

# CAREERS WITH STEM™

## MATHS+DATA

**RISK  
EXPERTS**

What maths  
do you need  
for trades?

p21

Two risk experts  
count the cost of  
climate change

p19

YouTuber  
unpacks the  
maths behind  
growing your  
followers

p34

CAREERSWITHSTEM.COM





# Understand the world – one data set at a time

Ready to work with your favourite AFL club or a global tech company while gaining practical skills in maths and data? RMIT's industry-connected degrees will help you launch an exciting career in numbers.

Did you know the number of people working as Mathematicians, Actuaries and Statisticians grew very strongly from 4,400 in 2014 to 7,200 in 2019?<sup>1</sup>

In RMIT's maths and data degrees, gaining sought-after problem-solving skills isn't all about equations on a whiteboard. It's about applying classroom theory to real-world scenarios, like industry-sponsored projects and placements with Microsoft, ANZ, AFL clubs, Deloitte, Police Victoria and Amazon Web Services<sup>2</sup> - just to name a few.

Get ahead of what's next in maths and data at RMIT.

Learn more: [rmit.edu.au/maths](https://rmit.edu.au/maths)

<sup>1</sup> <https://joboutlook.gov.au/occupations/actuaries-mathematicians-and-statisticians?occupationCode=2241>

<sup>2</sup> Applied Maths and Stats: [rmit.edu.au/bp083](https://rmit.edu.au/bp083)

Data Science: [rmit.edu.au/data-science-from-job-growth-to-industry-opportunities](https://rmit.edu.au/data-science-from-job-growth-to-industry-opportunities)

What's next...



# MATHS IS EVERYWHERE!

In today's digital society, maths and data are a driving force for the growing digital economy globally

**M**aths has superpowered technology. As technology is increasingly bursting into our world, data is becoming hugely relevant and maths is taking centre stage. Maths and data are also powerful tools for solving problems in digital computation which greatly affect how we communicate every day.

The COVID-19 pandemic has changed the world immensely, possibly forever. Thanks to the sophistication of statistical and data analysis techniques, we can now assess how previous pandemics played out and understand their impacts.

When I was growing up, I found science the most fun thing to learn about. I loved watching Julius Sumner Miller's science show, *Why is it so?* Each week, he'd solve problems in physics and chemistry. Almost everything involved maths!

This *Careers with STEM: Maths + Data 2021* magazine is a brilliant resource. I wish I had something similar to inspire and guide me when I was growing up. Not only does it open your eyes to all the ways maths is used, but it also showcases inspiring role models and career paths in the areas of health, business, trades, security, society and more.

No matter what you are doing in your life, learning fundamental maths is a gift to all of us. It provides you with the necessary tools to make decisions and find solutions in each step of your career.

This is a time of great challenges and maths is one of the most powerful tools we need to face



PROFESSOR  
CHERYL E PRAEGER

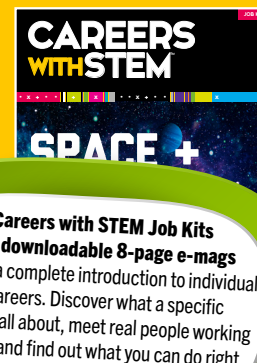
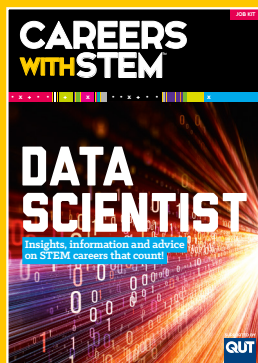
**NO MATTER WHAT YOU ARE DOING IN YOUR LIFE, LEARNING FUNDAMENTAL MATHS IS A GIFT**

the future. Finding our way through these challenges such as pandemics, climate change, waste management, recycling, sustainable agriculture, cybersecurity threats – and solving these problems – will be extremely exciting.

Australia needs you as up-and-coming STEM professionals, creating the best possible environment and society for us today and making the world a safer and better place for the future.

**Professor Cheryl E Praeger AC**, Senior Honorary Research Fellow, University of Western Australia and supporter of Women in STEM.

# STEM JOBS SET TO BOOM!



The **Careers with STEM Job Kits** are free downloadable 8-page e-mags which offer a complete introduction to individual STEM careers. Discover what a specific STEM job is all about, meet real people working in that job and find out what you can do right now to set your career on the right path.

[CareerswithSTEM.com.au/product-category/stem-job-kit/](https://careerswithstem.com.au/product-category/stem-job-kit/)

**CAREERSWITHSTEM**



# What's inside?

**P5** Seven highly paid jobs

**P6** Everyday maths

**P8** Closing the maths and data science skills gap

**P9** Ask a student

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**P16**



## STEM + X =

Looking for ways to combine maths (STEM) with your passion (X)? Start here!

Maths + ...

**P12** Health

**P18** Business

**P20** Trades

**P22** Security

**P24** Society

**P26** Agriculture

**P28** Education



**P24**



**P6**

**P14**

Your heart beats about

**100,000**

times a day



**P20**

**I FOUND MATHS VERY IMPORTANT FOR WHAT I AM DOING NOW, BUT IT'S NOT THE TYPE OF MATHS THAT YOU NEED TO MEMORISE" STEF APOSTOLIDIS**

## WHY MATHS+DATA?

The National Skills Commission has put jobs in data science at the top of its "emerging occupations" list. That means graduates with data analytics know-how will find their skills listed in Australian job ads over any other skills. Maths, specifically, is critical to not only fast-growing STEM jobs but also careers in insurance, health, trades, security, agriculture and more. Of all the STEM elements (Science, Technology, Engineering and Maths) students have the most trouble imagining what a career in maths might look like so we're here to help.



**P26**



# HOW MUCH IS IT WORTH?

If you're interested in a career that involves numbers and have ever wondered what your salary might look like per year, check out these seven maths-related jobs to see how much you can get paid to be an expert!

#1

Chief Financial  
Officer

**\$157K**  
per year

#2

Senior  
Data Scientist

**\$141K**  
per year

#3

Senior Finance  
Manager

**\$130K**  
per year

#4

Senior Data Engineer

**\$134K**  
per year

#5

Senior Financial  
Analyst

**\$106K**  
per year

#6

Senior  
Actuarial Analyst

**\$99K**  
per year

#7

Senior Data  
Analyst

**\$99K**  
per year



# MATHS AND THE CITY

Proof that maths is used outside the classroom

## Unit conversion

Solar panels collect the sun's rays and turn them into energy. The rays get sent to an inverter, which takes the DC (direct current) energy and turns it into AC (alternate current) energy – this is what houses and buildings use to power themselves.

## Trigonometry

Construction workers use trig to calculate the best way to build projects that are safe and stable. They need it for everything from making walls parallel and perpendicular to getting roof inclination right.

## Ratios

The VCR (volume capacity ratio) measures the level of congestion on a road based on traffic volume and road capacity. This helps transport authorities figure out ideal speed limits, as well as make adjustments to ease congestion.

## Biometrics

If you unlock your smartphone using your face, you're using maths! Facial recognition relies on biometrics – body measurements and calculations related to human characteristics – to verify identity.



## Probability

Weather forecasting is all about probability, especially when it comes to rain. The probability of precipitation (the chance of rain) is calculated from the product of two variables – confidence and area affected.

## Geometry

Pilots use geometry to calculate angles for taking off and landing. They need to get this right to avoid damage to the plane and, well, crashing!

## Artificial Intelligence (AI)

Supply chain management (the management of the flow of goods and services) uses AI to help with capacity planning, route optimisation and data analysis. This saves businesses time and money.

## Logarithms

Loved by few, used by many! Logarithms are used to measure the pH levels of different bodies of water to see how acidic they are.

## Algorithms

Ever wondered how your tablet or device just so happens to select the most relevant ads and news for you? That's the work of algorithms, based on what you've been clicking on and where you're located.

The movement of an elevator is also determined by a simple algorithm. The algorithm decides when the elevator should stop, travel in the same direction, or change direction according to requests (AKA people pressing buttons). – Louise Meers



# CLOSING THE GAP!

Australia needs mathematicians and data scientists in the workforce to compete in the global digital economy



**LILLIAN  
AJURIA**  
LAW PARTNER

## Global competition

A Data Skills and Capability in the Australian Public Service report notes that Australia's ability to remain competitive in the digital economy is reliant upon harnessing the value of data: "Australia needs to be supported by a workforce that has the skills and capability to analyse and extract the most value out of the data. And therefore, the biggest skills gap that currently exists is in data analysis."

Lillian says the Australian Government's Global Talent Visa Program is "attracting a lot of interest from individuals all over the world with backgrounds in data and maths". Which can only be a good thing.

"More companies are looking to connect with these individuals and there is certainly a strong feeling that opportunities for new graduates and those with experience in these fields will be in high demand for some time," she says.

**D**ata and maths skills are in big demand in industry, but not enough graduates with these skills are coming through. One way to fill that gap is skilled migration. Each year the Australian Government allocates places to people looking to live here under a "Skilled stream", so temporary visa holders and permanent residents can contribute specific skills to the workforce. Post-COVID-19, the demand for these skills is growing.

"As we emerge from the pandemic, we are seeing a real increase in enquiries from companies wanting to hire skilled data scientists and those with a background in mathematics," says Lillian Ajuria, at partner at Ajuria Lawyers who specialises in corporate immigration. "Australia is clearly competing with other western countries for this talent as we deal with a skills shortage."



**ASHISH SETHI**  
PRINCIPAL  
SOLICITOR

## Sign me up

If you're an on-shore international student studying maths or data science, there are opportunities in the Federal Government's migration program strategy.

Migration program planning levels are set by the Department of Home Affairs and they're divided into state and federal-based occupation skills lists.

According to Ashish Sethi, principal solicitor at Migration Law Firm, some of the most sought after maths and data occupations in the GSM (general skilled migration) and ENS (employer nomination scheme) programs are:

- **Mathematicians**
- **Accountants**
- **Statisticians and Economists**
- **Data Scientists**

"Australia is a country of innovators," says Ashish. "The Federal Government continues to encourage and promote immigration pathways for students and applicants from STEM backgrounds, including maths and data science."

