TERM 2, 2022

CAREERS WITH STEM™

MATHS+DATA

DOUBLE ISSUE
FLIP FOR CAREERS WITH ECONOMICS

CAREERSWITHSTEM.COM

HEALTH + OUTDOORS + RETAIL + ARTIFICIAL INTELLIGENCE + AUTOMATION

Think Data Science. Think QUT.

QUT Bachelor of Data Science student, Emma Studerus, always wanted to use her analytical skills to solve real-world problems. With a love of statistics, mathematics, and having a programming background, she finds data science is where all these skills meet.

Emma chose QUT as it was the only university to offer a dedicated Data Science course. But it's the mixture of real-world and practical learning that really sold her on applying.

QUT's flexible, online learning delivery and support services allow Emma to manage her family responsibilities and a part-time job. While studying, Emma hopes to move into a part-time data science job and get into research too.

To discover more of Emma's story, search QUT Data Science.

QUT DATA SCIENCE

the university for the real world

QUT

CRICOS No: 00213J

MATHS MATTERS

Dan Jermyn's job is all about making the best decisions from data – and for that, his maths skills are essential. Oh, and did we mention that the world runs on data, too?

DAN JERMYN
CHIEF DECISION SCIENTIST
COMMONWEALTH BANK

CHIEF DECISION SCIENTIST, COMMONWEALTH BANK OF AUSTRALIA

HEAD OF DIGITAL ANALYTICS, ROYAL BANK OF SCOTLAND

DIRECTOR AND CO-FOUNDER, SITETAGGER

MASTER OF SCIENCE (COMPUTING), CARDIFF UNIVERSITY

While maths was one of my interests at school, football and guitar were my driving passions! I was one of the first in my family to go to uni and it was the democratic nature of maths – the fact that anyone can learn, access and use maths in the real world – that led me to study maths-heavy physics for my undergrad degree.

From there, I developed an interest in IT – going on to create a startup that formed the basis of tag management on websites, a piece of code that helps people find and retrieve information, and is still used today. Finally, I moved into banking in the UK and now I'm head of Commonwealth Bank's data science capabilities as chief decision scientist.

Why a decision scientist? Because while data drives our tech world, making the right decisions from data is the crucial part. That's why the Commonwealth Bank has data scientists embedded in every part of its operations – making data and maths skills critical to more than just banking and interest rates. Data, and decisions from data, are essential for both helping our customers and improving the way we work.

Take natural disasters, for example. Using technology, data science and artificial intelligence (AI), we've developed a tool that uses machine learning to reach all of our customers in the right channel, at the right time. It uses custom-built algorithms to monitor, in real time, a mix of data points from official emergency sources and weather alert systems to offer support to people impacted. It also lets our frontline teams know if a customer is in a high-stress situation, and why they are likely to be calling so they can offer the best support for that customer. Maths is fundamental to today's world and it is accessible to everyone – it's a universal language that cuts across societal, gender and race divides, which is a beautiful thing.

> **"THE COMMONWEALTH BANK HAS DATA SCIENTISTS EMBEDDED IN EVERY PART OF ITS OPERATIONS – MAKING DATA AND MATHS SKILLS CRITICAL"**

My advice for those who might not feel like they are 'good' at maths is to back yourself. With the fast-paced nature of technology and innovation, maths will give you the skills to access some of best and most exciting jobs, whatever your passion.

Dan Jermyn
Chief Decision Scientist
Commonwealth Bank

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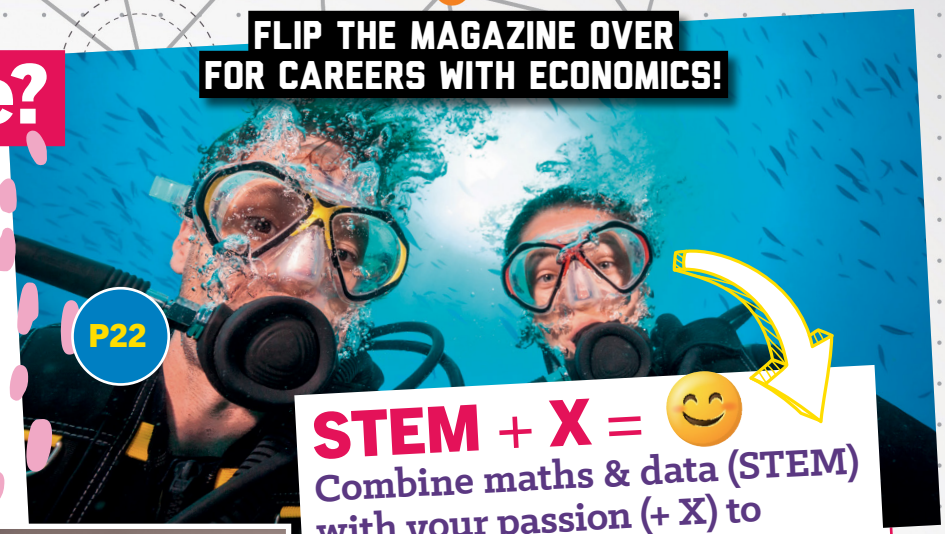
What's inside?

FLIP THE MAGAZINE OVER FOR CAREERS WITH ECONOMICS!



STEM + X =

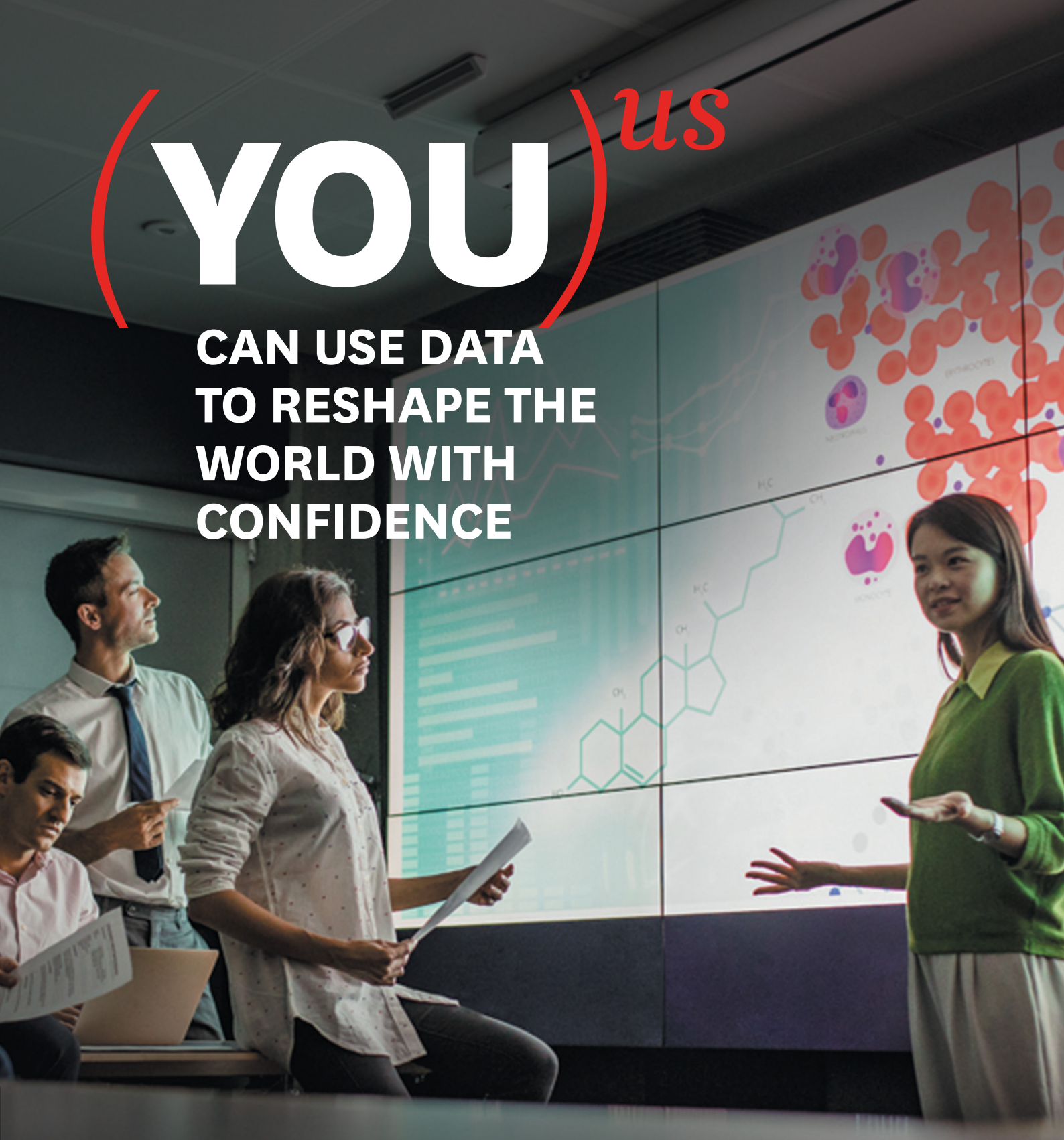
Combine maths & data (STEM) with your passion (+ X) to discover your dream career.

