# The Write Angle

Letter from the Editors

Founded in 2020, 'The Write Angle' is Exeter Mathematics school's official student newspaper. This is an accumulation of works from our students, run by a collection of student editors, posted on a biweekly basis. Here you can see articles, opinions and insights into life at EMS. We encourage all students to participate, whether by submitting articles or becoming a part time editor.

Photos of the Week
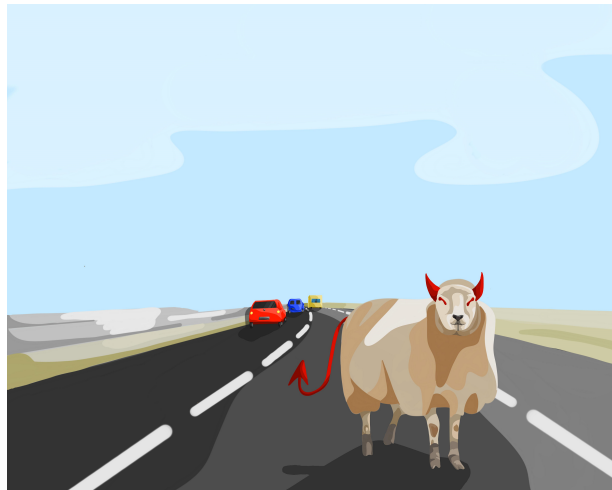
Look After Yourself

Being at home can be isolating, make sure you look after yourself. Work hard and keep your spirits up. Tor has started her lockdown emails again, these are a great resource to help you smile! Make sure you keep in touch with people and try not to get disconnected (unless you really love being isolated).

Looking back at 2020

For many, 2020 has brought us a mess of stress and heartbreak. But what has it brought us in the unwavering world of STEM?

Multiple groups globally -The Covid-19 vaccine:

Of course we could not publish an article celebrating advances in both science and mathematics within the year of 2020 without first mentioning the fast paced creation, approval and distribution of the COVID-19 vaccines. Currently, both the Pfizer-BioNTech and the Oxford - Astrazeneca vaccines are in distribution within the UK, and it is thanks to these advances in science that our government is now prophesying that an end to this coronavirus debacle could soon be in sight. Not only has COVID-19 propagated this "New Normal" that we appear to be living in, but it has also spurred increased global cooperation for vaccine research and distribution in a united race for herd immunity.

The team (composed of researchers from both the Jenner Institute and the Oxford Vaccine Group) developing the Oxford - Astrazeneca vaccine was led by Prof Sarah Gilbert, Prof Andrew Pollard, Prof Teresa Lambe, Dr Sandy Douglas, Prof Catherine Green and Prof Adrian Hill. The team's experience in vaccine research is internationally recognised, and many of which were participants in the response to the Ebola outbreak of 2014.

In the creation of the vaccine the team used a harmless weakened form of a chimpanzee adenovirus as a vaccine vessel (or vector). As this virus is the chimpanzee equivalent of 'the common cold, and as it only affects chimpanzees it could not cause disease in humans. This is not the first time that ChAdOx1 vaccine technology (this same chimpanzee adenovirus) has been used by this Oxford team. It is widely used as this virus is easy to alter (so that it physically resembles the chosen virus), and it has been shown to promote a strong immune response from just single dose exposure in other vaccines.

Despite research published to comfort the populations of people who will be required to partake in vaccination (in order to achieve herd immunity), we have seen a resurfacing of the anti-vax movement. Increased communication opportunities brought about by social media (please see our 'profiling in computer science' article published in issue 1 of The Write Angle) can result in the propagation of fake news. Groups such as anti-vaxxers profit from the spread of misinformation which, especially in the case of COVID-19, could prove to result in dangerous and life threatening consequences within the population. For our government this spread of false information and mistrust in the scientific community is an unexpected hurdle that they now must fight to overcome. Now, more than ever, it is our responsibility as individuals to encourage the spread of information that has scientific backing. Don't just trust us, we don't have accreditation!

If you have an interest in virology, we would strongly recommend that you partake in the further reading of materials available on the Oxford university website (linked below).

[Home | Research | University of Oxford](#)

Lisa Piccirillo- the conway knot:

Many of us may be familiar with the Conway Knot. It is a particular knot with 11 crossings named after John Horton Conway (who sadly

lost his life to COVID-19 in February, 2020) and, up until recently, has been home to a particular problem that has been stumping mathematicians within the land of topology for over 50 years.