— Astha Singh

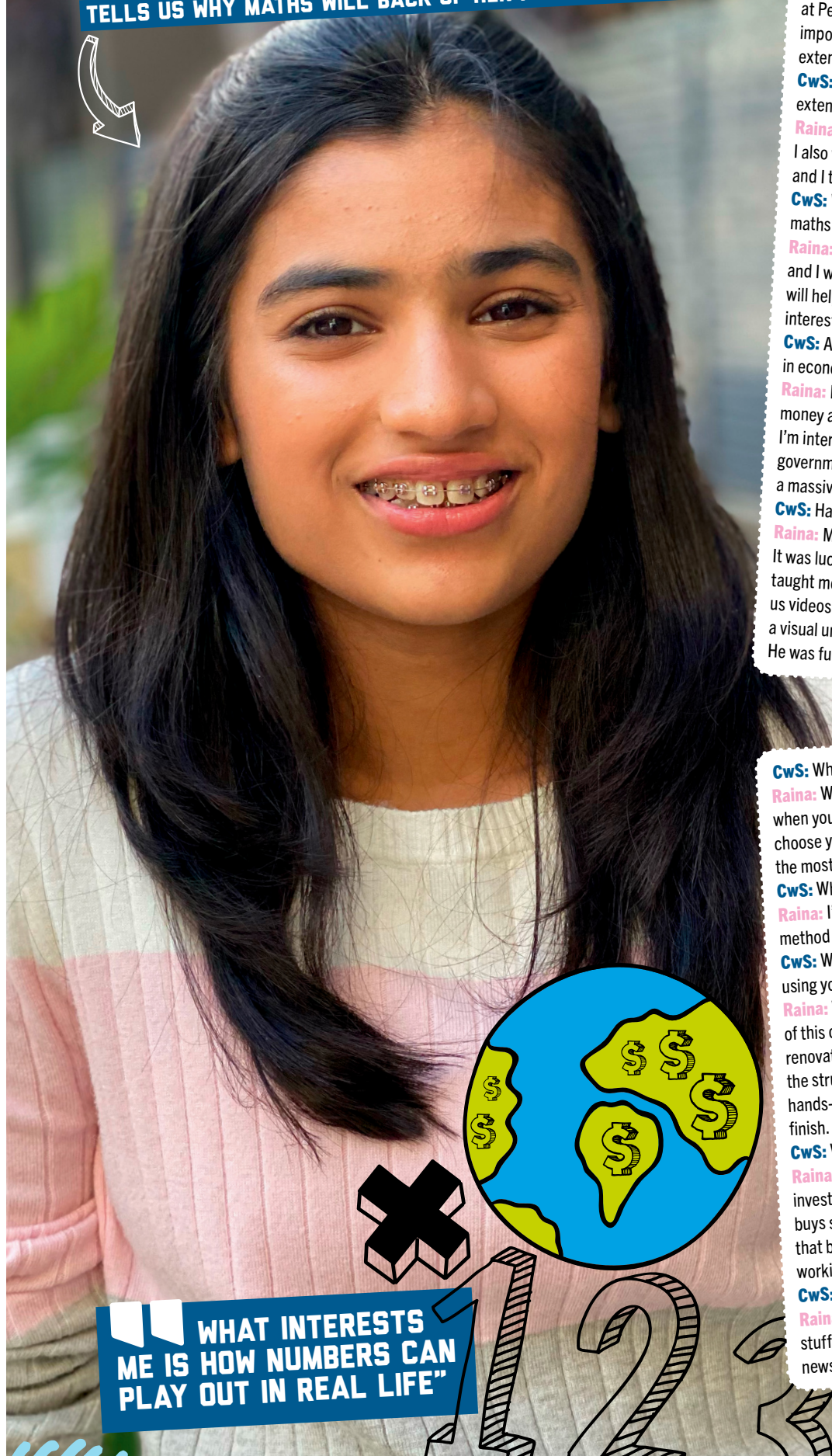
**AUSTRALIA IS A  
COUNTRY OF INNOVATORS"**



# ASK A STUDENT!



**RAINA JAIN FROM PENRITH SELECTIVE HIGH SCHOOL IN SYDNEY TELLS US WHY MATHS WILL BACK UP HER FUTURE CAREER PLANS**



**WHAT INTERESTS ME IS HOW NUMBERS CAN PLAY OUT IN REAL LIFE"**



**CwS:** Hey Raina, can you tell us about yourself?

**Raina:** My name is Raina Jain, I'm a year 11 student at Penrith Selective High School and a couple of important subjects I have taken this year are extension maths and economics.

**CwS:** What year 10 subjects encouraged you to take extension maths and economics in year 11?

**Raina:** Science (physics, chemistry) and economics. I also want to have a greater understanding of data and I thought these would be helpful.

**CwS:** What are you hoping to study in maths extension?

**Raina:** I'm really looking forward to studying graphs and I want to know more about trends analysis that will help me in economics. Most importantly, what interests me is how numbers can play out in real life.

**CwS:** And what are you looking forward to in economics?

**Raina:** I want to know how the government spends money and how money moves around the world. I'm interested in how money is controlled by the government, businesses, individuals and how it plays a massive role in our lives.

**CwS:** Have any teachers helped you along the way?

**Raina:** My maths teacher from last year was Mr Tan. It was lucky we had him. He was very engaging and taught most topics to us in creative ways. He showed us videos to explain basic concepts and that gave us a visual understanding of what was really happening. He was funny as well.

**CwS:** What do you like about solving problems?

**Raina:** When you understand a concept and then when you are given a problem to solve, you get to choose your own method to solve it. That has been the most fun and satisfying part for me.

**CwS:** What happens if you don't solve it first go?

**Raina:** I'd try again and again until I got the correct method and the accurate answer.

**CwS:** What was the most fun you've had at school, using your maths and data skills?

**Raina:** We did a STEM project renovating a block of this old building. We had to create a design to renovate it and consider things such as the height of the structure, trees around it, space and costs. It was hands-on and it took about four weeks from start to finish. That was a really cool learning experience.

**CwS:** What's your ultimate career pathway?

**Raina:** I want to take up finance. I am interested in investment banking. I get inspired by my dad – he buys shares and stocks so I'm keen to understand that bit of investment banking. I also like the idea of working for Google one day.

**CwS:** In a perfect world, what's your dream job?

**Raina:** I would like to be a presenter – just present stuff to large groups of audiences. Maybe a finance news person or present TEDx talks. – Astha Singh



# Join the information superhighway

Wherever there is data (um, everywhere) there's a need for data experts.  
Match your skills with the data jobs of today and tomorrow

## Today's Jobs

**SKILLS** Maths/Communications  
**JOB** Data analyst/business analyst/  
market research analyst

### WHAT YOU'LL DO

Turn boring numbers into compelling stories people can engage with. Data analysts use the tools of data engineers to analyse data and report on what they find – identifying trends, creating charts and visual representations of the data.

**SKILLS** Computer science/Maths

**JOB** Data engineer

### WHAT YOU'LL DO

Deal with millions of data points and manage the storage of data. Data engineers design, build and maintain the infrastructure needed for data generation, including tidying up raw data to make it readable and useful.

**SKILLS** Science/Maths/Languages

**JOB** Data scientist

### WHAT YOU'LL DO

Make hypotheses and evaluate them using scientific principles. Data scientists come up with their own questions (hypotheses) and create computer algorithms to make predictions based on data.

## GET SCEPTICAL

DATA ALLOWS US TO MAKE SENSE OF THE WORLD AND CHANGE IT FOR THE BETTER. BUT IF IT'S USED BADLY, IT CAN ALSO MAKE IT WORSE

Machine learning (automated analysis of data) can be used to make amazing discoveries, but it can also be used to amplify existing bias and prejudice – such as artificial intelligence (AI) systems that claim to pick the best people to hire. These systems are based on who the company has previously hired so if the company mostly hired men, the system will specifically select for males. Plus, the system uses its results to feed back into its behaviour so the more men it hires, the more likely it is to keep suggesting the same.

Predpol is a predictive policing system that uses past records of crime to predict future areas where crimes might occur. But if the police force is focusing on certain neighbourhoods because people of colour might live there, it means the area will be more heavily policed so they'll look to find more crimes. We all need to be data literate to spot the bad takes, the flawed data and the dodgy results.

**Linda McIver** Executive Director  
Australian Data Science Education Institute



**LINDA MCIVER**  
DATA SCIENCE EDUCATOR



# Future Jobs

**SKILLS** Maths/Law  
**JOB** Data ethicist

## WHAT YOU'LL DO

Tell stories that are skewed or selectively focused on areas of bias, and make sure companies are compliant with data laws. Establish legislation that protects us from unauthorised use of our data such as facial recognition being used to track our movements.

**SKILLS** Machine learning/  
Computer science  
**JOB** Data shepherd

## WHAT YOU'LL DO

Decipher near incomprehensible algorithms trained on data. "Data shepherds will use machine learning to guide a program towards being successful and correct in the future," says Greg Baker from General Assembly.

**SKILLS** Maths/English/  
Computer science  
**JOB** Data librarian

## WHAT YOU'LL DO

Keep track of vast quantities of data and find relevant data sets to make programs work better, tracking the provenance of data.

**SKILLS** Biology/Maths  
**JOB** Biostatistical  
data specialist

## WHAT YOU'LL DO

Keep track of – and utilise – biological data. In the future we might have an Apple watch that can diagnose disease, or instant genetic sampling of species. "There's a huge range of areas that can benefit from biological data in the future," says Greg.

**Show me the money:**  
The average annual income  
for a data scientist is set to pass  
**\$130K**  
within the next 12 months  
(\*2021 Deloitte).

**ADAM BENARI**  
DATA SCIENTIST



## HELPING CONNECT PEOPLE WITH SUPPORT

**ADAM BENARI USES DATA SCIENCE TO IMPROVE  
DISABILITY SUPPORT SERVICES**

Careers with data are some of the most in-demand job areas, with an anticipated growth in employment of almost 13% during the next five years. The roles are wide and varied.

Data science has three parts: computer vision, natural language processing and machine learning. And each area suits people with different skill sets.

"There are trillions of words of text being generated every day – the exciting part is trying to make sense of this," says data science industry leader and General Assembly educator Greg Baker. Careers in data involve using tools such as software and maths to look through raw data and recognise any patterns to help with a problem.

## EVERYONE BENEFITS

For 24-year-old Adam Benari, his path to becoming a data scientist at Hireup, one of the leading disability support providers in Australia, began as a family affair. His mum, who worked as an occupational therapist while Adam was growing up, found her way into support work at Hireup, which inspired him to give it a go, too.

Adam worked with people with disabilities and gained crucial experience in the admin department while he was studying at uni. From there, he contacted the head of data at Hireup and soon found himself a member of the team.

The role of a data scientist is extremely collaborative. "It's all about using analytical skills and tools to help companies answer business problems and identify trends," says Adam. One of the projects he's most proud of is Hireup's recommendations engine. It seeks to match data from the 20,000 profiles on the site to pair up support workers and people with disabilities who might be well suited.

The goal for the data science team at Hireup is to move the company, and the disability sector as a whole, forward in a positive direction.

Adam says young people interested in a STEM career should "follow their passion. That has to be the driver of everything you do." – Hannah Diviney

DATA SCIENTIST.  
HIREUP

DATA ANALYST.  
HIREUP

SUPPORT WORKER.  
HIREUP

BACHELOR OF ARTS (PSYCHOLOGY)/BACHELOR OF COMMERCE  
(BUSINESS INFORMATION SYSTEMS). MACQUARIE UNIVERSITY



# How doing the sums saves lives

Thinking of a career in health? Start by honing your maths skills

**M**aths isn't just about solving complex equations, it's also about saving lives. From deciding to stay at home to wearing a face mask on public transport, maths has helped us make decisions that have kept us safe during the COVID-19 pandemic.

"Mathematics, statistics and computing have all proven to be critical in managing the COVID-19 pandemic," says James McCaw, professor of mathematical biology at The University of Melbourne.

One example is the famous basic reproduction number, or  $R_0$  (pronounced R-naught), which tells us the average number of people who will catch COVID-19 from one infected person if we don't make changes to our behaviour, such as practising social distancing.

Mathematicians like James use this number to estimate how quickly diseases such as COVID-19 could move throughout the population. This helps governments and public health officials make big



**JAMES MCCAW**  
PROFESSOR OF  
MATHEMATICAL BIOLOGY



@j\_mccaw

decisions that can help slow the spread. While James says he has always loved maths, it wasn't until after he finished his PhD in physics that he discovered how it could be applied to health.

Now he works alongside health professionals, doctors and clinical scientists on Australia's response strategy to COVID-19.

"We all rely on mathematics to do our job helping to reduce the spread and keep Australians safe," says James.

— Gemma Conroy

## START YOUR CAREER HERE

### MATHS+HEALTH STUDY

Bachelor of Data Science, Queensland University of Technology

Graduate Certificate in Health Economics, Management and Policy, University of Newcastle

Bachelor of Science (Health Data Science), UNSW

### MATHS+HEALTH JOBS

Epidemiologist: \$68K-\$144K

Biostatistician: \$75K-\$117K

Data scientist: \$63K-\$137K

Healthcare consultant: \$53K-\$147K\*

\*Source: salary according to payscale.com

**WE ALL RELY ON MATHEMATICS TO DO OUR JOB HELPING TO REDUCE THE SPREAD OF DISEASES AND KEEPING AUSTRALIANS SAFE**

## DIAGNOSING THE DATA

**CATHY YUEN YI LEE HAS APPLIED HER STATISTICAL EXPERTISE TO ROLES IN PUBLIC HEALTH ALL OVER THE WORLD**

**A**lthough she is now based in Zurich, Switzerland, as a data scientist at Google, Cathy Yuen Yi Lee spent a large chunk of her career as a biostatistician tackling public health challenges.