Maths & Data + …

WHY MATHS+DATA?

Data is being generated in greater volume and faster than ever before, meaning people with the skills to interpret and analyse data are needed in almost every industry. That's why this issue is focused on the M in STEM: mathematics – a universal language that provides the foundation for all of STEM, fluency in which is only more valuable in our data-driven present.

SHUTTERSTOCK



(YOU)us

CAN USE DATA TO RESHAPE THE WORLD WITH CONFIDENCE

Imagine solving medical mysteries, increasing crop yields, finding new ways to optimise profit or managing global disease outbreaks.

Worldwide, data-driven decision making has become increasingly important. Study data science, statistical modelling and maths at Macquarie to become an expert in making objective, data-driven decisions and recommendations as we prepare you for emerging careers in diverse industries.

MACQUARIE University
SYDNEY·AUSTRALIA

6 reasons not to drop maths!

If you're not pumped on numbers, Year 11 + maths = no point, right? Wrong! Sticking it out could land you your dream career

Keen to drop maths as soon as you can? Before you subtract it from your life completely, consider the pluses that it'll have when applying for uni or acing your first gig.

Loads of uni courses include standard Year 12 maths as a prerequisite, not to mention the fun, exciting – and surprising – careers that use numbers every day.

"Maths teaches transferable problem-solving skills that are a desirable trait of a potential employee across a variety of career pathways," says Mountain Creek State High School maths teacher Emma Hodkinson. "The skills learnt in maths at any level are helpful for everyday life."

#1 LITERALLY EVERY JOB USES IT

All jobs use maths. Take that thing you love, add maths and there's your ultimate gig right there.

#2 IT'LL KEEP YOUR TERTIARY STUDY OPTIONS OPEN

When deciding what to study after high school, it's OK to take your time, change your mind and switch things up. But having maths under your belt helps and for some degrees, it's a prerequisite.

#3 YOU'LL BECOME A TIKTOK PRO

Reach, clicks and shareability are all modern maths tools designed to help us work out what is and isn't working – or trending on the socials.

#4 BECAUSE ALL THE STEM PROS SAY SO

From tradies to cyber security experts, animators and weather pros, if it's a job with numbers, chances are we've found an expert to match. Search careerswith STEM.com.au for all their tips!

#5 IT COULD INCREASE YOUR EARNING POTENTIAL

STEM skills are essential to future economies, which makes developing a solid foundation while still at high school seriously invaluable. And how's this for probability theory?! US company PayScale found that graduates in maths, science and engineering had the highest mid-career salary!

#6 IT'S ACTUALLY REALLY FUN

Gone are the days of crazy professors and snoozy blackboards full of random numbers. In 2022, maths and data are complex, cool, empowering and way more relevant to a career you'll want to land! – *Cassie Steel*

DO THE MATH!

THESE DREAMY JOBS SHOULD BE ENOUGH TO CONVINCE YOU TO HANG IN THERE WITH TWO-UNIT...

- MATHS+TIKTOK = SOCIAL MEDIA ANALYST
- MATHS+RETAIL = DATA SCIENTIST
- MATHS+DEFENCE = CYBER SECURITY EXPERT
- MATHS+CLOTHES = FASHION DESIGNER
- MATHS+FOOD = CHEF
- MATHS+BUILDING = ARCHITECT
- MATHS+TRANSPORT = PILOT
- MATHS+VIDEO GAMES = GAME DEVELOPER
- MATHS+DRAWING = ANIMATOR
- MATHS+MONEY = FINANCIAL PLANNER

Australian Government

National Careers Institute

I AM READY TO SUPPORT TO MOTIVATE TO FIND MY CAREER

Leaving school and thinking about next steps?

The Your Career website has everything you need to support your next steps in training, education and employment.

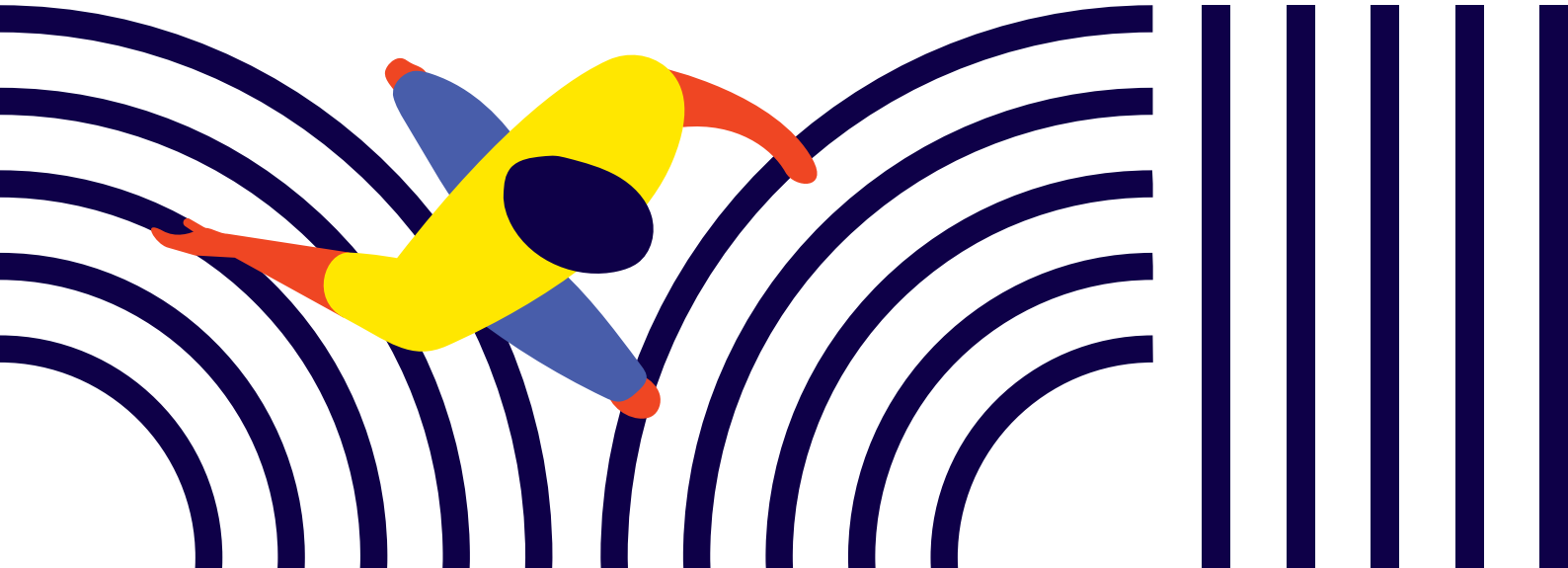
The tools on Your Career offer personalised information and advice by matching your skills, interests and goals to careers that may suit you.

You can explore over 1200 occupations listed from A-to-Z, see how much you might earn, learn what a real day on the jobs looks like, understand what kind of job prospects exist in a particular field - and what skills you need to get you there.

Find up to date, accurate careers information and advice about where the opportunities are now and where they'll be in the future at **yourcareer.gov.au**.

You can also access the School Leavers Information Service:

- calling **1800 CAREER** (1800 227 337), or
- texting 'SLIS2021' to **0429 009 435**



GET CONNECTED

Find out how high school maths is used in real life... We're talking all sorts of cool STEM jobs!

Maths is all around us and has enabled all the features of our modern world. Doing maths is all about looking for – and working with – patterns. It has its own language and rules, and once you master the basics you'll have it nailed.

The maths we learn at school is organised into categories to help us learn the language and rules quicker: there's numbers and algebra, measurement and geometry, and statistics and probability. But, in the real world, engineers, scientists, software developers, industrial designers and astronauts use a combination of different kinds of maths concepts to help with challenges like solving climate change, using energy more efficiently and even in space exploration.

While using their maths skills, these STEM experts are also considering other things like sustainability, ethics and social impacts. Everything in the world around you is connected and starts with the maths you learn at school. Check out these four fun facts on how maths matters...

ANALYSING DATA TO SAVE THE BEES

There are more than 2000 types of Australian bees! Often called 'nature's engineers' because of the complexity of their hives, bees use repeating hexagons (tessellations) to build a strong structure. But doing maths and making honey aren't the only things these cool critters do so well. Problem is, they're disappearing.

Farmers and scientists alike are conducting research to figure out why bee populations are declining – as these helpful little pollinators are responsible for about one third of the world's food production!

Analysing data on a global scale and looking at different variables is helping us to keep the world's bee population stable and future-proof food production. And maths is key to solving this global issue.