Topology contains a branch of mathematics known as 'Knot theory', which is quite simply the study of mathematical knots. While most of us think of a knot in day-to-day life as existing somewhere along a length of string with two distinct ends that at some point can or will unravel, a mathematical knot is very different. It does not in fact have two ends and it cannot unravel. You can think of the ends as being glued together and because of this, the knot will remain as being a knot as it cannot be undone.

So, what is this problem and who is Lisa Piccirillo?

In knot theory, some knots are "slices," which means they could be made by slicing a four-dimensional knotted sphere. Up until Lisa Piccirillo had a go at solving this debate, it was unclear as to whether Conways knot was indeed one of these kinds of knot. Amazingly, she had an answer in under a week. She achieved this by devising her own knot, now known as Piccirillo's knot, devised from the same four dimensional shape as associated with Conway's knot. Because her knot wasn't a slice, she determined that the Conway Knot couldn't be one either, and thus ended the 50 year debate.

As any of you who took Knot Theory as a curriculum X module would know, its basic principles cannot be explained in a simple article. Needless to say, Knot Theory is a complexly fascinating branch of mathematics that we encourage you to explore further.

There have been so many more advancements in the lands of science and mathematics that we wish we had time to share with you. If you are interested, we would love to hear about your favourites so please feel free to submit them to us. Happy reading and we hope that 2021 proves to be far kinder to us all.

By Freya Dover

The History of Desirable Dress

In this article, we will be taking a journey through the past, visiting periods in time and discovering the fashion and silhouettes for women in these eras.

The Elizabethans
The reign of Elizabeth 1st 1558-1603

The Elizabethans, like many generations before them, were all about status. Also like many generations before them, they used fashion to impose their status on others. What people were allowed to wear was dependent on their status, and was highly regulated. Particular fabrics like cloth of gold or silver, or a cotton fabric embroidered with silver or gold and various expensive furs were to be worn by only the highest classes. People had to know their place. All these declarations of who was allowed to wear what was outlined in the 1597 proclamation, which went into extreme detail.

The ruffs that you can see in the image were a feature that was worn by all, men and women, despite status. They began as frills around the neck and around the bottom of a dress, then gradually progressed into more elaborate structures. The use of starch allowed the structures to stand on end, increasing the drama of the piece. A puffed sleeve was also a feature of this era.

The womanly silhouette had emphasis on the full skirts, with corsets used to flatten the chest,

making the skirt look more voluminous. There were many layers to the clothing, especially for upper class women, who were often assisted by a few servants to dress and undress.

You'd begin with the shift, a nightgown-type garment. This was worn by all classes, and was used to protect the outer garments from sweat and bodily oils. You'd then add stockings, which for any men reading this, are like long thin socks. You'd then add the corset on top of the shift. Corsets were never worn on bare skin like many period dramas would lead you to believe. Next came what was called a "spanish farthingale", a hoop underskirt to give you that voluminous shape. Then is the bumroll, a roll at the waist to puff out the skirt. Now you've got on all of the undergarments, you can now add your more decorative garments.

The Georgians
The reign of the four Georges 1714-1830

No longer are the restrictive corsets oppressing the women of the era, they have been abolished entirely, with society favouring a natural draping bodice (however it made a swift return into fashion in 1810). This era came with the introduction of the 'chemise gown', a floaty light gown, that often had a high sash that accentuated the bust. You may have seen this type of dress shape in pride and prejudice movies, as they were based in this era.

We still see many pieces today, in our modern industry that are influenced by the 'chemise gown'.

The Victorians
The reign of queen Victoria 1837-1901

Fashion can change a lot in 70years, and although our current queen has surpassed queen Victoria in length of reign, Victoria still had a long standing power. Like the other eras, fashion in these years was still a display of class and wealth, and women were still dressed up to be married off.

In the 1830s, short puffy sleeves were all the rage, again. Day dresses were more modest, while in the evening you were allowed to show more skin, you could even show your collarbone with a popular off-the-shoulder cut.

In 1831, skirts started becoming fuller and heavier, and by 1832, they were extremely extravagant and cumbersome.

When 1836 rolled around, people were claiming that the short puffed sleeve had been abandoned, never to be seen again. We of course know now that it came back many times, including in the 1980s and they are even in trend now.