"In very simple terms it's applying statistics to medical and health problems," says Cathy. "It can really make a difference to public health policy." This was the case when she analysed risk factors for a NSW State Health Plan around premature babies.

While she has landed some spectacular jobs, from Harvard University to Google, Cathy says she didn't start out with a detailed set of goals.

"My university training helped me discover what I wanted my career to be like," she says. And from mathematics to critical analysis, Cathy is still applying those skills today. "I met a lot of amazing and inspiring people to help me grow. It was worth all the years of study," she says. — Gemma Conroy



**CATHY YUEN YI LEE**  
DATA SCIENTIST

BACHELOR OF MATHEMATICS (ADVANCED HONOURS), UNIVERSITY OF WOLLONGONG

HEALTHCARE ANALYST, NEW SOUTH WALES AGENCY FOR CLINICAL INNOVATION

MASTER OF BIostatISTICS, UNIVERSITY OF SYDNEY

PUBLIC HEALTH RESEARCH FELLOW, HARVARD UNIVERSITY, US

PHD (MATHEMATICS), UNIVERSITY OF TECHNOLOGY, SYDNEY

DATA SCIENTIST, GOOGLE, ZURICH, SWITZERLAND

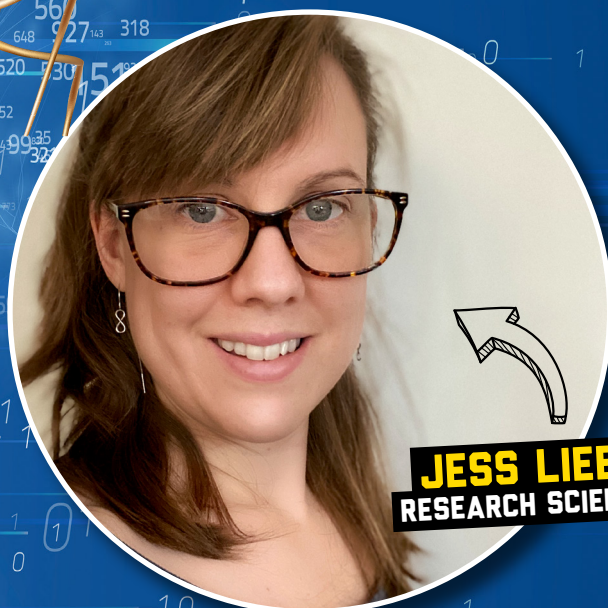


## What's next...

Make it RMIT:  
rmit.edu.au/school-leaver

## SKILLS THAT ADD UP

TACKLING INFECTIOUS DISEASES IS JUST ONE  
OF THE CHALLENGES YOU CAN SOLVE  
WITH A MATHS DEGREE



**JESS LIEBIG**  
RESEARCH SCIENTIST

When Jess Liebig was studying maths at uni, she never thought her skills would come in handy during a pandemic. Now, Jess and her team at the CSIRO are using massive data sets to model and predict the spread of infectious diseases from overseas in Australia. They're working on everything from COVID-19 to the mozzie-borne dengue fever.

### Changing things up

"I did my PhD in network science, which is often used to model disease spread, however that wasn't the focus of my work," says Jess.

But when she stumbled across a postdoc position (which you go into after a PhD) at the CSIRO focused on modelling the spread of dengue fever, she realised she could use her mathematical expertise to solve big problems in health.

A big part of her work involves analysing air travel records and disease incidence rates to forecast the likelihood of a disease spreading in Australia. Governments and public health organisations can use this information to develop plans to stop the spread ahead of time. Jess is also applying her maths know-how to explore how international travel restrictions have affected the spread of COVID-19.

"I thought it was really cool that I could apply all the skills I learnt previously to a new area and do something useful," she says.

Jess did her undergraduate degree, honours and PhD in mathematics at RMIT, which gave her a solid grounding in statistics, probability and modelling.

## WE'RE MORE AWARE OF HOW (MATHS) CAN BE APPLIED IN THE HEALTH SECTOR

Students enrolled in RMIT's mathematics and statistics degrees have the opportunity to participate in exciting industry placements in their third and fourth year with organisations such as Deloitte Australia, NAB and Police Victoria. Those who take on particular subjects also have the opportunity to apply for the SAS Joint Certificate Program to learn how to use business analytics software, and with statisticians jobs set to grow by more than 9%, it's worth knowing.

"Maths is a great foundation," says Jess. "We're becoming more aware of how it can be applied in the health sector. It's a skill worth having." – Gemma Conroy

RMIT MATHEMATICS AND  
STATISTICS ALUM

PHD. APPLIED  
MATHEMATICS. RMIT

POSTDOCTORAL RESEARCH  
FELLOW. CSIRO DATA61

RESEARCH SCIENTIST,  
CSIRO HEALTH + BIOSECURITY



# Numbers and the human body!

Numbers are all around us, from the alarm on your phone, to heating up food in the microwave. Every day throws some kind of sequence at us. And it's important to pay attention because digits can also have an impact on your overall wellbeing

There are plenty of jobs in health that rely on knowing your way around maths and data. Think biostatistician, medical lab technician, nutritionist, biomedical engineer or geneticist. Sound fun? Check out some of the stats they study.

## Fun facts about the human body

The human **nose** can detect about **1 trillion** smells

**Hair grows fast!**  
About 15cm per year.  
The only thing in the body that **grows faster** is **bone marrow**

Your body has more than **600** muscles

Your skin has **1000s** of different kinds of **bacteria** on it

The average human adult has **2000 to 8000** tastebuds

Your heart beats about **100,000** times a day

Blood makes **10%** of your body weight

Without your **pinky finger**, you would **lose** about **50%** of your **hand strength**

## Daily recommendations\*

Unsaturated fats  
**11-20g**

Serves of fruit  
**2 serves**

Serves of vegetables  
**5-5.5 serves**

Dairy (milk, yoghurt, cheese etc)  
**3.5 serves**

Sugar  
**19-21g**

Steps per day  
**9000 to 11,500 steps**

\*SOURCE: DAILY ALLOWANCES AND RECOMMENDATIONS FOR KIDS AGED 12 TO 18 YEARS ACCORDING NUTRITION AUSTRALIA AND THE WORLD HEALTH ORGANISATION. ALWAYS CONSULT YOUR DOCTOR WHEN CONSIDERING A CHANGE IN DIET OR WHAT IS RIGHT FOR YOU.



# HIDDEN DEPTHS IN DATA

**REAL-WORLD DATA SKILLS ARE CRUCIAL  
FOR ALMOST ANY JOB OF THE FUTURE**

"My father was a biology teacher and avid fisherman," remembers Stacey Reinke. "So my first biology lessons were when I was three or four, showing me the different parts of the fish."

What the three-year-old Canadian couldn't have known was that her passion would lead to a field of study that hadn't been invented yet in a job across the globe.

Stacey is a senior lecturer at Edith Cowan University (ECU) – one of the world's top 100 universities under 50 years in the Time Higher Education (THE) Young Universities Rankings – and an expert in clinical and biomedical metabolomics.

"Metabolomics captures hundreds or thousands of chemicals in our blood or urine," she explains. "Then we use data science and computational biology approaches to look for patterns in the underlying chemical structure."

## Top of her game

Supported by a range of world-leading experts in the research centre of ECU's Centre for Integrative Metabolomics and Computational Biology, Stacey searches for these chemical patterns in conditions such as asthma to understand how best to treat patients.

She also works on designing better ways to find these patterns, which has become a passion: "When I have a large biological dataset and it's just numbers, I get really excited when I think of a different way to visualise my data, and then manage to discover something new."

As senior lecturer for ECU's new Master and Graduate Certificate of Data Science courses, Stacey draws on maths, statistics and computer science so students can learn to extract knowledge and insights from all types of data.



**STACEY REINKE**  
**SENIOR LECTURER**

She is keen for students to be prepared to use their skills in the real world, too.

Like all lecturers at ECU, Stacey is laser-focused on helping her students become "world ready" through industry-relevant courses, supportive study environments and world-class facilities. This university-wide focus has driven ECU to becoming the top-ranked Australian public university for undergraduate teaching quality for six years in a row in the latest QILT rankings. "We try to make the teaching very applied so our students are ready for their future employment," she says.

In their final year, Stacey's students either lead a research project with academic and industry partners or take part in a 12-week work-integrated learning placement.

## A data-driven future

"We're exposed to hundreds of thousands, if not billions, of bits of data every day and we have to try to process that," she says.

"So I think any industry now – from biotech and pharmaceuticals to defence and mining – is starting to rely on data-driven research, meaning there's a very wide range of careers opening up." – Ben Skuse

**I GET REALLY EXCITED WHEN  
I THINK OF A DIFFERENT WAY TO  
VISUALISE MY DATA, AND THEN  
MANAGE TO DISCOVER SOMETHING NEW"**

**BACHELOR OF SCIENCE,  
AUGUSTANA UNIVERSITY  
COLLEGE**

**PHD IN BIOCHEMISTRY,  
UNIVERSITY OF ALBERTA**

**POSTDOCTORAL  
RESEARCH FELLOW,  
MURDOCH UNIVERSITY**

**SENIOR LECTURER,  
EDITH COWAN UNIVERSITY**



# COVID-19 WARRIORS

The global pandemic has shone a light on scientists with the skills to understand and fight back against COVID-19

## BATTLE TO STAY AHEAD

A CSIRO team – including SS Vasan, Laurence Wilson and Michael Kuiper – use maths and health knowledge in a race against time with new SARS-CoV-2 mutations.

As the CSIRO's COVID-19 project leader, Vasan has been at the heart of Australia's pandemic response from the start. His 92-strong team was the first outside of China to grow stocks of SARS-CoV-2 (the virus that causes COVID-19), the first to show that ferrets are a useful animal to test vaccines, and the first to identify how the virus is mutating.

"Now, I'm working with Michael and Laurence to develop an early warning system concerning virus mutations," he says.

Some of this work involves designing new methods to track changes in the virus, as well as platforms to handle the enormous amount of data being collected from around the world. Other parts involve simulating how vaccines interact with new mutations of the virus.

Ultimately, the CSIRO researchers want to apply their knowledge about COVID-19 to develop "affordable vaccines and therapies that can withstand these mutations" and help end the pandemic. – Ben Skuse

## SS VASAN

### COVID-19 PROJECT LEADER

#### What do you love about your job?

"I love the fact that we can pursue deep collaboration between teams with complementary expertise. I learn something new from my colleagues in every single interaction. It's humbling. We are paid to think about – and solve – big problems that will make a difference. There's nothing more fulfilling than that."

#### Career advice for a future pandemic warrior?

"Take your time, gain broad skills and learn teamwork. Interesting stints in various roles around the world gave me first-hand experience and knowledge of the challenges scientists in resource-constrained settings face. It also gave me insights on how the same problem is approached differently by small businesses, big pharmaceutical companies and healthcare commissioners. And it showed me the need to operate at speed during emergencies."

**I LEARN SOMETHING NEW FROM MY COLLEAGUES IN EVERY SINGLE INTERACTION. IT'S HUMBLING"**





**MICHAEL KUIPER**  
**BIOMOLECULAR MODELLER**

**What does a biomolecular modeller do?**

"My work focuses on looking at proteins and how they interact with one another and small drug-like molecules. It's very dynamic – we look at the new genetic data almost on a daily basis, and we work together with scientists who specialise in other areas, such as growing viruses in cells, or bioinformatics, to help get the bigger picture. Virtual reality has also been a terrific help in visualising the virus proteins that I use."

