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Achieving International Excellence

Celebrating Mathematics

Cheryl E Praeger

2010 AMC Perth Awards Ceremony

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Congratulations!

To all Western Australian Awardees in the Australian Mathematics Competition

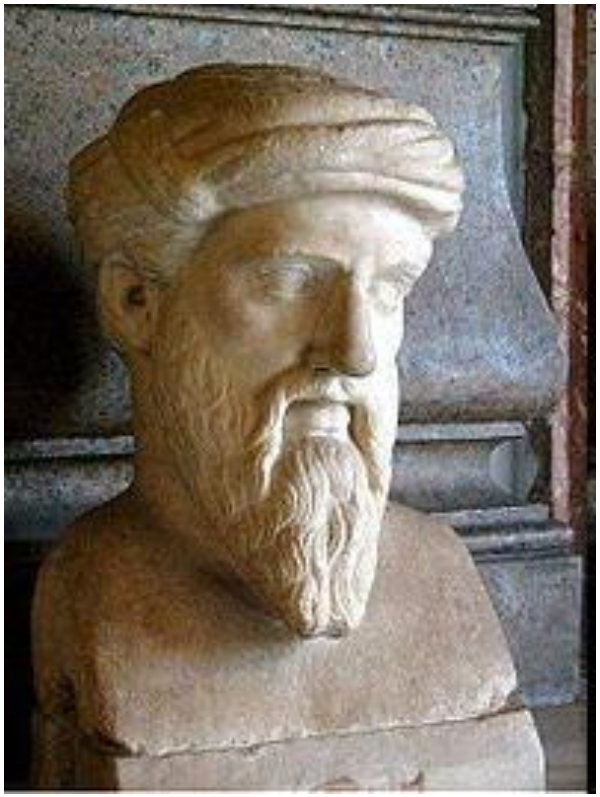
Well Done!!

Theme of my Presentation

Celebrating Mathematics

- Mathematics in the World/in Australia
- What is the “Nobel prize” for Mathematics?
- Where can Australian students aim?

What is Mathematics?



"Mathematics is the way to understand the universe"

Pythagoras (c 570-495 BC)

External environment

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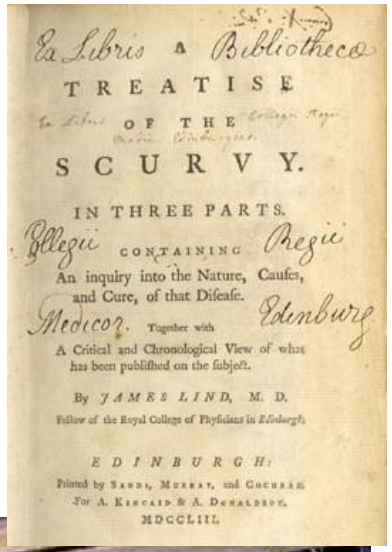
Dramatic changes, presenting us with enormous challenges and opportunities

- Global Financial Crisis
- Climate Change issues
- Managing data explosion – new technologies
- Improving public health, security

- Maths and Stats central for facing these challenges

Mathematics: Public Health

- Mathematical and Statistical methods: foundations for randomised clinical trials …
- *"cornerstones of the systematic attack on human disease that has dramatically increased life expectancy in advanced societies"*
- From James Lind 1747 – experimental treatments for scurvy on HM Bark Salisbury


Ex Libris A Bibliotheca
TREATISE
OF THE
SCURVY.
IN THREE PARTS.
CONTAINING
An inquiry into the Nature, Causes, and Cure, of that Diſeaſe.
Together with
A Critical and Chronological View of what has been publiſhed on the ſubject.
By JAMES LIND, M. D.
Fellow of the Royal College of Phyſicians in Edinburgh.
EDINBURGH:
Printed by SANDS, MURRAY, and COCHRAN
For A. KINCAID & A. DONALDSON.
MDCCLIII.