1840-50 was known as the Chales Dickens era for fashion (seen on the right), as many trends stemmed from the costuming of women at Dickens fairs and events. Women were layered again, very layered. Many women wore upwards of 5 layers. Skirts were full, and continued getting larger through to the 1860s. The fashion somewhat resembled a much simpler version of Elizabethan ladies.

The 1860s was the era of the civil war. In the midst of a war, fabrics and money were huge limitations, and so fashion became blander and cheaper, keeping on trend was no longer a necessity.

The 1870s-80s brought the iconic bustle dress (on the left). Bows and ruffles were back, and most of which resided on the hind of the dress. Bottoms were

heavily embellished during this time.

In the late Victorian era, we see the rise of Tea gowns. A transition to the future edwardian tea party fashion, although these were often white or cream, and in a light cloth. Then came the Edwardians.

The Edwardians

The reign of Edward VII 1902-1910

Many of the fashion before this period was dominated by heavy or restrictive clothing, with the brief exception of Georgian clothing. This, though far from what we have today, was a big step in freeing the female form, with lighter clothing in a much simpler style. It may have still been extremely modest, but it was one of the steps that brought us towards the freedom we have in fashion today. It was also a contrast to the previous Victorian style, trading in darker fabrics for the lighter, with all things frilly. The era much resembled a 24/7 tea party.

On the left, we can see a silhouette with a puffy bust and thin waist. Unfortunately, the corset had not been ditched yet as the fashionable small waist was only made possible with those famous corsets. There were, however, much less layering, with a looser and lighter look being seen as favourable.

Eras and dates: Periods-List-HE-FISH-WP.pdf (heritage-standards.org.uk)
Edwardian fashion: Edwardian Fashion: The S-silhouette at its finest | The Fashion Folks
Victorian fashion: https://vintagedancer.com/victorian/victorian-fashion-hisory/#:~:text=The%20Victorian%20fashion%20era%20began,in%201901%2C%20upon%20her%20death.&text=Victorian%20fashion%20began%20with%20large,and%20rigidity%20in%20their%20attire.
The 1597 proclamation (Elizabethan): Proclamation against Excess of Apparel by Queen Elizabeth I - The British Library (bl.uk)
Georgian fashion: Georgian Fashion – Dressing During the Georgian Period (victorian-era.o

By Molly Berridge

Land Of Maths

Double Your Money Risk Free

My dad says he has a brilliant strategy for winning roulette guaranteeing he makes money. Unfortunately for me, he's planning to use my university fund to try it out, so I need to make sure it's going to work...

So what's this "brilliant" strategy?

The roulette wheel Dad is using has a 50% (or $\frac{1}{2}$) chance of a bet on either red or black winning. These bets pay back twice the bet when they win. So if you bet £1 and win you will get £2 back, making you £1 richer than when you started. His strategy is to first bet £1 on red. Now if he wins he's made a profit of £1. If however he loses, this isn't a major problem, he just bets £2 on red and then if he wins that bet he would win £4 (£1 more than the £1 and £2 bets). But if he loses a second time he doubles the bet again to £4 and if he wins that he gets £8; that's still £1 up. Even if he has a long unlucky streak, eventually he's bound to win and make £1 on that group of bets.

All he has to do is keep making groups of bets, each winning £1, until we're millionaires!

Dad makes a good case but is it really going to work? There is £1023 in my uni fund, how many consecutive bets would he have to lose before he's lost all my money and how likely is that?

So what's the chance he loses all the money on his very first group of bets? There is a $\frac{1}{2}$ chance he'll lose his first £1 bet. Then there is another $\frac{1}{2}$ chance he'll lose the second £2 bet too. So overall there is a $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$ chance of losing both the £1 and £2 bets, costing £3 so far. Each additional bet doubles the stake and has another

$\frac{1}{2}$ chance of losing. After losing his tenth bet of £512 he has lost all £1023! The chance that he loses 10 consecutive bets is

$\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = \left(\frac{1}{2}\right)^{10} = \frac{1}{1024}$

and he loses all £1023 when this happens. Since the chance he loses everything is $\frac{1}{1024}$, then the chance he wins £1 must be $\frac{1023}{1024}$.