**MY WORK IS VERY DYNAMIC. WE LOOK AT THE NEW GENETIC DATA ALMOST ON A DAILY BASIS"**



**LAURENCE WILSON**  
**BIOINFORMATICIAN**

**Best thing about your career?**

"I've always loved science and that gives me an excuse to constantly be learning new things and asking more questions. I'm fascinated by the problem-solving aspect; the moment when you finally figure something out or find that piece of evidence that proves your hypothesis is just the best. At CSIRO, I also get to focus on translational science – doing research that has a direct impact on the world and contributes to the global good."



**SHRUTHI MANGALAGANESH**  
**CSIRO INTERN FROM MONASH UNIVERSITY**

**What have you learnt from being on this team?**

"I've always been fascinated by the science behind how the human body works. During my internship at CSIRO, I worked on the scientific project on SARS-CoV-2, focusing on the virus mutation rate and the frequency of specific mutations in countries across the globe. I helped with the development of some codes to sort the data – there were over 200,000 entries – so it was easier to analyse. It has furthered my passion and opened my eyes into what a career in research looks like."



# More than a 9 to 5

It's official – data runs the world. But it's people who can use maths to understand data who will shape the future

**"T**he world's economy is powered by data," says Jeremy Dennis. "Everything we do creates a piece of data that is processed, stored, analysed, reported on and used to develop new products, services and, in many cases, disrupt entire markets."

As National Analytics Lead for Modis Australia, Jeremy should know. At Modis, he is using maths and data skills to solve problems for companies and build new technologies that transform the way organisations work.

For example, Jeremy's team built an algorithm that works like a colony of digital ants scampering through a complex web of data to spot patterns of criminal activity so police can zone in on criminals.

Jeremy will also soon be working with the Mercedes-



**JEREMY DENNIS**  
BIG DATA ARCHITECT

Benz EQ Formula E Team to help them try to win the FIA Formula E World Championship.

"Millions of data points will be captured that represent everything about the race car 200 times per second," he says. "We will analyse this data to find any opportunity to improve performance."

Maths and data skills have clearly been key to Jeremy's career, but he also sees these skills as being crucial for almost all future business careers. "There will be opportunities in every single industry for people who understand data, and maths is the language data uses."

The possibilities are endless. People with maths and data skills are increasingly needed in everything from medicine – where analysts uncover patterns in data to discover new treatments and drugs – to social media, where digital content managers track and react to trends so they can boost their company's online presence.

"It's impossible for me to express the scale of amazing opportunities that are available to people who understand maths and data," says Jeremy. – Ben Skuse

**IT'S IMPOSSIBLE FOR ME TO EXPRESS THE SCALE OF AMAZING OPPORTUNITIES THAT ARE AVAILABLE TO PEOPLE WHO UNDERSTAND MATHS AND DATA**

## START YOUR CAREER HERE

### MATHS+BUSINESS STUDY

Bachelor of Mathematical Sciences,  
Australian National University

Bachelor of Science (Advanced Mathematics)(Honours)/  
Commerce, University of New South Wales

Bachelor of Mathematics (Applied Mathematics),  
University of Wollongong

Bachelor of Commerce, University of Adelaide

### MATHS+BUSINESS JOBS

Cost estimator: \$46K-\$102K

Fraud investigator: \$61K-\$124K

Digital strategist: \$52K-\$144K

Information architect: \$89K-\$204K\*

\*Source: salaries according to payscale.com

NATIONAL ANALYTICS  
LEAD, MODIS

ENTERPRISE INFORMATION ARCHITECT, NSW  
DEPARTMENT OF EDUCATION AND COMMUNITIES

DATA ARCHITECT,  
LANGGATE, WA

BACHELOR OF ELECTRONIC  
ENGINEERING, CURTIN UNIVERSITY



# INSURING FOR GOOD

THE INSURANCE INDUSTRY ISN'T ALL ABOUT PREMIUMS AND CLAIMS. THERE IS ALSO COOL MODELLING AROUND HOW NATURAL HAZARDS MAY AFFECT PEOPLE'S LIVES AND THAT REQUIRES EXPERTS IN DATA AND ANALYTICS

Insurance Australia Group (IAG) is Australia and New Zealand's largest general insurance company. They've been around since 1851 so they know their stuff. During the years, IAG have answered all the big questions: when weather episodes strike, what are the risks? What does that look like from a cost perspective? What is the impact of climate change on business and the community?

There's a natural perils team at IAG dedicated to working with actuarial consultants, flood scientists, geospatial analysts and statisticians to help protect us. Let's meet some of the team...



**PERILS PRICING MANAGER**  
**PHILIP CONWAY**

Philip Conway joined IAG with a background in engineering and a PhD in hydrodynamic modelling. His unique skills now help him in his role as the perils pricing manager. Philip's team have built national models on hazards such as bushfires, floods and financial modules to identify the risks a customer is potentially exposed to. One of the coolest projects Philip was part of was the Pacific Highway connecting Sydney to Brisbane.

"I was responsible for developing the models that ensured the roadway and bridges could withstand floods as well as not make flooding worse for nearby communities," he says. "To this day when I drive on it, I see the contributions we made."

## GETTING INTO STEM

"As a child I always had a passion for understanding how things – and the world – worked," says Philip. "That passion, combined with an affinity for solving problems, especially through maths, made me want to pursue a career in engineering."

A Swiss, Irish and Australian national, Philip prides himself in ensuring that communities across Australia are built in ways that are compatible with current and future potential natural disasters.

**ACTUARIAL CONSULTANT**  
**SYLVIA WANG**

Sylvia Wang is an actuarial consultant at IAG. She advises on the pricing and reinsurance of natural risks. "My day-to-day job involves a wide range of tasks, from data analysis, programming and building logics, to model comparison, statistical modelling and reporting," she says.

## CHANGE IS KEY

One of Sylvia's course advisors had doubts about her ability to complete the maths during her actuary studies, which made Sylvia question where her degree would take her. "Overall, it was a tough decision to change to STEM, but I'm glad I kept going as I love the work I'm doing now," she says. "Never be discouraged by others if you love STEM. It takes a lot of passion and dedication to pursue the path."

Sylvia thinks STEM disciplines are evolving and converging. "You will be seeing people with diverse backgrounds working together," she says. "For example, a statistician might be working with medical experts to solve cutting-edge medical challenges; or engineers consulting with meteorologists to understand the impact of climate change. There is a lot of collaboration." – Astha Singh

BACHELOR OF INTERNATIONAL  
BUSINESS. UNIVERSITY OF  
TECHNOLOGY SYDNEY

MASTER OF  
ACTUARIAL PRACTICE.  
MACQUARIE UNIVERSITY

MASTER OF DATA SCIENCE.  
UNIVERSITY OF SYDNEY

ACTUARIAL  
CONSULTANT. IAG

PERILS PRICING  
MANAGER. IAG

SENIOR ENGINEER.  
WMAWATER

PHD ENGINEERING.  
UNIVERSITY COLLEGE DUBLIN

BACHELOR CIVIL ENGINEERING.  
UNIVERSITY COLLEGE DUBLIN



# Build your own path

Melbourne Chippy Chick **Stef Apostolidis** mixes maths and entrepreneurial skills with building site management

**S**tef Apostolidis, aka @melbournechippyckick, shares active onsite shots full of sunshine to her 150k Instagram followers. She's also the founder of the Tradie Lady Club, supporting and networking women in the trades (#tradieladyclub, @tlcbymcc, melbournechippyckick.com.au).

It's clear Stef loves her job as a site manager and carpenter now, but it took a few twists and turns – and getting across the in-depth maths courses – to discover the career she wanted.

"I wanted to do engineering at high school so I took up the more difficult maths units. I tried tutoring but just lost track," she says.

"I find maths very important for what I'm doing now, but it's not the type of maths you need to memorise, such as every times table. It's more important to memorise the methods of how to work out volumes, areas and materials."

Stef's day-to-day maths skills include time management, paying bills, ordering materials, estimating and quoting jobs. "Reading plans is critical in my job. Understanding numbers and symbols and converting that into a house takes a lot of hard work and understanding," she says.

Her advice to high school students thinking of study and career choices is to focus on subjects you enjoy "because that's what you will end up being good at. Think about what you enjoy most and try to envision that in a job." – Heather Catchpole



**STEF APOSTOLIDIS**  
CARPENTER + FOUNDER  
TRADIE LADY CLUB



**I CAN EAT MY LUNCH OUTSIDE ON A PILE OF DIRT. I CAN WORK IN SWEAT AND DIRT ALL DAY. I CAN GET CUTS AND SCRATCHES. I CAN LIFT VERY HEAVY THINGS. I LOVE THAT. BUT THAT'S ME"**

## START YOUR CAREER HERE

### MATHS+TRADES STUDY

Bachelor of Construction Project Management,  
University of Technology Sydney

Bachelor of Building Design Management,  
Western Sydney University

Master of Construction Management,  
University of Adelaide

### MATHS+TRADE JOBS

Carpenter: \$44K-\$95K

Construction site manager: \$61K-\$195K

Project manager: \$61K-\$163K\*

\*Source: salaries according to payscale.com

DIPLOMA OF BUILDING AND CONSTRUCTION  
SWINBURNE UNIVERSITY

CERT III IN CARPENTRY  
MELBOURNE POLYTECHNIC

YEAR 12 CERTIFICATE, ACADEMY  
OF MARY IMMACULATE



## STEF'S TYPICAL DAY

GET A COFFEE. GET TO SITE. MORNING RUN THROUGH OF WHAT THE DAY WILL INVOLVE. MAKE A LIST OF EVERYTHING THAT NEEDS TO BE COMPLETED. GET THE TOOLS OUT. MUSIC ON AND START BUILDING OR PLANNING...



@melbournechippyck

## QUICK STUDY OPTIONS

LOOKING FOR NON-UNI PATHWAYS? HERE ARE NINE CAREER AREAS WHERE VOCATIONAL PATHWAYS LET YOU TAKE YOUR MATHS AND DATA SKILLS DIRECT TO EMPLOYERS

### #1 CODING

**Maths used:** logic, algorithms  
**Employment:** software engineer, dev ops, machine learning engineer, UX designer  
**Course:** Advanced Diploma of Information Technology [bit.ly/ADiplnTech](http://bit.ly/ADiplnTech)



### #3 DATA SCIENCE

**Maths used:** statistics, mathematical modelling, abstract logic  
**Employment:** data scientist, data analyst  
**Course:** Online data science course, General Assembly [generalassemb.ly/education/data-science-remote-online](http://generalassemb.ly/education/data-science-remote-online)

### #2

### DIGITAL MARKETING

**Maths used:** statistics, percentages  
**Employment:** social media marketer, digital marketing manager, digital content coordinator  
**Course:** Diploma of Social Media Marketing [tafecourses.com.au/courses/digital-marketing/](http://tafecourses.com.au/courses/digital-marketing/)

### #4

### CYBER SECURITY

**Maths used:** algebra, probability, algorithms  
**Employment:** information security analyst, digital forensics, pen tester  
**Course:** Certificate IV in Cyber Security [bit.ly/Cert4Cyber](http://bit.ly/Cert4Cyber)

### #5

### FINANCIAL MATHS

**Maths used:** simple and compound interest, numeracy, probability, statistics  
**Employment:** accountant, bookkeeper, entrepreneur  
**Course:** Accounting and finance courses, TAFE NSW [tafensw.edu.au/courses/accounting-and-finance](http://tafensw.edu.au/courses/accounting-and-finance)

### #6

### CONSTRUCTION MANAGEMENT

**Maths used:** geometry, trigonometry, optimisation, measurement  
**Employment:** construction site manager, architect, urban planner  
**Course:** Advanced Diploma of Building and Construction (Management) [bit.ly/ADipConst](http://bit.ly/ADipConst)

### #7

### ELECTRICAL ENGINEERING

**Maths used:** trigonometry, geometry, calculus, mathematical modelling  
**Employment:** transformer design engineer, electrical engineer, automotive electrical engineer  
**Course:** Diploma of Electrical Engineering, TAFE NSW [bit.ly/DipEETAFE](http://bit.ly/DipEETAFE)

