special numbers all satisfy the following equation:

$$a+b+ab = 10a+b$$

What did the triangle say to the circle? You're pointless!