If 1024 people each with £1023 used this strategy to try to win £1, then we expect one person to lose all their money and everyone else to win £1. Overall, there is no new money coming in. Most people have won a small amount and one person has lost a huge amount! This is represented by this equation:

$£1 \times \frac{1023}{1024} + (- £1023) \times \frac{1}{1024} = \frac{1023}{1024} - \frac{1023}{1024} = £0$
.

Okay so if he tries to make £1 million he's almost certain to lose all the money and any winnings he's made before we become millionaires. What about if he only attempts to double the money? That must be a pretty good chance to make money, right? Well again let's calculate the probabilities. We've shown there is a $\frac{1023}{1024}$ chance that he wins £1 for each group of bets. To double the money he needs to win 1023 consecutive groups of bets and not lose any groups of bets. The likelihood of this is $\left(\frac{1023}{1024}\right)^{1023}$ which is about 36.8%. In fact, the probability of double our money with this method gets closer and closer to $\frac{1}{e}$ or 36.8% as we start with more and more money, but that explanation is for a different time.

By Isaac Wood (Alumni)

Land Of Science

Team Theory: Forming, Storming, Norming and Performing

Now seems like the ideal time to introduce an interesting topic about group development that should allow Year 12's to reflect on their academic EMC projects and the Year 13's to look forward to teams they will inevitably be a part of in the future. I hope to both cover interesting theories and provide practical advice.

Tuckman's model of group development includes four main stages called *"Forming, Storming, Norming and Performing"* which I will explain individually, but together they explore the lifecycle of the typical team.

Forming is when the team is first brought together with a common objective and they don't yet know each other. I remember my first EMC session when we all sat there quietly trying to understand what we were expected to do. Everyone is still working individually but could be curious, anxious or even excited about what the team will do.

Next is *storming*, when the members of the team gain enough confidence to start sharing ideas, which can lead to disagreements. A common cause of these disagreements occurs when tasks must be divided between members who aren't aware of each other's strengths and weaknesses. This can leave some people feeling like they have been given an unfair workload, whilst others feel underutilized.

Later the team reaches the *norming* stage, where everyone is content with what is expected of them and through understanding the weaknesses of individuals in the team, conflict can be avoided. At this stage, the team members are happy to ask each other for help when needed and can offer constructive criticism.

And then there is *performing,* this is when every team member's individual strengths are utilized to efficiently meet the teams objectives. Teams at this level can be quite rare due to the hard work and time involved in reaching this stage.

I have presented these stages in linear order but in real life *norming* teams may revert back to *storming* due to deadlines or other issues. Some teams may never leave the *forming* stage or need outside assistance from managers to deal with *storming*. There are also smaller stages such as *mourning* which is reached when the team is disbanded, often as the team has met its objective, which may leave team members feeling temporarily sad or absent of purpose. I hope that with this knowledge, whether during EMC or otherwise, if you feel yourself *storming* you can joke that, just like thunderclouds, this too will pass.

Tuckman, B. W. (1965). Developmental sequence in small groups. Psychological Bulletin, 63(6), 384–399. https://doi.org/10.1037/h0022100

By Ryan Traviss

Global Affairs

<u>2021? 2020Anon</u>

Ashli Babbitt was shot by a police officer on 6th January 2021 while she was attempting to climb into a barricaded room in the US Capitol. People have reacted to this in a multitude of ways. One of the most common reactions is why? Why deny the result of a free and fair election and give up your life in an act of defiance that ultimately did not accomplish anything. The answer to this is QAnon.

For those who do not what QAnon is – it is a conspiracy theory, of which Mrs. Babbitt was a subscriber of, that claims that there is an international cabal of Satanist cannibalistic child traffickers with many of its members holding high up places in society such as prominent members of the US Democratic Party, most notably former Democratic Presidential nominee, Hillary Clinton, famous Hollywood celebrities and Silicon Valley tech billionaires like Bill Gates and Mark Zuckerberg. In addition QAnon adherents believe that Donald Trump as president has been engaging in a clandestine war against this perceived cult.

You can easily see that for people who are already neck-deep in this conspiracy theory that believing that the election was rigged is not much of a stretch when you are already committed to the core conspiratorial tenants of QAnon. The second question you might be asking however is why did this theory come about and why would people believe in it. QAnon first arose in late 2017 where amongst many claims that were made included that Hillary Clinton was to soon be arrested. This is yet to occur however some adherents believe that Hillary Clinton has in fact been arrested a long time ago and a clone of her likeness was put in her place. This magical thinking features heavily

in the QAnon community especially when trying to reconcile its failed predictions.