### #8

### CIVIL ENGINEERING

**Maths used:** algebra, statistics, calculus, differential equations  
**Employment:** project manager, civil/structural engineer, site engineer  
**Course:** Diploma of Engineering, University of Newcastle [newcastle.edu.au/degrees/diploma-in-engineering](http://newcastle.edu.au/degrees/diploma-in-engineering)

### #9

### CREATIVE INDUSTRIES

**Maths used:** algebra, measurement, geometry  
**Employment:** graphic designer, digital media producer, furniture designer, fashion designer  
**Course:** Cert II in Creative Industries [bit.ly/CertIICI](http://bit.ly/CertIICI)

## BY THE NUMBERS

### STUDY:

Most STEM vocational training is focused on engineering

**80% ENGINEERING**

**10% AGRICULTURE AND ENVIRONMENTAL SCIENCE**

**8% INFORMATION TECHNOLOGY**

**2% NATURAL AND PHYSICAL SCIENCES\***

### EMPLOYMENT:

Construction is the biggest employer of VET STEM-qualified workers

**15% CONSTRUCTION**

**15% MANUFACTURING**

**10% OTHER SERVICES**

**8% TRANSPORT, POSTAL AND WAREHOUSING**

**7% PUBLIC ADMINISTRATION AND SAFETY**

**20% of males and 9% of female VET STEM qualified workers earn \$104,000 and above\***



# Owning it: who's protecting your data?

Fancy being the next James Bond with a career in cyber security?  
You might not get to drive an Aston Martin but you will help to protect our country and your fellow Aussies

**R**ight now there's a shortage of cyber security workers, which increases the risk of us getting hit by a cyber attack. Australia's cyber security growth network AustCyber says there were around 14,000 cyber security jobs up for grabs last year. To fill the gaps, governments and industry urgently need STEM-smart grads. Hamza Sellak, a Postdoctoral Research Fellow at CSIRO's Data61, says it's "a really exciting time to be at the forefront of local and global cyber security". "The world's most valuable resource right now is data," he says. Data61 is the digital specialist arm of our national science agency, CSIRO, so Hamza should know.

## Valuable info

"One of the top research topics in cyber security is how to balance utility and privacy," he says. "You want the data but you also want to protect the privacy of individuals."

Hamza's work is on security involving wearables such as health and wellbeing gadgets.

"The data is really valuable as it can monitor performance and identify health issues, but users have no idea who controls it or can see it," he says. "We are trying to give the user more control over their own data. Then they can decide how private they want to be."

Hamza is in the human-centric security team which focuses on strengthening cyber



**HAMZA SELLAK**  
CSIRO RESEARCH FELLOW

security by understanding human behaviour and perceptions.

Hamza is also working on making mobile health apps safer. There are thousands of these, focusing on everything from sleep to stress, but, "there is no control over them," he says.

"So we are devising a tool to make sure those services satisfy the minimum requirements needed in terms of cyber security."

## Leading the way

"This could be a first in the world," says Hamza. "I haven't seen anything like this available in open app stores."

The work Hamza and his team do will help app developers be more cyber secure and make Australia cyber-safer. – Matthew Brace

## START YOUR CAREER HERE

### MATHS+SECURITY STUDY

Certificate IV in Cyber Security,  
Swinburne University of Technology (free TAFE course)

Bachelor of Science (Cyber Security),  
University of Western Australia

Bachelor of Cyber Security, Deakin University

Master of Cyber Security, Swinburne University of Technology

### MATHS+SECURITY JOBS

Cyber security analyst: \$52K-\$114K

Information security analyst: \$60K-\$134K

Data modeler: \$56K-\$173K\*

\*Source: salaries according to payscale.com

**THE WORLD'S MOST VALUABLE  
RESOURCE RIGHT NOW IS DATA**

MASTER OF SCIENCE IN INFORMATION SYSTEMS,  
DECISION SCIENCE, NETWORKS AND MULTIMEDIA.  
SIDI MOHAMED BEN ABDELLAH UNIVERSITY

PHD IN COMPUTER SCIENCE,  
MOULAY ISMAIL UNIVERSITY, MEKNES

CSIRO POSTDOCTORAL  
RESEARCH FELLOW, HUMAN  
CENTRIC SECURITY, DATA61



# SECURE YOUR FUTURE

ARMING YOURSELF WITH NUMERACY KNOWLEDGE COULD BE KEY TO CAREER SUCCESS IN DEFENCE AND SECURITY

Feel like a challenge? The defence industry needs mathematics graduates to work across a huge range of exciting careers all across Australia – and we don't mean just the forces. If you want exposure to the latest in secure tech, check out these examples of security-based jobs that are screaming out for maths and data-skilled people.

## Australian Defence Force

People working in defence and security use their mathematical research methods to analyse data, as well as modelling and simulating solutions to help the Australian Defence Force (ADF) make informed decisions about national security. When the ADF needs answers, each team member steps up to research, problem-solve and find the answers to issues on the rise. **Think: recruits, office management, police...**

## Online Shopping

Ecommerce relies on big data analysis and math modelling to gather info on customers and their shopping habits. To keep all that on the down-low and completely confidential, ecommerce services are now relying on data scientists to bring their in-depth cybersecurity knowledge to build maths-based solutions to protect the data, and keep the information that is stored secure. **Think: retail, entertainment, food delivery...**

## Cybersecurity

Data is all around us – our social posts, search history, online purchases, music and entertainment preferences leave a stream of data that forms our digital footprint. So cybersecurity specialists work everywhere. AustCyber says there are more than 52 career pathways to choose from in the cybersecurity space. **Think: banks, schools, health jobs...**

## Australian Navy

The Australian Navy's maritime capability relies on acquisitions in fleet, firepower and auxiliaries – so, what are the most efficient combinations it can buy, given Australia's naval missions and fields of operation? That's a job that requires skills in maths. Answering a battalion of 'what-if' questions is rewarding work for maths-minded peeps. **Think: specialised roles within the defence force...** – Astha Singh

# A CALCULATED CAREER

Mingmei Teo, a mathematician with Defence Science and Technology (DST) in Sydney, says a love of problem-solving led to her career that mixes maths and the military. "I wanted a career where I could make an impact or contribute to society," she says.

So she completed her Doctorate in Applied Mathematics at the University of Adelaide, with a focus on infectious disease, which she now uses in her current role assisting the Royal Australian Navy.

Mingmei says it was at uni when she realised the huge potential her maths studies had in solving real-world applications. Just like at uni, when using maths in defence jobs you need to communicate mathematical theories, calculations and outcome.

"You have to translate the problem that a client might have into algorithms, equations or a mathematical model," says Mingmei, "and then be able to explain your results in a way they can understand." – Astha Singh

**MINGMEI TEO  
MATHEMATICIAN**

BACHELOR OF MATHEMATICAL SCIENCES, UNIVERSITY OF ADELAIDE

PHD APPLIED MATHEMATICS, UNIVERSITY OF ADELAIDE

MARITIME CAPABILITY ANALYST, DST

MATHEMATICIAN, DST



# GETTING SOCIAL

There are some big changes happening in the maths world, which is good for society at large

**W**e see it every day: maths and STEM solutions help create and improve things we use, such as smartphones and skateboards. They help buses run on time (or almost on time!), architects build better buildings, companies predict profits, and medical experts track and fight diseases.

"Maths underpins everything," says Nalini Joshi AO. "It is playing an increasing role in society, solving everyday problems for everyone."

Data science companies such as Melbourne-based firm Eliiza are already onboard with this focus on society, with the company website setting the company tone: "This is more than

**ALWAYS LOOK BEYOND THE NUMBERS"**

## ADDICTED TO MATHS

**NALINI JOSHI IS ALL ABOUT DRIVING CHANGE IN MATHS AND STRIVING FOR EQUALITY**

**P**rofessor Nalini Joshi, AO, is one of Australia's leading mathematicians. She is Chair of Applied Mathematics at the University of Sydney, working on cutting-edge research in fields as varied as the distribution of large prime numbers, bus arrival times and how diseases spread. Her message to students: "Always look beyond the numbers."

"We want students to be able to answer questions they have not come across yet," says Nalini. "It's more about enabling students to ask the questions that will help them invent the maths tools of the future."

"Mathematics is a creative art, not just number crunching. You can use it to become a discoverer so don't let go of mathematics too early because it's essential for what's coming in your future."

Nalini is also a passionate campaigner for equality in Australia's STEM society. She has suffered sexism and racism here, notably arriving at meetings and conferences where – because she is female and Asian (she was born in Myanmar but has Indian heritage) – organisers assumed she was part of the kitchen crew.

She is, in fact, the first ever female maths professor at the University of Sydney and only the third female mathematician elected to the Australian Academy of Science. "The science community, like any community, needs diversity, not just in entry-level lecturer positions but in senior leadership roles," she says. – *Matthew Brace*

**NALINI JOSHI**  
**MATHEMATICIAN**

**BACHELOR OF SCIENCE (HONOURS),  
UNIVERSITY OF SYDNEY**

**PHD COMPUTATIONAL AND APPLIED  
MATHEMATICS, PRINCETON UNIVERSITY (US)**

**FELLOW, THE AUSTRALIAN  
ACADEMY OF SCIENCE**

**AUSTRALIAN RESEARCH COUNCIL GEORGINA  
SWEET AUSTRALIAN LAUREATE FELLOWSHIP**

**CHAIR, APPLIED MATHEMATICS  
AT THE UNIVERSITY OF SYDNEY**



# TAKING A DIFFERENT ROAD

**SOPHIA FRENTZ IS ON A MISSION TO BRING AWARENESS TO THE DATA INDUSTRY**

**SOPHIA FRENTZ**  
SENIOR DATA CONSULTANT

Sophia Frentz is not your average data consultant. A degree in genetics and a PhD in clinical genetics are not the usual requirements for the job. But explosions in data and tech are ripping up the rule books.

"There are so many different pathways to getting to what's right for you," says Sophia. "Take any pathway you want but don't forget to try stuff. You don't know what will scratch the itch on your brain."

Sophia is a senior data consultant with Eliiza, a progressive, Melbourne-based company that uses data science to build large-scale solutions.

"Eliiza has very strong ethics so we think of society as a whole and consider all groups," says Sophia, who is autistic, has a disability and identifies as non-binary (so uses the pronouns 'they' and 'them').

"I love solving complex problems," they say, "but for me it's also about whether I have the right to be non-binary in the workplace. A professional environment that respects my non-binary status is new."

Sophia has a side hustle, too, reviewing how the scientific community defines gender. "Spoiler alert – the answer is 'poorly'," they say. "Being female means many different things physiologically and psychologically – some women can menstruate and become pregnant, and some can't, for example – yet researchers often group all women as one."

"It can cause harm through misdiagnosis and inappropriate treatment. I'm hoping to change that thinking." – *Matthew Brace*



PHD MEDICAL GENETICS,  
UNIVERSITY OF MELBOURNE



SENIOR DATA  
CONSULTANT, ELIIZA



BACHELOR OF SCIENCE / GENETICS  
(HONOURS), UNIVERSITY OF OTAGO



TECHNOLOGY, STRATEGY AND TRANSFORMATION  
GRADUATE PROGRAM, DELOITTE AUSTRALIA



TAURANGA GIRLS COLLEGE,  
NEW ZEALAND



## START YOUR CAREER HERE

### MATHS+SOCIETY STUDY

Bachelor of Mathematics (Data Science), University of South Australia  
Bachelor of Mathematical Sciences, Australian National University  
Bachelor of Science (Maths / Computer Science), University of Sydney  
Bachelor of Science (Mathematics), La Trobe University

### MATHS+SOCIETY JOBS

Data analyst: \$51K–\$100K

Data scientist: \$63K–\$129K

Data engineer: \$61K–\$134K

Machine learning engineer: \$60K–\$136K\*

\*Source: salaries according to payscale.com

just technology. It means considering how AI [Artificial Intelligence] will drive value for businesses and society, and be used in transparent, ethical and fair ways."