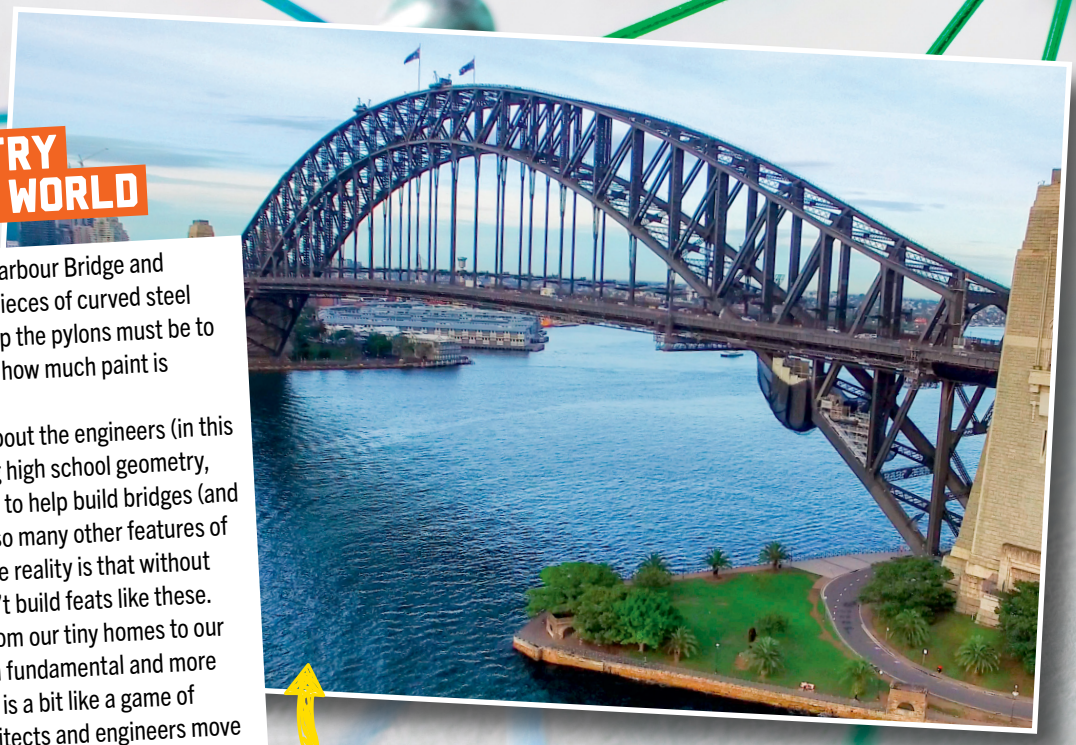
The maths: data collection and analysis
The careers: climate scientist, agriculturalist, data analyst, software engineer

USING GEOMETRY TO BUILD OUR WORLD

Ever looked at the Sydney Harbour Bridge and thought about how many pieces of curved steel are used in the arch, how deep the pylons must be to keep the bridge anchored, or how much paint is required each year?

While you may not think about the engineers (in this case structural or civil) using high school geometry, algebra and material density to help build bridges (and roads and skyscrapers and so many other features of our urban environments), the reality is that without this foundation you just can't build feats like these.

The built environment, from our tiny homes to our largest dams, relies on both fundamental and more complex mathematics, and is a bit like a game of Tetris. Town planners, architects and engineers move 'pieces' around to make sure all the parts fit to make our cities safe, smart and future-proof.



The maths: geometry, algebra, material density
The careers: civil engineer, structural engineer, town planner, architects

SHUTTERSTOCK

USING CRYPTOGRAPHY TO SEND SECRETS

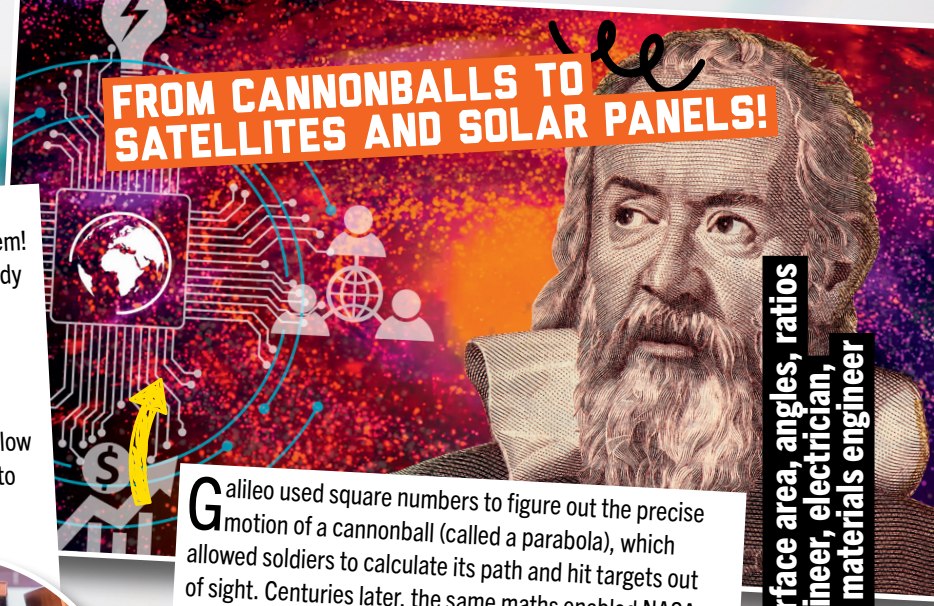
Ever written a note to your friend in class and hoped the teacher didn't read it? Well maths could solve your problem! Enter the world of cryptography and number theory (the study of the integers and integer-valued functions). Encryption is what keeps your personal data secure online. It scrambles data intel like your credit card details and home address to ensure hackers can't misuse this information.

Cryptography relies on keys to help find the pattern to allow you to 'translate' the data. See if you can discover the key to decipher the following message: pdwkv lv wkh frrohvw! (answer on page 28)

In this age of Big Data, technology and quantum computers, the codes for secure cryptography will need to become more sophisticated, which means plenty of career ops for people with a head for numbers, linguistics and seeing trends and patterns.

The maths: number theory, algebra, logs and matrices, probability
The careers: coder, hacker, intelligence officer

FROM CANNONBALLS TO SATELLITES AND SOLAR PANELS!



Galileo used square numbers to figure out the precise motion of a cannonball (called a parabola), which allowed soldiers to calculate its path and hit targets out of sight. Centuries later, the same maths enabled NASA to design a satellite and launch it into orbit.

The maths of parabolic analysis is used in many applications, from building satellites and keeping our global communications and monitoring systems functioning to building more efficient solar panels – for everything from your roof to solar farms!

Parabolic solar panels can concentrate the Sun's light rays, collecting and converting more of it into electricity to power our lifestyles.

As our exploration of space and energy needs increase, so will the demand for critical and creative thinkers. Peeps who can apply maths concepts, see patterns and predict problems before they occur, can also design the solutions to make our world a better place. – *Angela Crompton*

The maths: quadratics, algebra, surface area, angles, ratios
The careers: renewable energy engineer, electrician, astrophysicist, industrial designer, materials engineer

Maths is everywhere!

Maths is used every day in almost everything we do – including some pretty awesome careers that might surprise you

Looking for fun, practical and creative activities to enhance your maths skills? Visit education.nsw.gov.au/everyday-maths

The M in STEM is pretty special because it isn't just another field – it actually underpins science, technology and engineering. If you think of it more like a language than a skill set, then the value of maths in everyday life starts to make more sense.

Understanding mathematical concepts, logic and developing an analytical way of thinking are useful and valuable in almost everything we do – yes, that includes the obvious maths-heavy STEM career paths like technology and engineering, but maths is also used for running a business and in sectors like healthcare and retail, too (turn the pages for some cool examples!).

But don't stop there – numbers really are everywhere you look if you know where to find them and how to use them. In our data-driven world, speaking the language of maths and being part of that conversation will give you an edge in almost any career! Still not convinced?

Meet three people with cool careers who use maths everyday...

#1 KAI SAKAKIBARA
AUSSIE BMX CHAMPION

@sakakibarakai

"IN BMX, WE USED TIMING AND NUMBERS EVERY DAY TO HELP OUR PERFORMANCE. SO MANY OF THE SKILLS I LEARNT THROUGH SCHOOL WERE APPLIED TO HELP ME GET BETTER"

#2 MAHALIA BARNES
SINGER AND SONGWRITER

"MATHS IS AN ESSENTIAL PART OF MY CAREER, FROM BUDGETING AND PLANNING A TOUR, LOGISTICS AND TRAVEL, TO WRITING, LEARNING AND PERFORMING"

@mahaliabarnes

#3 DAN REILLY
BUILDER/FOREMAN ON THE BLOCK REALITY TV SHOW

@danreilly_official

"MATHS IS SOMETHING I USE EVERY DAY IN MY WORK AND HAS HELPED ME ON MY CAREER PATH"

STUDY WHAT MATTERS

STUDY DATA SCIENCE AT ECU

When you choose to study Data Science at ECU, you learn to decode large amounts of data into useful information that can help solve real-world problems.

Data science is a significant area of growth, providing employment opportunities in Australia and around the world. Our strong industry links provide students with the most up-to-date information and important networking and internship opportunities, while our flexible study options allow you to fit study around your life.

