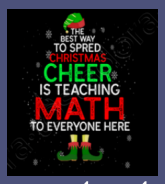
Issue 2 - Dec 2024



Merry

Maths Matters

FORTITUDINE CRESCAMUS

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Welcome to the December issue of the Newstead monthly maths newsletter.

Each issue covers various maths matters: we will highlight some new or interesting maths **(Maths in the Moment)**, take you back in time for a snippet of historical maths fact **(Mathematical Time Machine)**, explain how maths is applied in real world and how it links with other subjects **(Maths Meets the World),** show maths in unexpected places **(Maths in the Unexpected)** and give 5 recommendations **(Reasons to Love Maths).** There are also two new sections: **Mathematician of the Month** (with thanks to Dr Neman) and **Insights from the Newstead Maths Team**.

All this to prove that Maths does Matter! No doubt maths also matters to you so please get in touch and contribute to the next issue of this newsletter with your recommendations. Thank you to those who have contributed so far! Please contact **Elleanore P in 12F or Dr. Neman.**

MATHS Time Machine

With thanks to Bella J (9W), Ipin P (9N) and Priyanka K (9W)

JULIAN 1582		October			Gregorian 1582	
Sun	Mon	Tues	Wed	Thurs	Fri	Sat
	1	2	3	4	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

What has happened on December 25th throughout the years?

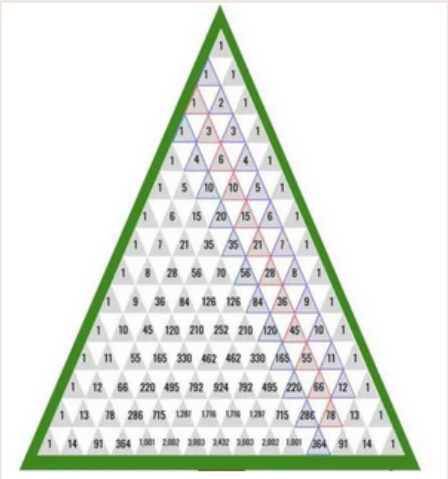
Did you know that, because of the difference between **Gregorian and Julian calendars**, in England, Christmas Day 1642 was not celebrated on the 25th of December, but rather on Isaac Newton's birthday, which has been documented as 4th January 1643! However, his birth records indicate that he was actually born on December 25th, 1642, according to the Julian calendar, which was in use at the time.

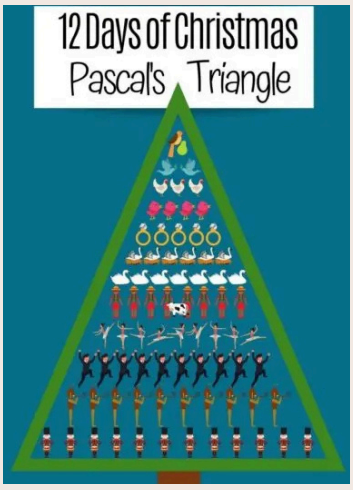
England only adopted the Gregorian calendar in 1752, which changed Newton's birthday to January 4.

But why did we adopt the Gregorian calendar anyway?

We adopted the Gregorian calendar because the Julian calendar was inaccurate. It had a leap year every 128 years which was much more than the actual length of a solar year. This caused the calendar's seasonal dates to go back by 1 day per century and so by 1582, seasonal equinoxes (when the Sun is exactly above the Equator and day and night are of equal length) were happening 10 days too early! This caused religious holidays like Easter to fall in the wrong season.

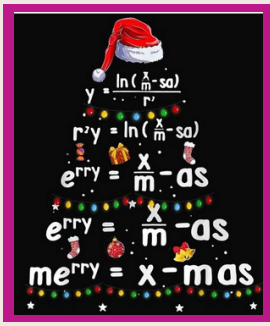
MATHS In The Moment





Only Santa knows how many presents we will receive at Christmas but **Pascal's triangle** gives an instant answer the question of how many presents the true love gives to you by the end of the 12 days of Christmas song. **Pascal's Triangle** is a fascinating triangular array of numbers, where each number is the sum of the two numbers directly above it. It begins with a 1 at the top, and every row starts and ends with a 1.