Because maths is at the heart of so many solutions, it is also shaping the jobs of the future.

"Finance is a big area for maths grads but they might equally choose a different field such as interrogating data from videos or images to find patterns and trends... or working for YouTube, for example," says Nalini.

Eliiza's senior data consultant Sophia Frentz says data science can even be used to help particularly marginalised groups such as those with a disability, "even though most people still think tech is the cool blokes' club".

Nalini has previously spoken out about how women in particular are under-represented at senior levels in

STEM education in Australia. As part of her drive to bring awareness and change, Nalini helped set up the Science in Australia Gender Equity (SAGE) initiative, which encourages and recognises higher education and research hubs doing good work on gender equity, diversity and inclusion. As Maths and STEM play bigger roles in increasingly diverse societies, it makes sense that STEM communities themselves become more diverse, too. – *Matthew Brace*



# Farming by numbers

Is ag your jam? Then you're going to need strong maths and data skills

## START YOUR CAREER HERE

### MATHS+AGRICULTURE STUDY

Bachelor of Agriculture / Graduate Certificate in Science (Mathematics), Charles Sturt University

Bachelor of Agriculture / Bachelor of Science (Mathematics and Statistics), The University of Melbourne

Bachelor of Agricultural Science / Bachelor of Science (Mathematics), University of Tasmania

Bachelor of Business / Agribusiness, La Trobe University

### MATHS+AGRICULTURE JOBS

Agricultural engineer: \$46K-\$173K

Biochemist: \$52K-\$136K

Environmental engineer: \$55K-\$103K

Soil scientist: \$50K-\$87K\*

\*Source: salaries according to payscale.com

**A**griculture is the practice of cultivating soil, growing crops and raising livestock. And at its core is a bunch of maths and data. "A number of concepts in statistics and maths are extensively used in various fields of agriculture, such as soil science, animal and crop production, agricultural engineering and agricultural economics," says Kanika Singh, a research fellow at the University of Sydney, who is currently working on optimising soil management and health in Papua New Guinea.

Agriculture also relies on a range of data sources. Think weather and climate data for forecasting; sensor data for info on soil, temperature, humidity, rainfall, sunlight and farm equipment; animal and plant genomics research data; plus remotely sensed data through satellites and drones.

How do agriculturalists make sense of all that data? Statistical modelling combined with maths, according to Kanika.

### Finding your field

When it comes to career paths, you're spoilt for choice. Options include water and irrigation engineering, soil science, plant and crop physiology (in agronomy and horticulture), agricultural extension and education, biosystems and machineries, and animal science.

"The agriculture domain is quite dynamic, diverse and responsive to consumers of today, especially when it concerns people's health and ethics," says Kanika.



**KANIKA SINGH**  
SOIL SCIENTIST

### Cultivating your interest

So what's the best way to start your agriculture journey? Besides taking all the science classes you can in high school, you should also get involved in citizen science. This will give you the opportunity to actively contribute to research initiatives, while gaining cool new skills and knowledge.

It's also awesome for building communities and connections.

"Citizen science enables members of the public to contribute to research as partners in knowledge generation," says Kanika. "For example, at the University of Sydney a real-world research project that evaluates soil health (simply using a tea bag!) offers students a chance to get their hands dirty and learn the importance of maths in soil science." – Louise Meers



**KATE HELMSTEDT**  
MATHEMATICIAN

## WATER WORKS

**H2O IS VITAL TO AGRICULTURE. AND MANAGING IT PROPERLY REQUIRES A LOT OF MATHS**

**Q**uestion: what does agriculture have to do with the Great Barrier Reef? Quite a lot.

Farming practices can have huge impacts on surrounding ecosystems. In Queensland, the chemicals used on farms can enter the water system and make their way to the reef.

Kate Helmstedt is a mathematician and Fellow at Queensland University of Technology (QUT), and is researching how different regulations might influence farmers' decisions and ultimately change their behaviour.

"The choices farmers make on their land – such as how much fertiliser to use and what they do with their rubbish – have an impact on water quality and speed up the decline of the Great Barrier Reef," says Kate.

"Lots of policies and laws have been tried to get farmers to make better choices, but

it's hard to figure out how they'll respond."

Kate works with a multidisciplinary team that includes social scientists, economists and behavioural scientists to model different policies on how farmers work their land.

"There are lots of things society gets from land. We need to feed people, we need places to live, we need recreation," says Kate.

"We can use mathematics to trade off all those different objectives so we can balance our needs with biodiversity conservation."

– Chloe Walker

**THERE ARE LOTS OF THINGS SOCIETY GETS FROM THE LAND**

COURTESY OF QUT

**BACHELOR OF SCIENCE (MATHEMATICS), UNIVERSITY OF QUEENSLAND**

**PHD IN APPLIED MATHEMATICS, UNIVERSITY OF QUEENSLAND**

**POSTDOCTORAL RESEARCHER, UNIVERSITY OF CALIFORNIA, BERKELEY**

**SENIOR LECTURER AND RESEARCH FELLOW, QUT**

## RISKY BUSINESS

**IRRIGATING HOPE FOR A BETTER FUTURE USING MATHS AND DATA**

**ELLIE HUBBARD**  
PRINCIPAL, OPERATIONAL RISK + ASSURANCE

**W**ater management is a big issue in agriculture. Water authorities have a responsibility to ensure water is supplied not just to the taps in our homes, but also to farms for irrigation.

Ellie Hubbard is principal, operational risk and assurance at Seqwater in Queensland. She helps the organisation make better business decisions through understanding uncertainties and their effect on strategic objectives. Maths skills are fundamental to this, and enable her to establish an aligned view on what matters most across the organisation, such as building a new dam or temporarily shutting down a plant.

Ellie studied maths and engineering at QUT and spent eight years working in design and construction before moving into risk management for asset operations.

"I wanted a bigger-picture role where I could shape decisions early on," she says. "I think bulk water supply is going to be the next big challenge for our generation."

Ellie's maths skills from her study at QUT are critical to her work. "Modelling and statistics are the skills I've ended up using the most." – Chloe Walker

**BULK WATER SUPPLY IS GOING TO BE THE NEXT BIG CHALLENGE FOR OUR GENERATION**

**BACHELOR OF ENGINEERING (ELECTRICAL) / BACHELOR OF MATHEMATICS, QUT**

**ELECTRICAL ENGINEER, AURECON**

**MANAGER, DECISION + RISK ADVISORY, AURECON**

**PRINCIPAL, OPERATIONAL RISK + ASSURANCE, SEQWATER**

COURTESY OF QUT



5

# SIGNS you should be a maths teacher

See if maths + education is the right STEM path for you!

## Your maths knowledge is > than most

You're known around school as a maths whiz, and in your spare time you devour books on statistics and equations. But to lead your own class, you'll need a Bachelor of Education (Secondary) or a combined degree in mathematics and education. Good maths teachers also stay across the latest maths news and developments, attend courses, and research teaching techniques so their skills stay sharp and up-to-date.

1

## You have A+ attitude

Do you think maths is amazing? Are you the first to share a maths meme or fact with your friends and fam? Are you generally a positive person? If your maths enthusiasm level rivals Eddie Woo's and you've got a can-do attitude, then inspiring students to love algebra, geometry and logarithms could totally be your dream job.

2

## You = a good leader

If standing up in front of a bunch of high school kids on the daily doesn't sound like a fun time to you, you might want to choose another maths career. However, if you love to flex your leadership skills and know how to motivate people to get the best out of them, you'll absolutely be in your element in the classroom.

4

## You know how to ÷ and conquer

Teachers are the masters of multitasking! How are your juggling skills? As a maths teacher, not only will you need to plan lessons, teach and set homework for dozens of students, you'll have to mark, write reports, chat with parents and help out with school duties.

3

## Your care factor is 100 %

Think about all the best teachers you've had – they really cared about their students, right? Teachers need to create learning environments where everyone feels supported and respected. If you're the first person to always jump in to lend a helping hand or give encouragement, teaching could be for you. – Louise Meers

5





## A TICKET TO LEARN

**JOSH ROSS IS USING HIS BACKGROUND IN FINANCE TO HELP THOSE IN NEED ACCESS EDUCATION**

CO-FOUNDER  
HUMANITIX

PARTNER/SENIOR INVESTMENT ANALYST  
WATERMARK FUNDS MANAGEMENT

Many people start their own company to earn big bucks, but Josh Ross wondered how he could give back. Along with his best mate, Josh co-founded Humanitix, a ticketing platform that uses profits from booking fees to support projects that help disadvantaged children access education.

"We got fixed on the idea that we could use business to improve the world instead of just making money," says Josh. "Our mission is that every child should be given the opportunity to thrive and give back to their community."

Through Humanitix, Josh is connecting Indigenous kids around Australia with good quality education, scholarships and other programs. Humanitix is also partnering with Room to Read to work on literacy and life skills programs for young girls in developing countries.

Josh studied applied finance and accounting at Macquarie University and spent more than seven years working as an investment analyst at Watermark Funds Management where



he managed investments in areas such as healthcare, gaming and retail. His financial know-how proved a handy skill when getting his startup off the ground and it helped him decide on a workable idea.

"Part of the process is figuring out whether your idea makes economic sense at scale," says Josh. "If you financially model an idea and it doesn't make sense, you can kill it before wasting money on it."

Josh's advice for maths wizards with an entrepreneurial flair is to study software development. "It's really powerful and relevant to businesses of all shapes and sizes," he says. "If you are a software developer and naturally commercial, you can go into any type of business." – Gemma Conroy

**OUR MISSION IS THAT EVERY CHILD SHOULD BE GIVEN THE OPPORTUNITY TO THRIVE"**

### START YOUR CAREER HERE

#### MATHS+EDUCATION STUDY

Bachelor of Commerce/Computer Science, UNSW  
Bachelor of Mathematics Education, University of Wollongong  
Bachelor of Education (Secondary Education: Mathematics) / Bachelor of Science, University of Sydney

#### MATHS+EDUCATION JOBS

Mathematics teacher: \$59K-\$103K  
Software developer: \$50K-\$103K\*

\*Source: salaries according to payscale.com

BACHELOR OF APPLIED FINANCE/COMMERCE  
(ACCOUNTING), MACQUARIE UNIVERSITY



# Class of YouTube

From behind the maths desk, these teachers are also famous on YouTube!

**PATRICKJMT**



**From: Texas, USA Joined YouTube: 2007**

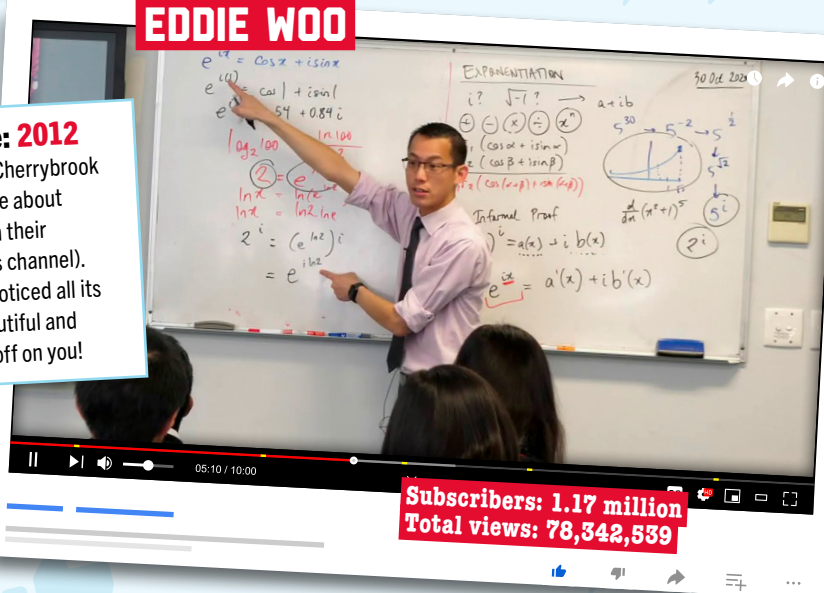
Patrick is a mathematics teacher at Austin Community College and is on a mission to help people improve their maths game and grasp of basic mathematical principles. He says his videos are “nothing fancy” and “just clear explanations”, which is what we think is really cool about them! Check out his channel if you need help with things such as trigonometric functions, integrals and logarithms.