We offer a range of data science courses including:

- Bachelor of Science (Data Science Major)
- Graduate Certificate in Data Science
- Master of Data Science
- Master of Bioinformatics

FIND OUT MORE AT
ECUWORLDREADY.COM.AU/SCIENCE

AUSTRALIA ECU EDITH COWAN UNIVERSITY

15 MATHS JOBS OF THE FUTURE

The National Skills Commission has identified the top emerging careers in Australia. A recurring theme in almost all of them? Maths and data skills!

1. Data Analyst
Gather and analyse data, develop data visualisations, conduct statistical analysis.

2. Data Scientist
Develop machine-learning models, data mining, data analytics, visualisation, reporting, consultation.

3. Data Engineer
Develop, manage and maintain databases, provide data in a ready-to-use form for data scientists and analysts.

4. Data Architect
Design and manage data platforms, build and monitor databases, develop data governance and security procedures.

5. Pricing Analyst
Analyse product prices, revenue modelling, review pricing agreements.

6. Logistics Analyst
Improve supply chain efficiency, analyse logistics data, inventory forecasting and monitoring.

7. Biostatistician
Collection, analysis and reporting of biological data. Monitor and analyse data from experiments.

8. Digital Marketing Analyst
Online marketing, social media marketing, campaign monitoring (through web analytics).

9. Social Media Specialist
Develop, implement and manage social media strategy, content and campaigns.

This might not sound like a 'new' job to you, but the NSC included it because demand for this role is increasing!

10. User Experience (UX) Analyst
Analyse user data to inform the design of web and mobile app interfaces.

11. Researcher
Conduct and manage research projects, analyse data and write papers.

12. Risk Analyst
Statistical modelling of corporate risk, risk management advice, helping businesses comply with regulations.

13. Energy Auditor
Measure household energy use, advise companies on energy use and efficiency, analyse energy data.

14. Compensation and Benefits Analyst
A data role in the Human Resources department that involves analysing salary packages, pension plans and managing workers' compensation claims.

15. Energy Efficiency Engineers
Analyse and report on energy data, implement programs to reduce energy waste, design controls for energy systems.

– Gemma Chilton

Visit bit.ly/3EuISLB for the full report

SHUTTERSTOCK

CAREERS THAT COUNT

Meet three maths grads forging exciting careers at the Commonwealth Bank

#1

THARINI SOORIYAKUMARAN LOVES THE BLACK-AND-WHITE NATURE OF MATHS AND DATA – BUT SHE'S ALSO LEARNT THAT NAVIGATING YOUR CAREER PATH INVOLVES DEALING WITH SHADES OF GREY!

THARINI SOORIYAKUMARAN
ANALYTICS GRADUATE, COMMONWEALTH BANK

Tharini always enjoyed maths and problem-solving, but it wasn't until attending a maths and technology event that she set her sights on a career with numbers.

"The event showcased cool technologies that used mathematical concepts," she recalls. "For the first time, it was something I could really connect with and it excited me about the future I could be a part of!"

So Tharini signed up for a Bachelor of Actuarial Studies at UNSW, coupled with a Bachelor of Commerce.

"This degree would provide the opportunity to use my passion for maths in a practical setting – specifically, to use data and numbers as a tool to navigate risk and uncertainty," she says.

NAVIGATING UNCERTAINTY

One problem a maths formula couldn't solve was where Tharini would take her career. But embracing that uncertainty was important, she says.

"One of the things I would have loved to have known back in school is to not put too much pressure on defining your career path too early," says Tharini.

"The skills you learn via a maths or data degree are so versatile and can be applied to a range of STEM roles, so it really is okay if you're interested in STEM but not entirely sure what you want to do."

As it turns out, Tharini landed a job as an Analytics Graduate at Commonwealth Bank, where she now works analysing and modelling data to better understand – and help – the bank's customers. For example, she recently worked on helping to identify unique customer spending habits and their relationship to risk.

"What I enjoyed most about this piece of work is that it helped me understand the human element behind the technical work of analytics and data science," she says.

While Tharini may not know exactly where her future career path will lead, her goal is to stick with banking and analytics, and she is confident that maths has given her a robust foundation for the future.

"With STEM careers constantly evolving, it's not about how much you know, but about how you can effectively learn new information and make sense of ambiguous problems," she says. – *Gemma Chilton*

> "THE SKILLS THAT YOU LEARN VIA A MATHS OR DATA DEGREE ARE SO VERSATILE AND CAN BE APPLIED TO A RANGE OF STEM ROLES"

BACHELOR OF ACTUARIAL STUDIES / BACHELOR OF COMMERCE, UNSW >> GLOBAL MARKETS SUMMER ANALYST, CITI >> ANALYTICS GRADUATE, COMMONWEALTH BANK

LAUREN TROMPP

#2

FROM A KID WHO LOVED SCIENCE EXPERIMENTS TO A TOUGH FINAL YEAR AT HIGH SCHOOL, RYAN SUCKLING HAS KICKSTARTED A BRIGHT CAREER WITH DATA

RYAN SUCKLING
TECHNOLOGY GRADUATE, COMMONWEALTH BANK

TECHNOLOGY GRADUATE, COMMONWEALTH BANK

BACHELOR OF MATHEMATICS (STATISTICS) / BACHELOR OF SCIENCE (PHYSICS), UNIVERSITY OF NEWCASTLE

When he was younger, Ryan loved science – especially fun, hands-on experiments – but turning that passion into a STEM career wasn't always easy.

"I struggled with knowing how to study and I wasn't the best student. I didn't think I would be able to go to uni," he recalls.

But Ryan was able to turn things around just before exam time and managed to get into one of his course preferences – a combined Bachelor of Mathematics (Statistics) and Bachelor of Science (Physics) at the University of Newcastle.

KEEP TRYING

"I think a lot of people don't realise that failing is OK. You can always pick yourself up, dust yourself off and keep trying," he says.

While studying full-time at uni, Ryan was also working night shifts – a workload that started to hurt his grades. Unable to make more time to study, he instead developed more efficient study methods, bringing up his grades to the point of being recognised on his faculty's commendation list two years in a row. Ryan's advice?

"Be patient," he says. "Maths needs a solid foundation. Building that is a better use of your time than trying to learn ahead of where you should be. It's OK to find things difficult – eventually they'll click."

Now, as a Technology Graduate at Commonwealth Bank, it's Ryan's job to ensure new and existing data solutions are in line with the bank's data strategy and that "they also meet the needs of the people who use them", he explains.

Ryan has come a long way since high school – and he couldn't have done it without being surrounded by supportive, encouraging people.

"My biggest future goal would be to support others in the same ways that I have been supported throughout my early career," he says. – *Gemma Chilton*

"YOU NEED TO BE PATIENT WITH YOURSELF WHEN THINGS ARE HARDER FOR YOU. IT'S OK TO FIND THINGS DIFFICULT – EVENTUALLY THEY'LL CLICK"

LAUREN TROMPP

#3

AS A DEVOPS ENGINEER, MARK VARNEY SPENDS HIS 9-TO-5 MIXING ADVANCED COMPUTER SCIENCE CONCEPTS WITH THE LOGIC OF MATHS

MARK VARNEY
DEVOPS ENGINEER, COMMONWEALTH BANK

DEVOPS ENGINEER, COMMONWEALTH BANK

GRADUATE SOFTWARE ENGINEER, COMMONWEALTH BANK

GRADUATE CERTIFICATE OF MATHEMATICS, UTS

MASTERS OF INFORMATION TECHNOLOGY (SOFTWARE DEVELOPMENT), UTS

BACHELOR OF ARTS IN COMMUNICATION (JOURNALISM), UTS

Mark was never into maths in high school. In fact, he only discovered his affinity for STEM while he was doing an arts degree – majoring in journalism – at the University of Technology, Sydney (UTS).

"I did a very basic web design subject and enjoyed using the HTML/CSS to code up a web page," he explains. "At the time, I was also into amateur music production and became obsessed with building homemade gear which required electronics knowledge too."

Gradually – at home and at uni – Mark got more into computer science and, after graduating from the journalism degree that turned out not to be his thing, he signed up for a Master of IT.

"I decided that I wanted a job in tech and settled on programming after I got over the initial brain pain," he laughs.

A snap decision to upskill and add a Graduate Certificate in Maths to his list of qualifications further advanced Mark's understanding of complex computing science subjects like machine learning, algorithmic efficiency and computer graphics.

"The structured logical thinking has proved really useful to the technical problems I face daily," he says.

BANK ON IT

One of the most exciting real-world projects from Mark's Master's involved working alongside Commonwealth Bank software engineers.

The vibe of the company, alongside the exciting opportunities it boasted for tech grads, convinced him to apply for an internship – and later a spot in Commonwealth Bank's graduate program.

As a fresh grad, Mark helped create the code that allowed consumers to do their banking online.

"If you've ever made or received a payment using the CommBank app, there's a good chance you've used code that I've worked on," he says.

> **"THE STRUCTURED LOGICAL THINKING HAS PROVED REALLY USEFUL TO THE TECHNICAL PROBLEMS I FACE DAILY"**

However, he soon became curious about what was going on in the level underneath that – servers, clouds, sandboxes, environments and processes – and is now more focused on supporting developers within the business to deploy and test their apps.