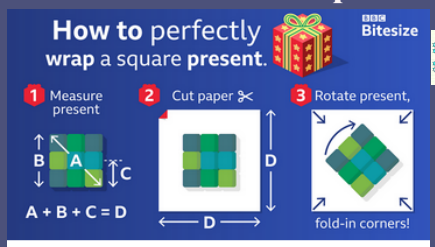
It creates a pattern that connects to areas like probability, algebra, and geometry. It reveals binomial coefficients, helps in calculating combinations, and even hides powers of 2, Fibonacci numbers, and more! A simple yet powerful tool, it shows how patterns emerge from basic arithmetic. It also allows us to instantly find out that the combined total of gifts recieived from the true love by the end of the 12 days of Christmas is **364**!!! If you would like to see the full explanation then please check the link in the recommendations section below.



Full explanation of this equation is in this video.

MATHS Meets The World

MATHS in the unexpected



Source: BBC Bitesize

Is there a **maths formula which allows to wrap square gifts efficiently, minimising waste and allowing patterns to align at the joins**? Of course there is! It's

$$1/2\,(d+2h+w)^2 = 2(w+h)^2$$

Dr Sara Santos, a mathematician, devised this formula which, though complex at first glance, can be simplified with a straightforward method:

1. Measure the Gift:
Find the diagonal of the gift's largest side (or any side if it's a cube). Then add this measurement to 1.5 times the gift's height.

2. Prepare the Wrapping Paper:
Use the result (in cm) to measure and cut out a square piece of wrapping paper with sides of that length.

3. Wrap the Gift:
Place the gift diagonally in the center of the wrapping paper, making it look like a diamond inside a square. Then fold in the corners and tabs to wrap neatly, matching patterns for simpler designs like stripes. This method ensures a neat and efficient wrap with reduced waste. While the formula also applies to oblong gifts, it does not align patterns for such shapes.

Secret Santa isn't just a fun holiday tradition—it also highlights fascinating **mathematical principles** like **randomness, probability, and exclusion**. These concepts reveal how math can solve practical problems, offering insights into **combinatorics and probability theory**. Secret Santa relies on two fundamental principles:

1. Total anonymity – no one should know who picked whom.
2. Equal probability – everyone should have an equal chance of being selected by anyone else.

However, the common method of drawing names from a hat often fails both principles. If someone picks their own name, they must put it back, and the process repeats. This flaw breaks anonymity and skews the probabilities, especially for the last person drawing.

This is where math comes to the rescue! The solution lies in **derangements**—special permutations where no element (or name) ends up in its original position. Derangements ensure that no one draws their own name, maintaining fairness and anonymity.

If you'd like your Secret Santa this year to follow these principles perfectly, check out the link to a Numberphile video in the recommendations section for a mathematically foolproof method.

5 REASONS THIS MONTH TO LOVE MATHS

1. In this Numberphile video Professor Hannah Fry explores the **mathematics behind Secret Santa**, focusing on the concepts of anonymity and derangements, offering insights into a more effective approach.

2. **"The indisputable existence of Santa Claus (the Mathematics of Christmas)"** book written by Hannah Fry and Thomas Oleron Evans – the mathematics of Christmas. **This book is available in the school library!!!**

3. Baubles, tinsel and delivering perfectly wrapped gifts: The maths of Christmas BBC Bitesize.

4. The maths (and physics) of **snowflakes** in this short article including information how this immediately identifiable and beautifully symmetrical shape comes into existence.

5. See in this video how **Pascal's Triangle** can be used to provide in instant answer to the question of how many gifts were given in total in the famous song "**The Twelve Days of Christmas**".

Insights from the Newstead Maths Team

What is your favourite area of maths (your personal favourite or school topic that you love teaching at Newstead)?

Dr Neman:
My favourite subject to teach is **Proof**. I believe that only when you can prove a concept you have understood that idea properly.

Miss Burrow:
Euclidian geometry. I just love the kinaesthetic way you can create solutions and it reminds me of my childhood.

Dr Bevan:
Hypercomplex numbers and their application to geometrical structures are at the heart of understanding the origin of the universe. I have been fascinated with complex numbers since year-9 when a chemistry teacher told me they were needed to understand electronic structure of atoms, and later when my year-13 mechanics teacher showed me how to derive centripetal and Coriolis forces by differentiating Euler's formula. A few years later at Cambridge a friend did a thesis on electrons in relativity and would try to explain to me their ideas: they went on to a PhD at Princeton, while I kept the interest going as a hobby.

Miss Bailey:
My favourite area of Maths is **Decision Maths**, I love the pure logic of it.

Mr Fernando:
Too many great Maths topics that I like teaching, but if I had to choose, I could narrow it down to **sequences**, and **arcs** & **sectors**!