As for why people choose to believe in QAnon is a more difficult question. QAnon originated on the online imageboard website known as 4chan. 4chan has long been known for its far-right "content", due in part to its lax ... policies. Therefore many of the first members of early QAnon culture were already sympathetic to the distorted world view that the conspiracy theory presents. Up until recently QAnon stayed within its niche circles, however, with the beginning of the coronavirus pandemic, this changed. In the months of March, April and June, QAnon activity on mainstream social networks like Facebook and Twitter tripled. While many regard QAnon as a purely online phenomenon, with QAnon supporters being elected in the 2020 congressional election, QAnon is becoming a political movement to be reckoned with. This helped to culminate in the events that took place in the Capitol along with the aid of other even more extreme groups, showing how QAnon still maintains its early links to fascism and the American far-right.

Those of whom think we are isolated from such things as QAnon in the UK are sorely mistaken. The UK anti-racist, anti-fascist advocacy group, Hope Not Hate found in their report that 6% of their sample claim to support QAnon and 25% believe other conspiracies that QAnon is often coroberated with, such as that the coronavirus is a hoax or was intentionally created by the Chinese state to weaken other nations.

These are very uncertain times for everyone. The large level of disruption, political instability, economic turmoil and number of avoidable deaths around the world has led to many people trying to find a simple answer to the world's problems even if there isn't one. Accusations of

being Satan-worshipping cultists by QAnonners seems to fall disproportionately upon those of Jewish heritage or are known to support left-wing causes highlighting the striking resemblances between QAnon and the conspiracy theories propagated by the Nazis and how people turned to these ideas as a way of coping with the economic turmoil of their times. In our trying times I think it is important to remain vigilant to the threat that fascism continues to present to this day.

By Jabez Kent

Climate News

Ella's Law

Many of us are oblivious to the harsh reality of air pollution as, in most cases, it is the masked killer that you can neither see, hear or touch. However, this statement is sadly not the case for the family of a young girl called Ella Roberta Adoo Kissi-Debrah, who died at the age of nine in February, 2013. In the year 2021, nearly eight years after her death, Ella's story is resurfacing and has been met by shock and awe. So, this really begs the question who was Ella and why has her death caused such a stir within the heart of our nation?

Just over ten years ago on 10th December 2010, Ella experienced her first of many hypoxic seizures and was rushed to the emergency room. She reportedly lost consciousness and stopped breathing. Prior to this experience, Ella had not been diagnosed with any long term health conditions and she had no past experience with asthma of breathing difficulties. An interesting factor in the case to note is that nitrogen dioxide levels around her home in Lewisham were at a record high, far exceeding the EU and WHO's guidelines. Unbeknownst to her family, Ella would visit that emergency room nearly 30 times before the loss of her life in February, 2013.

A coroner ruled, after inquest into Ella's death in 2014, that her death had been caused by acute respiratory failure and severe asthma. This inquest however did not account for her asthmas sudden onset, and why it was indeed so acute. A seven year case into the exact cause of Ella's death, in which more inquests were requested, made some shocking discoveries.

Ella Roberta Adoo Kissi-Debrah lived in Lewisham, south-east London, 25 minutes from the south circular road which is notorious for being a 'pollution hotspot'. Unbeknownst to many of the inhabitants of Lewisham, many of their children walk along that very road each day on their way to school. Seven years after her death, a second inquest conducted by inner south London coroner Philip Barlow found that her death was indeed caused in combination with excessive pollution, asthma and acute respiratory failure, as the levels of nitrogen dioxide near Ella's home exceeded EU and WHO (world health organisation) guidelines. Infact, a recent report made by asthma and air pollution expert Prof Stephen Holgate (in response to the Kissi-Debrah case) found that there was a "striking association" between Ella's emergency hospital admissions and recorded spikes in levels of nitrogen dioxide (NO_2) and PM10s, the most noxious pollutants around Lewisham's south circular road. In his report, Holgate outlined that there was a "real prospect that without unlawful levels of air pollution, Ella would not have died."