"Being a DevOps engineer is very technical," Mark says, joking: "People at parties never understand my job!" – *Cassie Steel*

A picture of health (careers)

Keen on a cool health gig? Maths is your secret weapon!

JOB INSPO

CHECK OUT SOME EXAMPLES OF THE MATHS USED IN HEALTH JOBS!

1 **Pharmacists** are constantly working with formulas, equations, measurements and conversions when dispensing medications.

2 **Audiologists** need arithmetic to assess differences between each ear, plus ratios and statistics to work out if hearing test results are in a normal range.

3 **Dentists** require measurements to check gum health and monitor tooth enamel wear.

4 **Physiotherapists** need geometry to measure the mobility of a patient's joints.

5 **Psychologists** rely on data and statistics to prove hypotheses and interpret psychological tests.

Careers in health are hot!

Did you know that more than 1.8 million people were employed in the healthcare and social assistance industry last year? It's Australia's largest employing industry according to the Australian Industry and Skills Committee. If you love health *and* numbers, you're in luck. Everyone from dentists to bioinformaticians, epidemiologists and psychologists rely on solid maths and data skills in their 9-to-5.

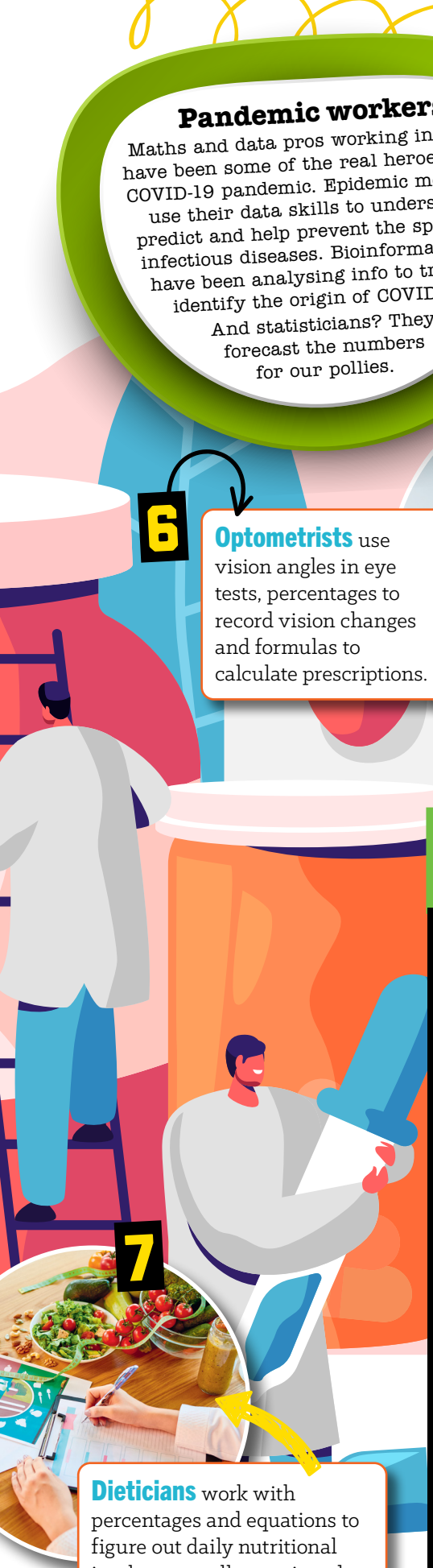
Maths help. Unis like the University of South Australia, Western Sydney University and RMIT have online hubs and resources to help you scrub up on the specific maths skills you'll need for nursing, and TAFE SA even offers a short course called Maths for Nursing.

Pandemic workers

Maths and data pros working in health have been some of the real heroes of the COVID-19 pandemic. Epidemic modellers use their data skills to understand, predict and help prevent the spread of infectious diseases. Bioinformaticians have been analysing info to try and identify the origin of COVID-19. And statisticians? They forecast the numbers for our pollies.

6

Optometrists use vision angles in eye tests, percentages to record vision changes and formulas to calculate prescriptions.



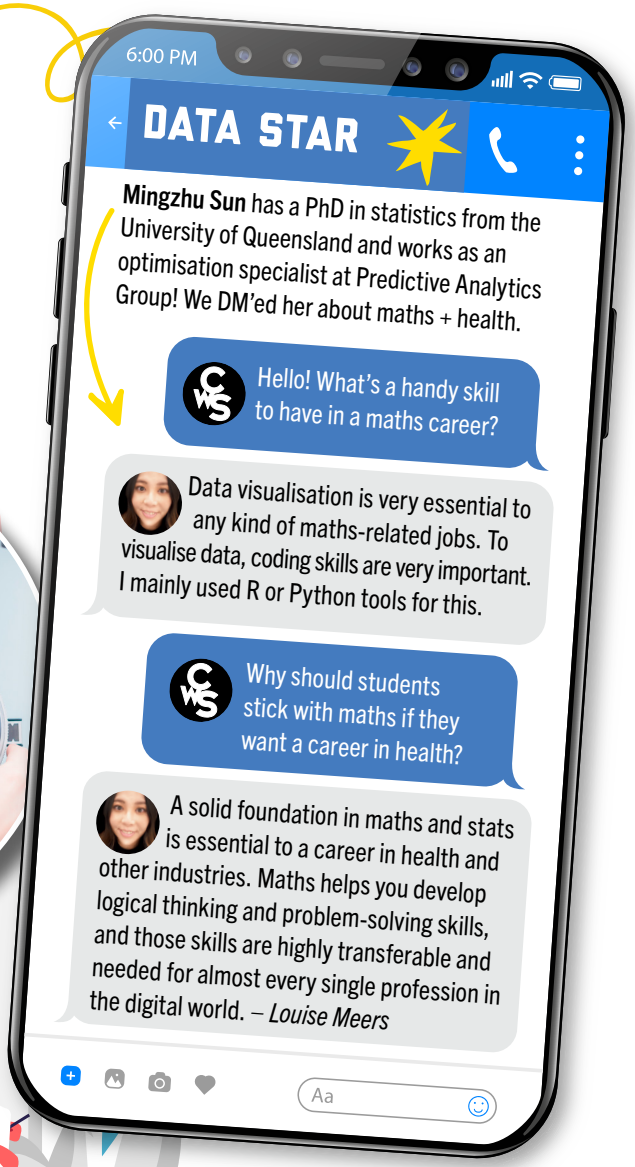
7

Dieticians work with percentages and equations to figure out daily nutritional intakes, as well as patient data to come up with individual meal plans based on age, weight and other factors.

STEM SPOTLIGHT ON NURSING

THE NATIONAL SKILLS COMMISSION HAS IDENTIFIED THE TOP 10 JOBS THAT ARE PROJECTED TO GROW THE MOST BY 2025 AND COMING IN SECOND IS A REGISTERED NURSE! AND GUESS WHAT? THERE'S PLENTY OF MATHS IN NURSING. THINK:

- Arithmetic for IV and medication calculations
- Metric conversions and decimals when dealing with weight
- Fractions, ratios, rounding and unit conversions for administering medication dosages
- Percentages for giving oxygen



"MATHS SKILLS ARE HIGHLY TRANSFERABLE AND NEEDED FOR ALMOST EVERY SINGLE PROFESSION..."

START YOUR CAREER HERE

MATHS+HEATH STUDY

Bachelor of Biomedical Science/ Bachelor of Mathematics, QUT

Bachelor of Science and Master of Mathematical Sciences, The University of Sydney

Bachelor of Health and Medical Sciences, University of Adelaide

MATHS+HEALTH JOBS

Epidemiologist: $71K–$106K

Registered nurse: $57K–$91K

Statistician: $60K–$117K*

*Source: salaries according to payscale.com

SHUTTERSTOCK

DR NICOLE WHITE
STATISTICIAN

SENIOR RESEARCH FELLOW, QUT
RESEARCH ASSOCIATE / LECTURER, QUT
PHD IN STATISTICS, QUT
BACHELOR OF APPLIED SCIENCE (HONOURS), QUT
BACHELOR OF MATHEMATICS, QUT

Data-powered healthcare

QUT graduate and Senior Research Fellow Dr Nicole White uses her background in maths and statistics to find meaning in healthcare data

Nicole preferred the humanities over maths in high school. "I enjoyed maths, but I didn't see how the problems we were solving could be applied to the world outside of the classroom," she says. "It felt like your career choices from studying mathematics were limited to being a teacher, an engineer or an accountant."

Now, as a statistician who analyses medical data to help improve patient care, she's keen to dispel some of the misconceptions about what a career in maths looks like.

One of the projects that Nicole's currently working on involves analysing the records of over 16,000 critically ill COVID-19 patients from 55 countries around the world to help doctors understand the best way to treat and manage the virus.

To process such vast numbers, Nicole draws not just on her maths and statistics skills, but also coding, communication and creativity.

"I call data a beautiful mess and statistics helps us find meaning," she says. "My job is to distil that beautiful mess down into a clear message that doctors can use to better treat patients.