Florence Nightingale (1820-1910)

Pioneer of

- modern nursing and hospital reform
- **She was a mathematician!**
- introduced epidemiological methods in public health statistics
- first woman elected member of the UK (Royal) Statistical Society

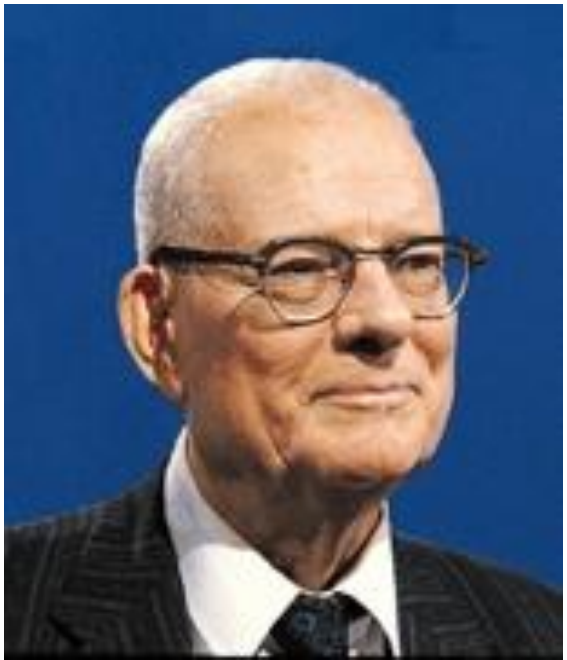
Mathematics: Scientific Experiments

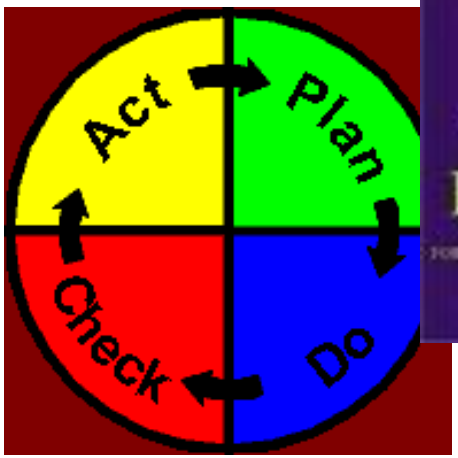
- R. A Fisher (1890-1962)
- *1935 "The Design of Experiments"*
- incorporates comparison, randomisation, replication, and grouping of experimental units
- With Yates (1902-1994)
- factorial designs increase efficiency, maintain accuracy
- Outcomes of "variety trials" in Western Australia boost farm profitability

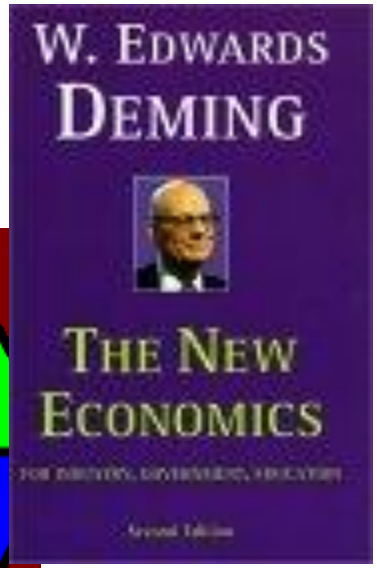
Stained glass window
Caius College Cambridge
- Latin Square

Mathematics: Manufacturing and Business - W. Edwards Deming (1900-93)

- Fundamental mathematical theory of quality management and quality control
- *"improving quality will reduce expenses while increasing productivity and market share"*