Lewisham High Street, Lewisham, London SE13 6

Ella became the first person in the UK to have air pollution listed as a cause of death on their death certificate. For her family, after a seven year battle, this is a monumental achievement. In an interview with Ella's mother, Ms Kissi-Debrah, she said that her daughter would have cared about the suffering of others. Ella can't have been the first person to perish unnecessarily due to illegal levels of air pollution. Ms Kissi-Debrah said that Ella would want her legacy to live on through a new Clean Air Act, so that no more children have to suffer as much as she did.

We shouldn't have to live in a world where a child has to die before the idea of change is put on the table, but sadly this is what it has come to. How many more have to die before action is taken to prevent such unnecessary deaths from happening. Our government has a duty of care to protect vulnerable members within society and, as seen with the COVID-19 pandemic, they have the ability to do so. Yet, with illegally high levels of air pollution dotted around the country, it is clear that this danger has not been a priority. With deaths such as Ellas theorised to increase substantially over the next few years, we should all ask ourselves: when does disregard become murder, and when should these people be held responsible for their lack of actions?

"But also it's about other children still, as we walk around our city of high levels of air pollution, and I hope you heard what the coroner said that there are still illegal levels of air pollution now, as we speak, so this matter is far from over."
-Ms Kissi-Debrah

By Freya Dover

Good News

The Fish May Have Found Refuge!

Global warming has had a huge impact on our ocean, and as many of you may know, the coral reefs are dying. Coral reefs have always been essential for survival in the ocean, it supports so much life, and without it, the food chain breaks down.

Global warming has been known to cause 'warm water events', which is a rapid warming in the water's temperature, a blip in its usual temperature. This kind of fluctuation puts too much stress on the coral, and it begins to die. Some water however, seems to be exempt.

Off the coast of Kenya and Tanzania, there is a 400km squared refuge from these water warming events. This is due to the mountain Kilimanjaro. Within Kilimanjaro and the Usambara mountains, there are cool channels that feed water into the surrounding oceans. These channels were formed thousands of years ago from what used to be glaciers, and remain cool from the copious amounts of ice that once resided there. This constant stream of cool water flowing into the region forms a temperature barrier, regulating the temperature of the region, preventing the 'warm water events' from penetrating.

This cool escape is teaming with life, and has become a sanctuary for rare, and even prehistoric fish like the one in the image. It is an area of flourishing biodiversity, key for a sustainable ecosystem. This is great news; it brings hope for marine life, a refuge to migrate to when most other reefs inevitably die, so long as it is protected.

By Molly Berridge

Devine's Problems

This Issue's New Year Problem

Angela has just returned from a wild new years eve party. On the way up to her flat, she tripped on the stairs a total of six times. It is safe to say that at this point (3am), that she is completely and utterly sloshed. Now, this is a problem for Angela, as she must be at work in her local KFC drive-thru at 7am this very same morning. In order for Angela to remain in full time employment, she must sober up completely by 6:45am (so she is able to drive the 10 minutes to her local KFC).

Angela must drink 8 glasses of water and 5 mugs of coffee before this time. However, on her way to acquire her 4th glass of water she knocks into the shelf that contains her cat's vintage kitchenware collection as she was too preoccupied remembering in her drunken stupor that :

$$\int cosec(x)\, dx \;=\; log\left|tan(\tfrac{x}{2})\right|.$$

Her cat's most prized possession is a vintage tortoise shell Circa 1960's tray with gold edging, worth over £500. Luckily for Angela's aggressive, short-tempered cat Bill, the tray is sturdy, stood in a vertical position at the edge of the shelf and is hinged at its lower end to a frictionless joint secured to the shelf.

As the shelf is knocked, the tray begins to fall. Modelling the tray as a vertical uniform rod of length 2a, find the amount of time that Angela must stare in fear for her life at the tray falling to its horizontal position.

Last Issue's Solution

Rudolph does indeed get shot.

We can suppose Rudolph is on train track m at the start, and he is jumping n train tracks forward each second.

We also let t be the number of times that have passed after Rudolph was on train track m.

Since Scrooge knows t, and Rudolph is in position $m+nt$, Scrooge can guarantee to shoot Rudolph if he knows m and n.

Now, if Scrooge plots the values of m and n on a graph, with m on the horizontal axis and n on the vertical axis, it's a matter of trying every point.

Scrooge can indeed try every point and guarantee to find a given point in finite time: just start at $(m, n) = (0, 0)$ and then go round and round in a spiral.

So Scrooge can find (m, n) in finite time so he can definitely shoot Rudolph in finite time.