The biggest challenge for me is the art of communication."

Nicole's own 'aha' moment about maths came during her first year of uni when she learnt about the role of data in the development of the polio vaccine.

"I started to see this whole new world of maths and how it could be combined with data to solve meaningful problems," she says.

Nicole switched to a Bachelor of Mathematics at QUT, which she says was "very applied and problem-solving focused", and went on to do her honours year in applied science and a PhD in statistics. Today, far from having a stereotypical maths job, she works across a range of projects in different places, using statistics and clinical expertise to find ways to improve our healthcare system.

Her advice? Stay open-minded about the diversity of career paths out there, and talk to those already working in the field! – *Amelia Caddy*

"I CALL DATA A BEAUTIFUL MESS AND STATISTICS HELPS US FIND MEANING"

THE SUNNY STATISTICIAN

From high school teacher in Ghana to researcher and lecturer in Western Australia, Dr Eben Afrifa-Yamoah is passionate about making maths fun

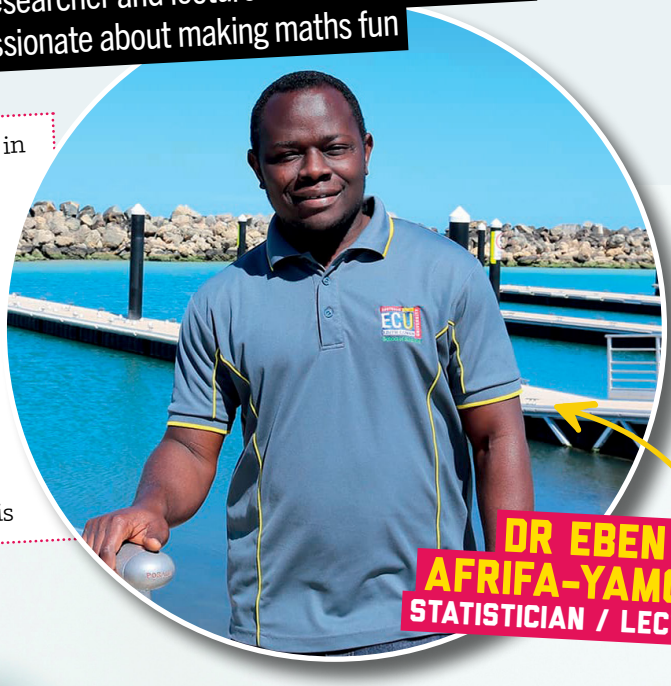
Eben has always loved maths. Growing up in Ghana, it was his best subject in school. He loved the fact that if you understand the rules in math and are disciplined in following those rules, you can always find a right answer in the end.

Eben worked as a high school maths teacher in Ghana before receiving scholarships to study in Norway and then Australia. He has three Master's degrees, which he pursued because he wanted to be the best teacher he could be. These days, he is a uni lecturer who enjoys the challenge of teaching, as well as his research.

"The subject I'm teaching is not [considered] lovable," he says. "But I'm going to change that perception! I let [my students] have a feel for the fun side of maths, the fun side of statistics."

Eben is a statistician, which means he mainly deals with data (stats) and how understanding those data and looking at them in different ways can tell us things about systems. His research has helped fisheries become more environmentally sustainable; helped people manage their medical conditions more effectively, and looked at the effects of climate change on people who work in hot environments.

He is currently working on a project that uses data to better predict which people in the community are at risk of developing diabetes, and says, "Data are ruling the world. So we need people who are able to make sense of those bunches of numbers." – *Rachael Bolton*



DR EBEN AFRIFA-YAMOAH
STATISTICIAN / LECTURER

> "DATA ARE RULING THE WORLD"

@EAfrifaYamoah

BACHELOR OF SCIENCE (HONOURS) (STATISTICS), UNIVERSITY OF CAPE COAST, GHANA >> MASTER OF EDUCATION (MATHEMATICS), UNIVERSITY OF EDUCATION WINNEBA >> MASTER OF PHILOSOPHY (MATHEMATICAL STATISTICS), KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

MASTER OF SCIENCE (MATHEMATICAL SCIENCES), NORWEGIAN UNIVERSITY OF SCIENCE AND TECHNOLOGY >> PHD (APPLIED STATISTICS), EDITH COWAN UNIVERSITY >> LECTURER, EDITH COWAN UNIVERSITY

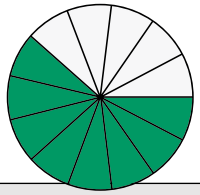
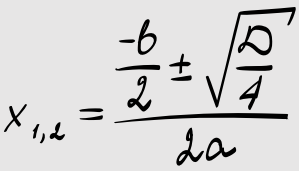
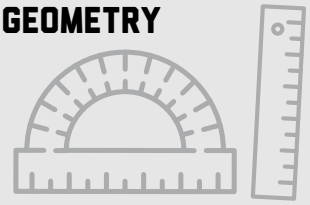
Lifesaving skills

Discover how the maths topics you're learning today help healthcare professionals save lives, everyday!

PROFESSOR ERWIN LOH
GROUP CHIEF MEDICAL OFFICER + GROUP GENERAL MANAGER OF CLINICAL GOVERNANCE, ST VINCENT'S HEALTH AUSTRALIA

"We use maths and data in the medical field all the time, from measuring a patient's vitals to interpreting public health statistics or calculating the potential spread of a global pandemic! In my job, I look at numbers, graphs and charts everyday to make sure our hospitals are running smoothly and efficiently, and patients are getting the best possible care. If you have your sights set on a career in medicine or health, then numeracy is an important skill to add to your toolkit."

@ErwinLoh

THE MATHS	USE IT TO SAVE LIVES	THE JOBS
STATISTICS AND PROBABILITY 	In school, you might be learning the probability of throwing two 3s with dice and wonder why it even matters if you're not into board games! But in the health sector, statistics play a crucial role. For example, in public health, they have helped us to understand and put the brakes on a global pandemic. Statistics are also applied when looking for patterns in genetic data, whether in an individual genome or across populations.	• Biostatistician • Bioinformatician • Epidemiologist • Geneticist • Molecular biologist • Public health physician
FRACTIONS, CONVERSIONS AND RATIOS 	The maths involved in calculating the safe and effective dosage of a medication for an individual (based on factors such as their age and body weight) can mean the difference between saving a life or causing a dangerous overdose!	• Pharmacist • General practitioner • Toxicologist • Nurse • Oncologist • Physician
EQUATIONS AND FORMULAS 	Equations aren't just about calculating the sides of triangles and drawing graphs – they can be used to calculate crucial health information, such as how much oxygen the blood can carry, and figure out drug dosages.	• Pharmacist • General practitioner • Researcher • Nurse • Pathologist • Optometrist
BASIC ARITHMETIC	There are few walks of life where basic arithmetic (addition, subtraction, division and multiplication) doesn't come in handy – and working in the health sector is no exception! Monitoring vitals (such as pulse, blood pressure, temperature) is the first step in pretty much any healthcare interaction and requires foundational knowledge of whole numbers, decimals, fractions and more.	• Physiotherapist • Paramedic • Nurse • General practitioner • Surgeon • Physicist
GEOMETRY 	You might be surprised by the diverse applications of the field of geometry in real life – and yep, health is one of them! For example, geometry concepts would be involved in 3D-modelling a tumour, to help healthcare professionals with a treatment plan, such as for a complicated surgery. – *Gemma Chilton*	• Researcher • Oncologist • Optometrist • Surgeon • Radiotherapist

SHUTTERSTOCK

EXPLORING THROUGH EPIDEMIOLOGY

THE STUDY OF STATISTICS PROVIDED HELEN RAMSAY WITH A GATEWAY TO AN INTERESTING CAREER AS A PUBLIC HEALTH RESEARCHER

HELEN RAMSAY
PUBLIC HEALTH RESEARCHER

What single field can connect chemistry, the environment and health? According to Helen, the answer is statistics. Or, more specifically, epidemiology: the use of statistics to study the cause and spread of diseases.

Like many others, Helen wasn't sure what she wanted to do when she left school.

"I didn't think a gap year would give me any clarity, so I jumped into uni and did science because that was the area I was attracted to in high school."

Helen initially enrolled in a chemistry degree at Macquarie University in Sydney, but later switched to climate science and, almost as an afterthought, added statistics. "I had room in my timetable for a second major and I thought stats would be useful," she says. As it turns out, she was right.

Her interest in epidemiology was piqued by a subject called 'epidemiology and biostatistics' and solidified by a capstone project which saw her travel to Fiji to study the health effects of kava, a psychoactive drink, among other lifestyle factors.

"I WORK WITH PEOPLE WHO ARE PASSIONATE ABOUT WHAT THEY DO. IT'S CONTAGIOUS"

ONE DEGREE, LOADS OF CAREERS

Now, with a Master's in Public Health, Helen works as a public health researcher and coordinates a network that brings together researchers to plan clinical trials.