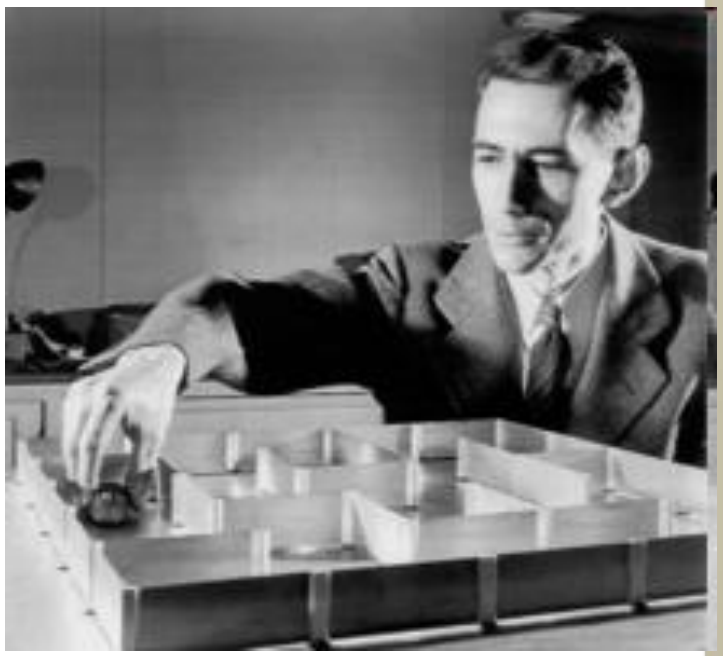






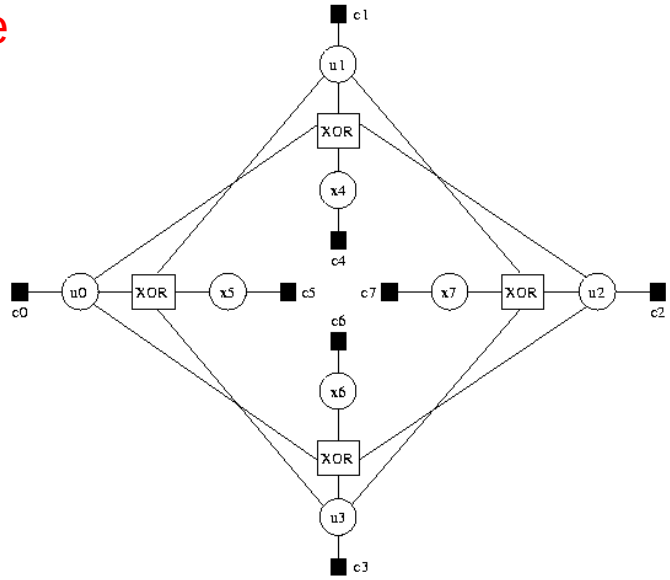
Mathematics: Communication and Secrecy

- Claude E Shannon (1916-2001)
- “A mathematical theory of communication” 1948
- Foundation of the digital revolution
- “Communication theory of secrecy systems” 1949
- Enabled telecommunications to move from analogue to digital