**Subscribers: 1.22 million**  
**Total views: 351,168,486**

**EDDIE WOO**

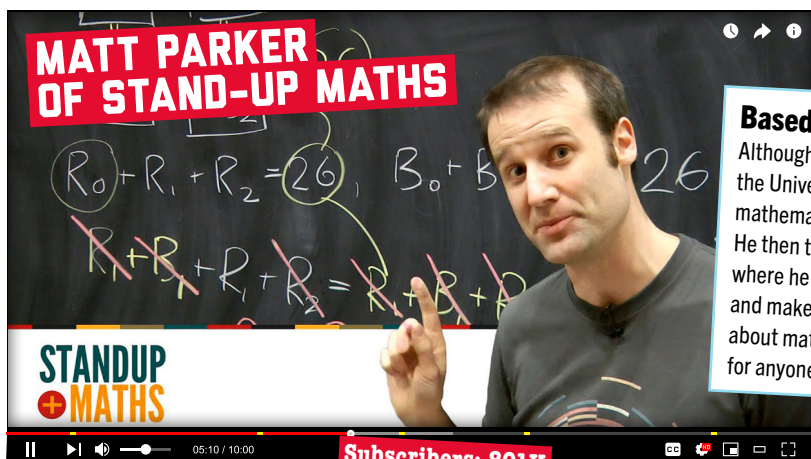
**From: Sydney, Australia Joined YouTube: 2012**

Eddie uploads videos of his actual classroom lessons at Cherrybrook Technology High School. And they're fun! He's passionate about creating free Australian maths resources for students on their favourite medium – YouTube (or WooTube, as he calls his channel). Eddie says he didn't love maths at school, but once he noticed all its patterns, relationships and connections, it became beautiful and surprising. His enthusiasm for maths will definitely rub off on you!



**Subscribers: 1.17 million**  
**Total views: 78,342,539**

**MATT PARKER OF STAND-UP MATHS**



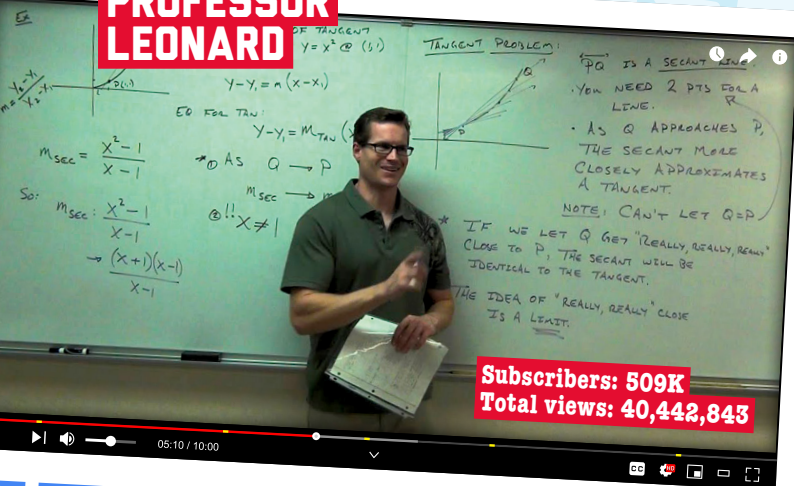
**Subscribers: 801K**  
**Total views: 83,333,324**

**Based: London, UK Joined YouTube: 2009**

Although Matt originally studied mechanical engineering at the University of Western Australia, he made the switch to mathematics and physics while writing comedy on the side. He then taught maths in Australia before moving to London, where he speaks at schools, helps students communicate maths and makes awesome videos. His goal? To get more people excited about maths! Hilarious and informative, Matt's videos are perfect for anyone who likes their pi with a side of laughs.



## PROFESSOR LEONARD



Subscribers: 509K  
Total views: 40,442,843

### From: California, USA Joined YouTube: 2011

If calculus is just not clicking for you, take a trip to Professor Leonard's virtual classroom. He's a professor of mathematics at Merced College and he posts entire lectures from his calculus classes. You'll also find algebra, pre-algebra and statistics videos on his channel. Tip: his videos are loooooong so grab some popcorn and settle in. Professor Leonard gets two big thumbs up from us because his lessons are easy to follow and they give you a lot of confidence!



EDDIE UPLOADS VIDEOS OF HIS ACTUAL CLASSROOM LESSONS ... HIS ENTHUSIASM FOR MATHS WILL DEFINITELY RUB OFF ON YOU"

## KRISTA KING



Subscribers: 221K  
Total views: 33,153,392

### From: Indiana, USA Joined YouTube: 2010

Krista is your geeky, trusty maths tutor taking the frustration out of maths one YouTube video at a time. She makes videos on ALL the maths topics: calculating simple interest, graphing polar curves, integrals, imaginary numbers... she even teaches you how to put the sum in summation notation. Thanks, Krista! We are also big fans of her cheat-sheet style notes and formula sheets you can use as you follow along in her lessons. – Louise Meers



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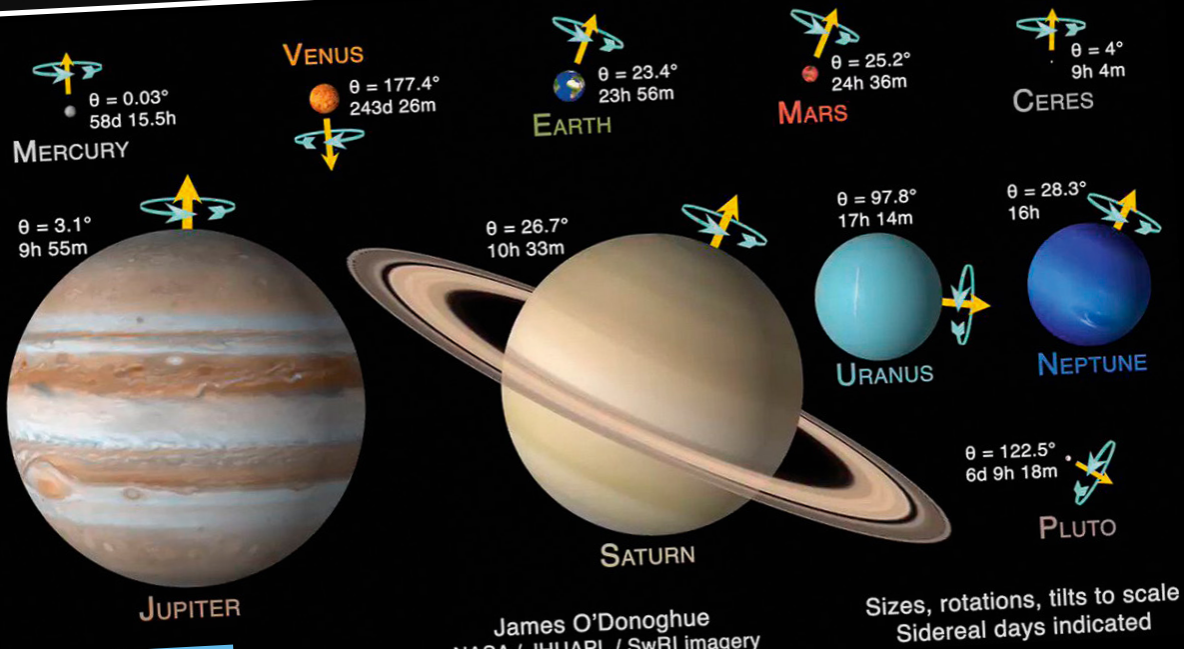


MATHS + DATA



# Picture it!

Data visualisation is an emerging area that helps us to better picture the true meaning of data

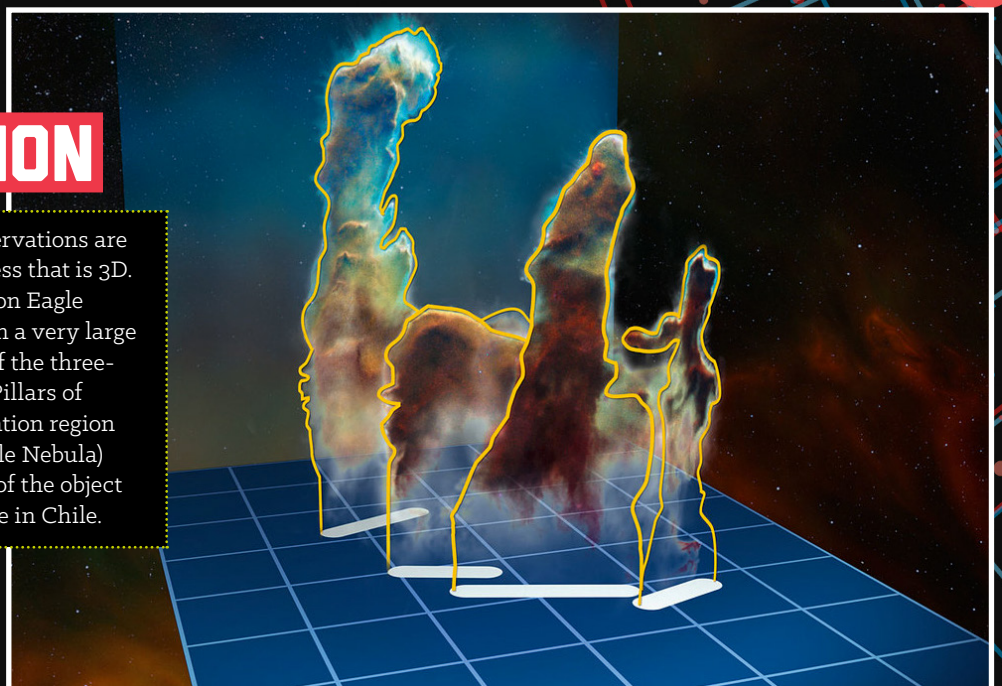


## SPACE

Maths and data go beyond planet Earth – they're galactical. Think time spinning on axes around suns; and distance from planet to planet and size difference. All maths. This to-scale visualisation of the planets allows us to compare size, tilt and rotation.