Her classmates from Macquarie have gone on to apply their stats skills in equally interesting ways, working in everything from the energy sector to consulting, coding and IT. "You've got so many options with statistics – it can be overwhelming," says Helen. "Trying to pinpoint what's a priority for you, what motivates you, helps in selecting a job."

Eventually, Helen wants to help remote and disadvantaged communities to address public health issues, but for now she loves the autonomy and diversity that her current role gives her. "Work with people who want to make a positive impact and who are passionate about what they do. It's contagious." – *Amelia Caddy*

BACHELOR OF SCIENCE (CLIMATE SCIENCE + STATISTICS), MACQUARIE UNIVERSITY >> MASTER OF PUBLIC HEALTH, UNIVERSITY OF MELBOURNE >> PROJECT ASSISTANT, MURDOCH CHILDREN'S RESEARCH INSTITUTE

RESEARCH ASSOCIATE, MONASH UNIVERSITY >> EXECUTIVE OFFICER, ANZMUSC CLINICAL TRIALS NETWORK

SUPPLIED

OUTSIDE THE BOX

Being chained to a desk all day not for you? Not all maths and data jobs involve spending 9-to-5 stuck inside!

Want a career as far away from a desk or a screen as possible? Then you might think there's no need for sticking with maths in the classroom. Not so fast! Maths is a crucial foundation for plenty of outdoorsy careers.

Dream of working in Mother Nature? A career path in environmental science or Earth sciences such as geology involves lots of remote fieldwork – and maths!

Sports-mad? You could apply maths to become a sports statistician or data analyst to help elite athletes improve their performance and strategies.

START YOUR CAREER HERE

MATHS+DATA+OUTDOORS STUDY

Bachelor of Science (Mathematics) / Bachelor of Biodiversity and Conservation, Macquarie University

Bachelor of Mathematics / Master of Teaching (Secondary), QUT

Bachelor of Engineering (Civil) (Honours) / Bachelor of Science (Marine and Freshwater Science), Edith Cowan University

MATHS+DATA+OUTDOORS JOBS

Carpenter: $45K–$95K

Environmental scientist: $54K–$90K

Geoscientist: $88K–$147K

Marine engineer: $60K–$196K*

*Source: salaries according to payscale.com

People who work in construction and building design also use maths on the daily and site visits are a big part of the gig!

Sure, most VET-qualification trades tend to be not so office-bound, but they still rely on more maths than you might expect, like measurement and conversion.

You don't have to be a maths genius to figure out this subject adds up to more career options under the Sun!

SHUTTERSTOCK

WORK-FROM-ANYWHERE POTENTIAL

IN THIS DIGITAL AGE, STEM JOBS DON'T AUTOMATICALLY MEAN AN OFFICE COMMUTE

Not all opportunities to work outdoors mean being a marine scientist swimming with dolphins, or a tradie working in the sun. Traditional corporate jobs are increasingly going remote.

Currently, two thirds of Aussie employees are setting up desks at home – or a sunny cafe courtyard! – changing how work-life balance looks in the 21st century. So don't discount maths when planning your dream career, indoors *or* out. – *Gemma Chilton*

For more outdoor STEM career inspo visit **CareerswithSTEM.com/outdoors**

A CUT ABOVE THE REST

AMANDA WOODHAMS' LOVE OF THE OUTDOORS TOOK HER CAREER TO NEW HEIGHTS

AMANDA WOODHAMS
ARBORIST + HORTICULTURIST

- ARBORIST + HORTICULTURIST
- DIPLOMA OF ARBORICULTURE, MELBOURNE POLYTECHNIC
- CERTIFICATE III, ARBORICULTURE, MELBOURNE POLYTECHNIC
- HORTICULTURIST T, CRUDEN FARM
- ASSOCIATE DEGREE IN URBAN HORTICULTURE, HORTICULTURE, UNIVERSITY OF MELBOURNE
- PERMACULTURE DESIGN CERTIFICATE, CERES

On any given workday, you might find Amanda up a tree, balancing on the end of a branch and pruning. Amanda is an arborist who helps people care for their trees. "I share the fundamentals of tree care and pruning techniques that lead to improved tree health, structure and beauty," she says.

Amanda runs her business with her best friend, Nick Bond. They met at Melbourne Polytechnic.

"We used to climb every weekend to keep up with the aerial tree climbing tests we had to complete to graduate with our Certificate III in Arboriculture."

From climbing tests to walking around campus identifying trees, Amanda's 'learning by doing' studies suited her. "I can't stand sitting in a room and listening to a teacher speak at me for hours," she says.

FROM STEM TO STEM

Maths and science are a big part of Amanda's job as an arborist. "Last week I was collecting data on 150 trees at Foster Secondary College using a risk matrix to categorise how much risk each tree posed to students. That's how we figure out which trees get prioritised for climbing and pruning," she says.

"Tree care requires a deep understanding of science (ecology, biology and horticulture) and an artistic eye for bringing out the best in a tree. That's what I love about it, the mix of science, physicality and creativity."

Amanda says there is a major skills shortage in many of the green industries in Australia and if you're wondering what it's like working outdoors, she has three words: "It's the best." – *Sarah Kellett*

@woodybynature

"TREE CARE REQUIRES A DEEP UNDERSTANDING OF SCIENCE"

PHOTO: ELLA PALIJ

Click and career

Shopping for a STEM role that flexes your maths and data smarts? Retail is undergoing a tech revolution – and there are loads of future-focused jobs for sale

Gone are the days of having to mission it to a real-life store. In 2022, one minute you could be cruising Facebook and the next you're clicking on an algorithm-driven ad served by an AI (artificial intelligence) chatbot.

Ever need an item super-fast? Thanks to the maths and data skills of next-gen retail staff, a driverless drone could have it delivered within hours.

"The tech we use to do our jobs is always changing – like payment capabilities and supply chain processes," says JB Hi-Fi area manager Majid Dubloo.

He's seen the digital revolution firsthand – and the career opportunities that have come with it. "For us, the maths is about data and customer insights," Majid says.

With 900,000+ new retail gigs requiring data management and interpretation skills, there's more wanted ads for skills and a talent for maths than ever before. – *Cassie Steel*

START YOUR CAREER HERE

MATHS+RETAIL STUDY

Master of Data Science, University of Adelaide
Bachelor of Artificial Intelligence, Deakin University
Graduate Certificate in Business Data Analytics, Charles Sturt University

MATHS+RETAIL JOBS

Blockchain developer: $85K–$135K
Cyber security analyst: $53K–$114K
Digital strategist: $50K–$147K*
*Source: salaries according to payscale.com

TAKE STOCK

THERE'S A PLACE FOR OLD-SCHOOL MATHS IN RETAIL TOO. HERE ARE SOME OF THE MOST COMMONLY USED FORMULAS INSTORE AND ONLINE:

BREAK-EVEN ($)
= Fixed Costs ÷ Gross Margin Percentage
Used to determine whether a company has made their money back from a sale

GROSS MARGIN
= Total Sales - Cost of Goods
To simply find the difference between what an item costs and what it sells for

MARGIN %
= (Retail Price - Cost) ÷ Retail Price
The amount of gross profit a business earns when an item is sold

BUY IT

These numbers-based eCommerce processes have changed big-time...

AGES AGO	2022
Layby	AfterPay
Cash	Digital wallets and mobile payments
Customer surveys	Complex data analysis
TV advertisements	Targeted, algorithm-driven FB ads
Instore purchases	Drone-led deliveries
IRL security	Sophisticated cyber security structures

** BLOCKCHAIN INCOME FROM SALARYEXPLORER.COM AUSTRALIAN SITE. SHUTTERSTOCK

JOBS FOR SALE

Data scientist: After an emerging role that employers are frothing for? Data scientists are among Australia's most in-demand employees! Consumer insights are up there with the most powerful levellers a retailer can use to make informed business decisions based on who their customers are – and what they're into – and mining it requires some seriously sophisticated stats skills.

Analysts fluent in customer analytics allow brands to predict trends and understand complex consumer behaviours. And the coolest part? All your favourite companies are hiring – think ASOS, Amazon, The Iconic and JB Hi-Fi!

Bonus! Along with the sweet staff discounts, grads fresh from university can be paid up to the $100,000 range, with seasoned data scientists expecting closer to $150,000 and up.

"FOR US, THE MATHS IS ALL ABOUT DATA AND CUSTOMER INSIGHTS"

eCommerce manager: With online purchases up 57 per cent year-on-year since 2020 (cheers, COVID-19), retail businesses are rapidly transitioning to digital-led platforms. Increasing numbers of maths grads are being employed to implement AfterPay capabilities, automate logistics and supply chain processes, work on UX (user experience) projects and set up digital security systems.

Bonus! There are loads of entry-level eCommerce jobs – some that even hire undergrads! Look into customer service, admin, warehouse or junior marketing gigs to gain some experience before you graduate. Fluency in numbers, a must.

Blockchain developer: As some of the most searched crypto jobs in Google, blockchain gigs aren't just reserved for managing Bitcoin. Blockchain developers are responsible for creating systems for recording secure digital and data transactions, including those made via digital wallets in eCommerce stores. Maths grads should have the recommended experience with large code bases and a strong knowledge of common algorithms and data structures.