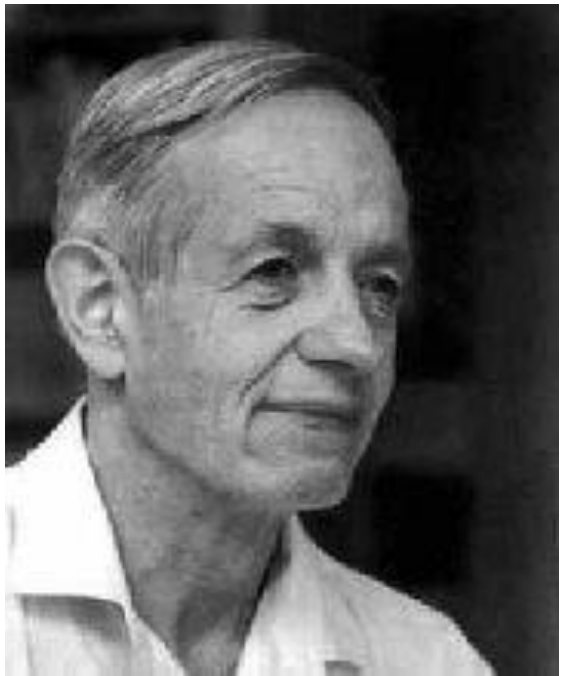
Mathematics: the electronic age

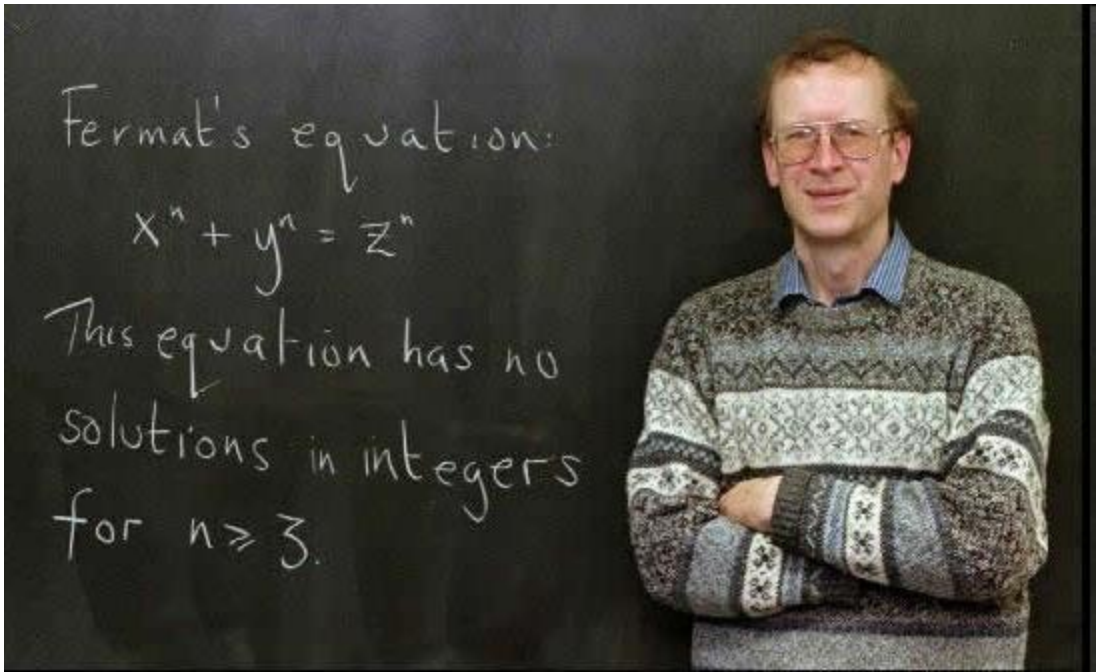
- "every device containing a microprocessor or microcontroller is a conceptual descendant of Shannon's 1948 paper" Neil Sloane
- Reliability of computers
- Music on our CD/DVDs
- Our mobile phones



Mathematics: Power Beauty Truth

- John Nash – non-competitive games – Nobel Prize 1994
- Andrew Wiles – Fermat's Last Theorem 1993





Mathematics: training influences us for life

- General **Sir John Monash** GCMG, KCB, VD (1865 – 1931)
- Australian military commander of First World War
- *"I am essentially a mathematical student. Anyone who devotes himself for three or four years to mathematics undergoes a complete mental reconstruction"*

[JM Diary 1884]

Mathematics and Statistics in Australia

Importance is recognised by politicians:

- *"Science and Maths are part of the language"* Barry Jones 1988
- *We should reward "specialist teachers such as in science or maths"* Julie Bishop 2007
- *"A nation that cannot turn out top-notch mathematicians … is a nation in deep trouble"* Kim Carr 2008

Mathematics: Go8 review 2010

Highlights some startling statistics

- From 2001 to 2007 the number of students enrolled in a mathematics major in Australian universities declined by approximately 15%
- The number of students taking Advanced Maths at high school also dropped by 27% between 1995 and 2007
- Demand for mathematics and statistics graduates is predicted to grow by 3.5% per year till 2013.

Mathematics: Go8 review

Performance slipping on international benchmarks

- TIMSS (Trends in Mathematics and Science Study)

For Year 8 mathematics:

- 1995 Australia statistically higher than the US and UK
- 1999 Australia statistically higher than the US and UK
- 2003 Australia not statistically different from US and UK
- 2007 Australia statistically below both the US and UK

Australian Mathematics Trust Programs even more important

How de we celebrate Mathematics?