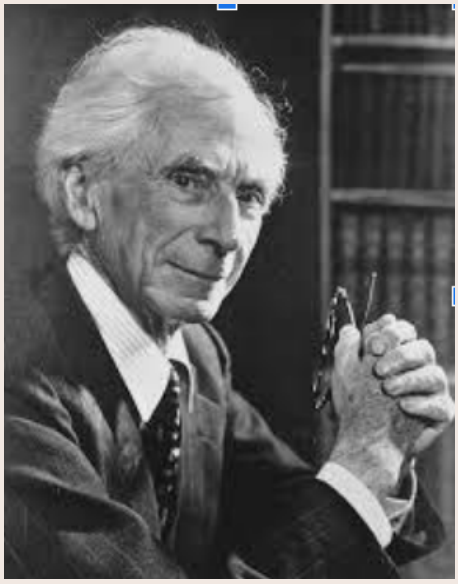
Mrs D'Silva:
I love **Calculus**. It's my favourite area of Maths and one of the most important topics in Mathematics. The relationship between the derivative and the integral is called the fundamental theorem of calculus. You can use Differentiation to find rates of change in Trigonometric and Exponential functions. Integration can be used to solve differential equations.
I also like **Applied Mathematics** (Statistics and Mechanics). The more Maths I do, the happier I am.

Mr. McKenna:
Quadratics as it has scope to be integrated into many other topics and can be approached from so many different perspectives.

Mr Anthony:
My favourite part to teach is **solving quadratic equations** with a coefficient of x^2 using completing the square - it often gives horrible fractions and surds which are both positive and negative. Lots of room for error but very satisfying when students get it correct!

Mr Davis:
I don't really have a personal favourite area of Mathematics teaching – I quite like teaching most topics. If I had to choose then while I like maths areas that have no obvious real life application – I see purpose in teaching areas that have application to real life. Thus I used to really like teaching all the **discrete mathematics** – The maths underpinning computing – for example Dijkstra's algorithm (Used in Google Maps to get directions, Primm's algorithm, Travelling Salesman problem, Game theory etc.). I also liked teaching this area as most mathematics taught is hundreds of years old whereas most of the discrete mathematics was invented in the 1960s and many of the pioneers of this branch of mathematics are still alive today. Of late I have liked teaching the **Statistics** as that has innumerable real life applications and is the mathematics most students are most likely to come across in their future careers. It is probably apparent from my lessons that I like teaching use of the graphical calculator as I like giving my students a significant advantage in their exams by knowing how to use the calculator effectively.

Mathematician of the Month



Bertrand Russell

With thanks to Dr Neman

December is the month when we celebrate the abolition of slavery (2nd) human rights (10th), and raise awareness against domestic violence (25/11-10/12). So what better mathematician to remember that **Bertrand Russell**, one of the most prominent intellectuals of the 20th century, and the brilliant mind behind modern mathematics, and an ardent advocate for women and minority rights.

As well as developing **set theory** with other mathematicians, Russell co-authored "Principia Mathematica" with Alfred North Whitehead, **the foundation for mathematical logic and analytic philosophy**. Being a man with formidable logic, he was a strong **advocate for women's rights and equality**. He even stood for Parliament in 1907 as a women's suffrage candidate, though he was not elected. He wrote in favour of women's suffrage, arguing that opposition to it stemmed from men's fear of losing their ability to act in ways injurious to women. He **supported racial equality and intermarriage**, writing a chapter on "Racial Antagonism" in his 1951 book "New Hopes for a Changing World" and was a **committed pacifist and anti-war activist**. He went to prison for his pacifism during World War I. Later in life, he became an **outspoken proponent of nuclear disarmament** and condemned the United States' involvement in the Vietnam War. This was not without a cost. Russell's controversial views on marriage, morality, and religion led to the loss of academic positions. His advocacy for open sex education, easy access to contraception, and "trial marriages" in his 1929 book "Marriage and Morals" caused significant protests during his visit to the United States. These views, along with his pacifism and atheism, contributed to his dismissal from Trinity College, Cambridge, and the loss of a teaching position at the City College of New York.

Despite these setbacks, because of his immense contributions to mathematics, logic, and philosophy Russell stayed a significant figure in the world of academia and beyond. **He was awarded the Nobel Prize in Literature in 1950 "in recognition of his varied and significant writings in which he champions humanitarian ideals and freedom of thought".**

Definitely a mathematician to know, to respect, and to celebrate.