Why do Mathematics?

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SCHOOL OF MATHEMATICS AND STATISTICS
Mathematics is the language of physical sciences, economics and finance.

Statistics pervades all sciences and commerce.
Why is Mathematics Important?

All the great civilizations of the past rose because of Mathematics.

Every great scientific discovery was preceded by a corresponding breakthrough in Mathematics – look up the history of Einstein’s theory of relativity, the Lorentz Transformation and Minokowski’s unified space-time model.
Many discoveries in Physics were predicted by Mathematics before they were observed experimentally.
Examples

Radio Waves, Big Bang Theory, General Theory of Relativity, Planck’s quanta, Black Holes, Antimatter, Quarks,…

Ref: Mathematics as a Sixth Sense, Stephane Durand
CAREERS IN MATHEMATICS AND STATISTICS

All quantitative disciplines need Mathematics!
Skill shortage is not in taxi drivers, managers, real estate agents, parcel deliverers, bakers, bank tellers, check out personnel,….

IT IS IN PEOPLE WITH TECHNICAL SKILLS! AND THIS NEEDS MATHEMATICS!
## Salaries – Feb 2010 Data

### Top 10

<table>
<thead>
<tr>
<th>Sector</th>
<th>Avg. Min</th>
<th>Avg. Max</th>
<th>Average</th>
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<tbody>
<tr>
<td>Average Australian Salary</td>
<td></td>
<td></td>
<td>$87,558</td>
</tr>
<tr>
<td>1. Mining, Oil &amp; Gas</td>
<td>$68,230</td>
<td>$219,667</td>
<td>$140,913</td>
</tr>
<tr>
<td>2. Executive</td>
<td>$60,583</td>
<td>$242,718</td>
<td>$117,253</td>
</tr>
<tr>
<td>3. Engineering</td>
<td>$47,192</td>
<td>$203,036</td>
<td>$112,006</td>
</tr>
<tr>
<td>5. IT &amp; Telecommunications</td>
<td>$45,175</td>
<td>$197,503</td>
<td>$99,650</td>
</tr>
<tr>
<td>6. Human Resources &amp; Recruitment</td>
<td>$43,776</td>
<td>$186,500</td>
<td>$90,546</td>
</tr>
<tr>
<td>7. Sales</td>
<td>$40,333</td>
<td>$178,750</td>
<td>$88,250</td>
</tr>
<tr>
<td>8. Scientific</td>
<td>$35,639</td>
<td>$148,152</td>
<td>$87,566</td>
</tr>
<tr>
<td>9. PR &amp; Communications</td>
<td>$44,024</td>
<td>$155,000</td>
<td>$83,779</td>
</tr>
<tr>
<td>10. Marketing</td>
<td>$46,117</td>
<td>$149,930</td>
<td>$82,410</td>
</tr>
</tbody>
</table>

How many of these need Mathematics?

Mathematics and Statistics are needed in:

- Physical sciences: physics, physical chemistry, bio-physics, engineering (all varieties), geo-physics (geo-statistics), biomechanics, computing science, Software Engineers, Database Managers, ....
Mathematics and Statistics are needed in:

And

Mathematics and Statistics

- Some career paths need mathematics and or statistics (engineering, physics).
- Others (such as financial or biological) are enhanced by selected knowledge in mathematics and particularly statistics.
- Someone with high level training in M&S has all quantitative careers open to them.
Technical skills are enhanced with higher level of Mathematics and Statistics. We in Australia are lagging behind the world, whereas we can be world leaders in science and technology!!
We all use the telephone, television, internet, transport, fridges, computer games, satellites for communications and weather forecasting, computers, electricity, transport (cars, planes,), mobile devices,….

NONE OF THESE WOULD BE POSSIBLE WITHOUT MATHEMATICS!!
Applications of Mathematics

The following posters illustrate the vast application of Mathematics in everyday life.
Weather

CHAOS IN THE WEATHER...

\[ \begin{align*}
    \frac{dx}{dt} &= \sigma(y-x) \\
    \frac{dy}{dt} &= xy - y - xz \\
    \frac{dz}{dt} &= xy - \beta z
\end{align*} \]

Maths Predicts

In 1963, the meteorologist E. N. Lorenz discovered chaotic behaviour in a simple model of the weather.

The smallest influences can have very large effects.

This realisation had enormous impact on the use of modern mathematics for analysing the weather, climate changes, and fluctuations in the stock market.

Maths Predicts
Global Warming

The tip of the iceberg is shaped by Catastrophe Theory.

80% of a floating iceberg is hidden below the ocean surface. As this part melts, the iceberg can become unstable. It topples sideways - and the process starts all over again. Catastrophe Theory helps explain these instabilities.
Aerodynamics

From seagulls to swans to 747s - maths can help us to understand the aerodynamics of flight. Understanding the way air flows around a wing or a jet engine allows us to design safer and more efficient aircraft, and to reduce aircraft noise over populated areas.

$L \sim \rho U^2 A \sin \alpha$

Maths Takes Off

Feb 2010
Gene Research

MATHS IS VITAL

DNA is the stuff of life. The human genome project is generating vast sequences of DNA data. New mathematical techniques are being used to analyse this data. This analysis is vital for the development of new medicines in the fight against viral disease.
Coding and Security

MATHS BREAKS THE CODE

Many of today's secret codes rely on the difficulty of 'factorising' huge numbers. This means solving problems like those below.

2 x ? = 10
11 x ? = 33
? x ? = 91

Every time you use a cash machine, your details must be checked with the bank's main computer. To protect your privacy, the data are scrambled mathematically.

Number Theory is important not only for keeping data secret, for example when shopping by credit card on a website, but also for cracking codes like that of the wartime Enigma machine.
Tsunamis

Waves are a source of delight. They also cause enormous destruction.

We need to understand how they form and how they propagate, and find ways to harness their energy safely.

Maths holds the key to this understanding.
Hurricanes
Blockages

Why don’t more people do Mathematics?
Mathematics is hard!
Yes it is! But it is also very rewarding, and is no more harder than learning to skate or tennis! It takes time to understand new ideas and concepts.
In any endeavour you need to do something hard to excel!
You need to be bright to do Mathematics.

No! You need not be very bright. But Mathematics makes your brighter. And it will improve your skills and understanding of other related subjects.
I don’t need a lot of Mathematics for science!

Wrong! A higher level of Mathematical skill will make you a better Scientist and Engineer.

Great discoveries and higher level performance in physics and engineering innovation requires high level Mathematics.
Rewards of doing Mathematics

• Problem solving skills that will help you in every aspect of your life.
• Good organisation skills.
• Logical, clear thinker.
• A very interesting, satisfying life full of challenges and achievements!
Rewards of doing Mathematics

USE YOUR SKILL AND TALENT TO SOLVE THE PROBLEMS OF THE WORLD!!
1. https://www.maths.uwa.edu.au