## PILLARS OF CREATION

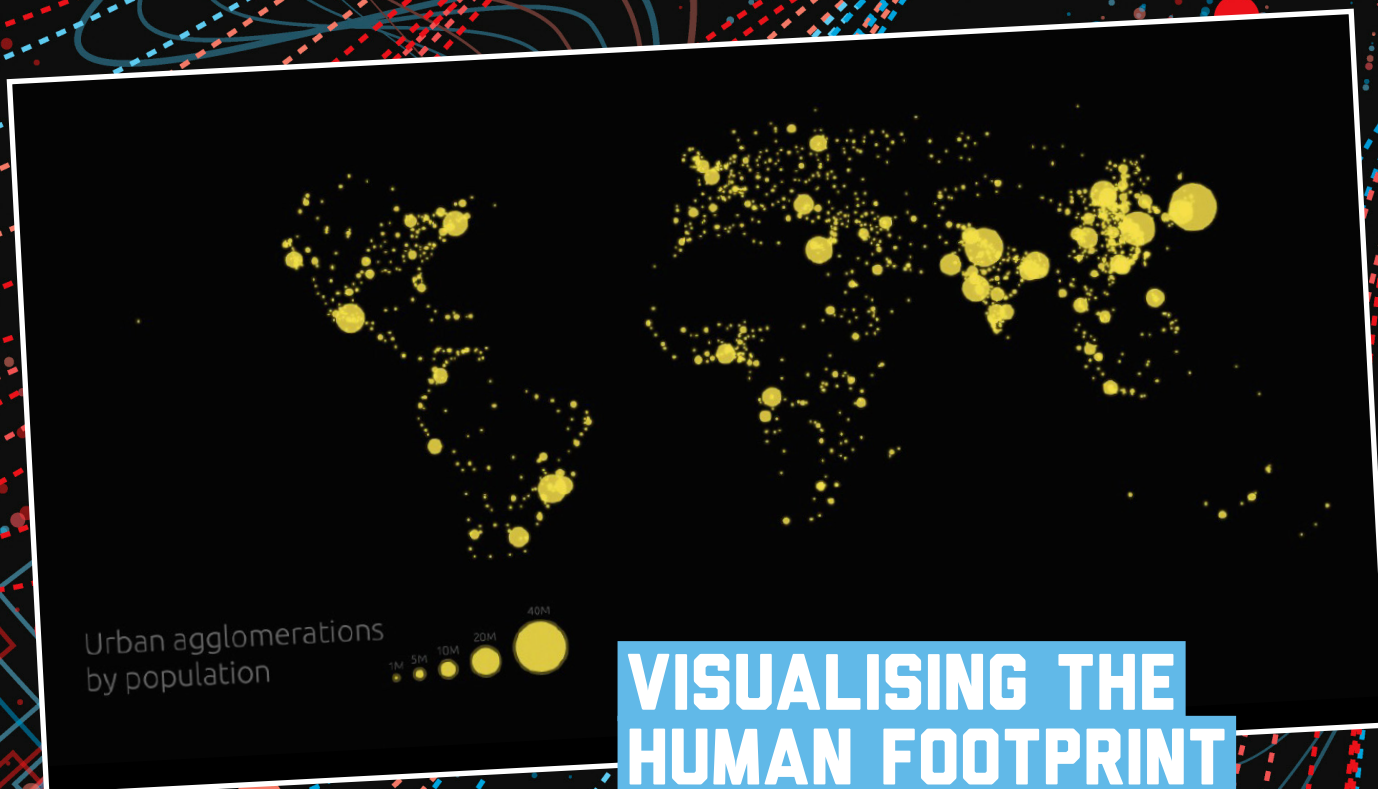
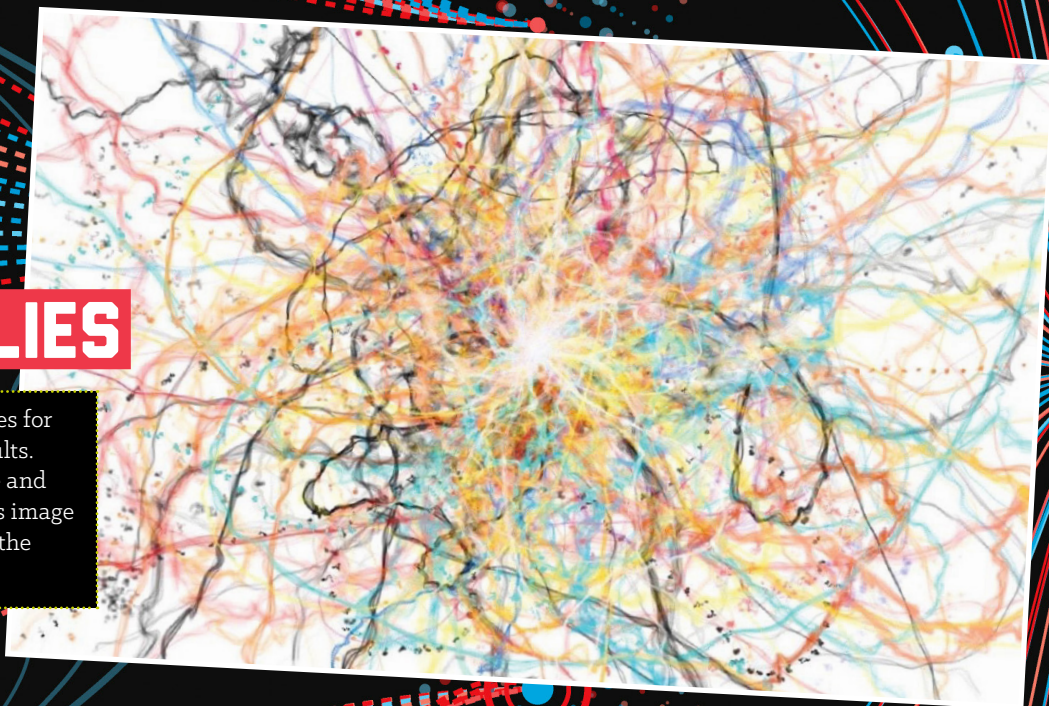
Scale, measurements and observations are all involved in the awesomeness that is 3D. Here it shows the star formation Eagle Nebula via images captured on a very large telescope. This visualisation of the three-dimensional structure of the Pillars of Creation within the star formation region Messier 16 (also known as Eagle Nebula) is based on new observations of the object using the Very Large Telescope in Chile.





## MARBLE BUTTERFLIES

Using data to create art makes for some pretty spectacular results. Growth, evolution, sequence and patterns are all covered. This image was made using real data of the flight paths of butterflies.



## VISUALISING THE HUMAN FOOTPRINT

Calculating the patterns of human occupation and impact in urban areas via art is a pretty interesting way to look at maths and data. This map of the world shows cities by population data revealing hotspots of urban agglomerations at a glance.



# 600K AND COUNTING...

WE ASKED SCIENTIST, MATHEMATICIAN AND YOUTUBER **TOBY HENDY** ABOUT THE MATHS INVOLVED IN GROWING YOUR YOUTUBE SUBSCRIBERS!

Hi Toby! Congrats on 600K+ YouTube subscribers! How did you get so many?

I've been uploading videos to my channel, 'Tibeas', since 2011 so it has been a long process. It took me until 2018 to reach 100,000 subscribers, but growth since then has been faster.

Did you notice any patterns as the number of subscribers went up?

There is a section of my subscriber growth that looks like it resembles an exponential curve. Once I found an audience it was easier to grow. Now my growth is a bit steadier but I do see spikes when particular videos become popular.

Do you pay much attention to the YouTube algorithm?

The YouTube algorithm is an infamously mysterious beast, but there are a few video metrics that the algorithm would consider when choosing which videos to display compared to users. One of these is the click-through rate, the percentage of users who click on a video when it is presented to them. If your click-through rate is high then the algorithm will show your video to more people, but if it's low then you might need to redesign the thumbnail or title.

Do you use maths in any other ways when making your videos?

There are opportunities to use maths and statistics to analyse a video's analytics. Someone who can understand trends in data really well might be able to use analytics to improve a channel's performance.

Why is it important to present maths in creative and fun ways?

Mathematics can be a useful tool, but at its heart it is really a creative endeavour. For example, academic mathematicians need to develop new ideas in order to progress the field and these ideas come from playing with maths and treating it like art. At the very least I hope my videos help people to overcome "math-phobia", and ultimately I would love to help more people see the creative side of maths.

Any tips for others wanting to follow a maths path?

I would advise people to spend time pursuing the ideas that interest them because you never know where it might lead. – Louise Meers

Check out Toby's maths, astronomy and the history of science videos: [youtube.com/user/tibeas](https://youtube.com/user/tibeas)

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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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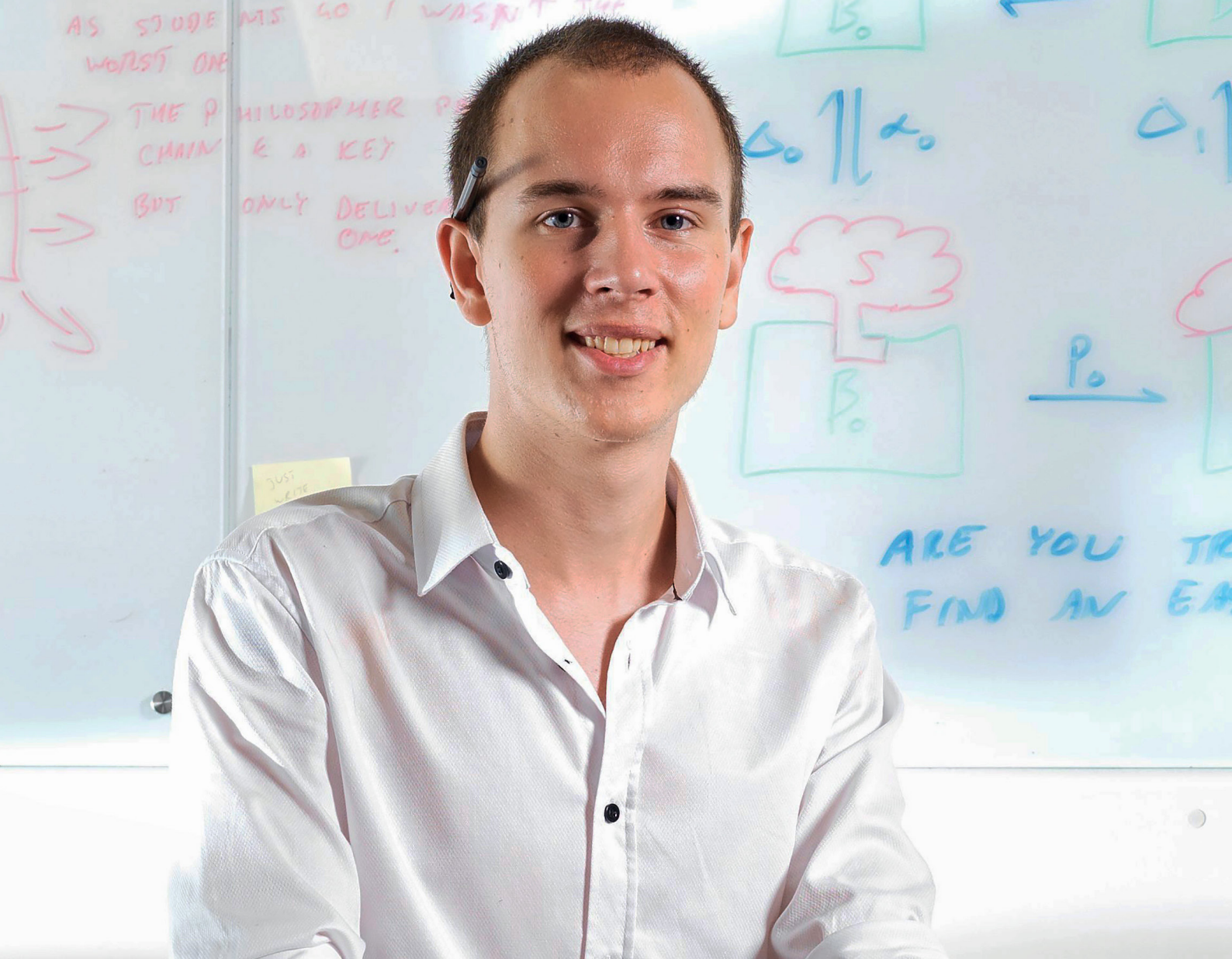
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# Think Mathematics. Think QUT.

Early in high school, Alex Vosten believed math was just endless numbers and symbols. He soon realised that through mathematics he could use his brain as a problem-solving machine. He studied QUT's Bachelor of Mathematics, majoring in Applied and Computational Mathematics, and discovered that the backbone of every industry, from business to politics; from global issues like climate change and population growth, to social networking; is maths. "I love the process of finding problems and solving them – it helps me every day; from being a better cook to beating the traffic, to potentially making life-saving discoveries."

His passion and skills for mathematics led him to participate in real-world research. "My project focuses on Computational Biology, where I study the behaviour of cells to help in medical research."

He believes this will give him the opportunity to make a positive contribution in understanding the degenerative disease of Alzheimer's.

While Alex was developing his skills in mathematics at QUT, he soon realised another passion, teaching. "One of my favourite aspects of the course was being offered a job to teach after graduating – it cements my understanding and means I am able to give back to the university that's given me so much. As well as being paid to teach something I love."

From study, to research, to teaching, Alex used his love of mathematics to embrace all QUT has to offer.



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