Bonus! With STEM skills being so transferable, roles in blockchain and cyber security allow maths and commerce grads to get stuck into their tech talents too. Look into a double degree – or add some maths and data units to your computer science path.

AUTOMATION NATION

In the age of AI and automation, maths and data reign supreme

Catch me up! What's AI?

AI (or artificial intelligence if you want to be formal!) is all about developing computer systems that use data to perform "intelligent" tasks like visual perception, understanding natural language, reasoning and decision making. Machine learning (ML) is one way of building these systems, where you provide a computer with examples of what it should do, then it learns how to do it. Behind all of this is not magic, but maths! – *Louise Meers*

START YOUR CAREER HERE

MATHS+AI AND AUTOMATION STUDY

Bachelor of Artificial Intelligence, Deakin University

Bachelor of Mathematical and Computer Science (Artificial Intelligence), University of Adelaide

Bachelor of Mathematics/Bachelor of Computer Science, University of Wollongong

MATHS+AI AND AUTOMATION JOBS

Automation engineer: $57K–$120K

Machine learning engineer: $57K–$130K

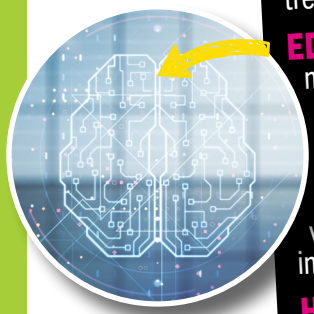
Software engineer: $57K–$118K*

*Source: salaries according to payscale.com

WHERE AI IS USED

AGRICULTURE: provides real-time data on crops, water supply and areas that might need fertilisation or treatment.

EDUCATION: makes classrooms accessible to students who speak different languages, or those with visual or hearing impairments.



HEALTH: screens for cancer, diagnoses COVID-19 and monitors patients over video telehealth systems.

LOGISTICS: detects fatigue in truck drivers and provide alerts to reduce accidents.

UTILITIES: analyses video footage from pipe inspections to find blockages.

**SOURCE: AUCYBERSCAPE.COM/LEARN, SHUTTERSTOCK

MATHS SKILLS LIST

If AI, automation or ML sound like something you want to get into, it's time to become best mates with maths. Knowing your stuff in the following areas will definitely give you the edge.

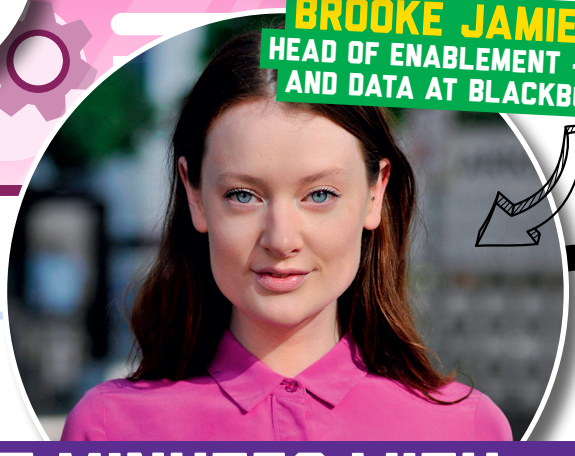
- [ ] ALGORITHMS
- [ ] CALCULUS
- [ ] GAME THEORY
- [ ] LINEAR ALGEBRA
- [ ] PROBABILITY
- [ ] STATISTICS

FUN FACT

The demand for ML is huge! Employees at the LinkedIn Top Companies (which include big names like Amazon, IBM and Apple) grew their skills in this area by 23% in 2021.

So is automation the same thing?

Nope! Automation is when machines are programmed to perform human tasks. AI needs the machines to do the whole 'think like a human' part too.



BROOKE JAMIESON
HEAD OF ENABLEMENT – AI/ML AND DATA AT BLACKBOOK.AI

5 MINUTES WITH ...
BROOKE JAMIESON HEAD OF ENABLEMENT – AI/ML AND DATA AT BLACKBOOK.AI

HEAD OF ENABLEMENT (AI/ML AND DATA), BLACKBOOK.AI

DIGITAL STRATEGIST, PLACEOS

BACHELOR OF SCIENCE (EXTENDED MAJOR IN MATHEMATICS), UNIVERSITY OF QUEENSLAND

CwS: Hey Brooke! Why is maths so important in AI and automation?

BJ: Mathematics is all about creatively solving problems using technical frameworks and working in AI and automation is quite similar! Just like in mathematics, being able to break down a big AI or automation problem into smaller and more manageable chunks means you can build on what you know already, even if you're the first one to attack a given problem. Obviously, there's lots of mathematics behind the scenes in AI/ML and data science, but the creative problem-solving aspect is really important too!

CwS: What's your top tip for students who want a career in this area?

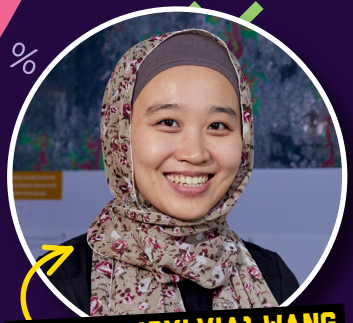
BJ: Make the most of the opportunities around you! There are so many resources and programs out there for people wanting to learn to code, or to participate in a hackathon, or attend a workshop. Have a look around for what's available near you and don't be afraid to have a go! There are so many opportunities in emerging tech fields, which can make it a bit tricky to work out what your path will look like. The best thing to help with this is meeting people in your local community who are working on things that interest you!

"THERE ARE SO MANY RESOURCES OUT THERE"

Quick quiz...
What does Siri, a driverless car and a manufacturing robot have in common?
They're all examples of everyday AI!

NEXT STEPS

Ready to become mates with maths? These resources will help you embrace the M in STEM!



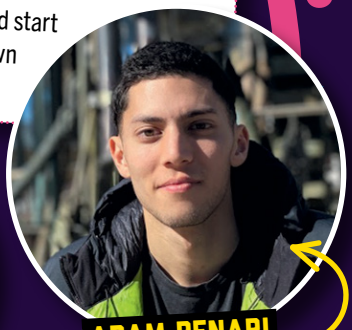
XUEYING (SYLVIA) WANG
ACTUARIAL CONSULTANT

Read their stories at CareerswithSTEM.com/maths-people

Find mentors and role models

Want real-life career inspo from maths and data grads who've gone before? CareerswithSTEM.com is packed with maths and data role models. Read their stories and start dreaming about what your own future career might look like.

MICHAELA DOLK
FLOOD ANALYST



ADAM BENARI
DATA SCIENTIST

Listen up!

Load up your earbuds with these podcasts and you'll never think of maths in the same way again

1. *Freakonomics*
Discover the "hidden side of everything" in this famous podcast that mixes statistics, economics and psychology for some seriously interesting listening.
freakonomics.com

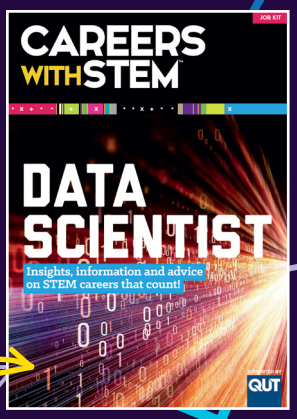
2. *Quick and Dirty Tips – The Math Dude*
With super-easy-to-search episodes like "How to Convert Decimals to Fractions" and "What is Exponential Growth?", this podcast will help you through tough maths topics and inspire a love of maths!
quickanddirtytips.com/math-dude

3. *Inspired by Math!*
Blogger Sol Lederman interviews people who are inspired by maths and inspiring other people along the way (including, hopefully, you!). **Search for it in Apple Podcasts**

4. *A Brief History of Mathematics*
In 10x15-minute episodes, Professor Marcus du Sautoy argues maths is the driving force behind modern science. Each ep looks back on some of the biggest math minds in history. **bbc.co.uk/podcasts/series/maths**

So you want to be a data scientist?

LOVE NUMBERS, ANALYSIS, TRENDS AND COMPUTERS? CAREERS IN DATA SCIENCE ARE SOME OF THE FASTEST GROWING RIGHT NOW. THANKS TO OUR INCREASINGLY DATA-DRIVEN WORLD! FIND OUT EVERYTHING YOU NEED TO KNOW ABOUT THIS MATHS + DATA-HEAVY CAREER IN OUR FREE 8-PAGE JOB KIT!



BIT.LY/DATASCIENCEJOBKIT

Answer from p9 (using Caesar Cipher): "maths is the coolest!"

SHUTTERSTOCK

FLIP OVER FOR ECOMONICS

REFRACTION MEDIA

CAREERS WITH STEM.COM

Commonwealth Bank

RESERVE BANK OF AUSTRALIA

We acknowledge the Traditional Owners of country throughout Australia and recognise their continuing connection to land, waters and culture. We pay our respects to their Elders past, present and emerging.

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