- There is no Nobel Prize in Mathematics

- What is the closest to it?
- Where can students aim?
- Abel Prize
- Fields Medal
- International Mathematics Olympiad

Abel Prize established 2002

- for outstanding scientific work in the field of mathematics
- awarded annually, by the Norwegian Academy of Science and Letters
- presented by Norway's King Harald
- 6 million NOK (about US$ 1.2 M)

Niels Henrik Abel 1802-1829

- Norwegian Mathematician and Hero
- *Oeuvres complètes de Niels Henrik Abel*, published 1881 edited by Ludvig Sylow and Sophus Lie
- 1898: Lie tried to establish prize - supported by King Oscar of Sweden

Johan Gørbitz 1826

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Abel Prize 2008

Awarded jointly to two Mathematicians working in Abel's own area

John Griggs Thompson and Jacques Tits

"for their profound achievements in algebra and in particular for shaping modern group theory"

Group theory is the mathematics of symmetry

Fields Medals

- "Nobel Prize in Mathematics"
- At most four awarded every four years by International Mathematical Union
- Medallists aged less than 40
- First awarded 1936

International Mathematical Union: to promote international cooperation in mathematics

- Peak International Mathematics Body
- Australia one of 70 countries that are members
- IMU Runs International Maths Congresses
- Concerned with mathematics: research, education, maths in developing countries,
- Scholarly Issues: electronic publishing/archiving, digital mathematics library, etc

Most Recent ICM/Fields Medals 2010 Hyderabad India

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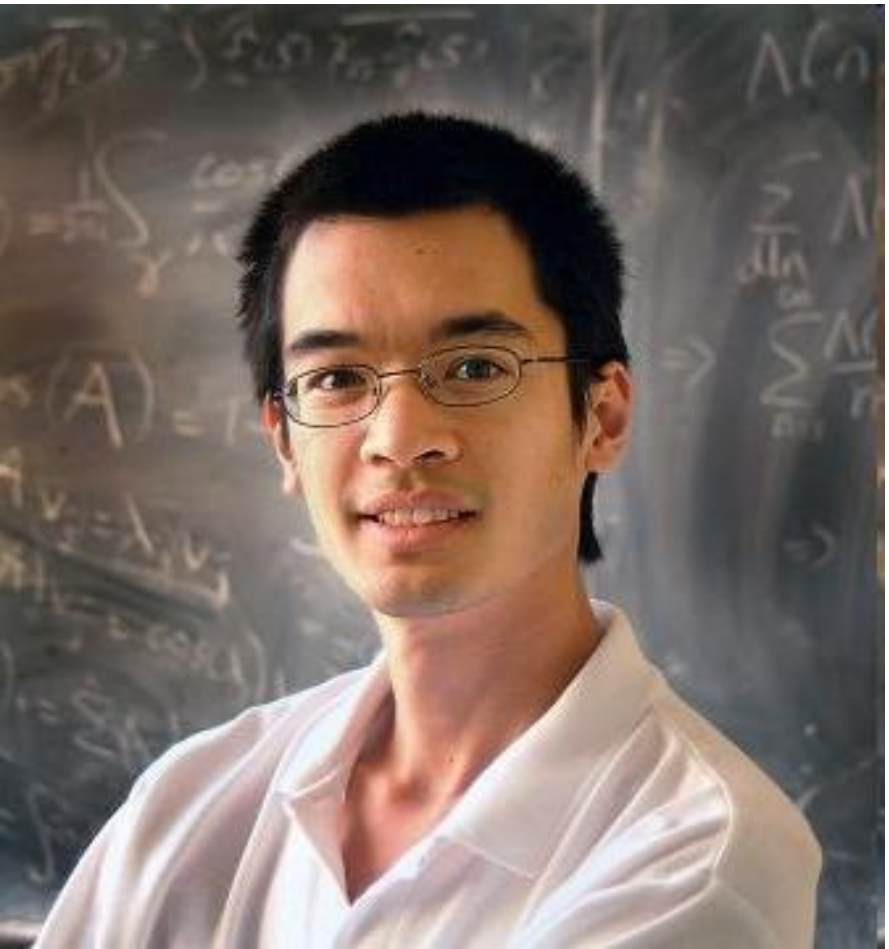
Mathematics: How does Australia measure up?



Terry Tao 2006 First Australian Fields Medallist

"like Mozart; maths just flows out of him"

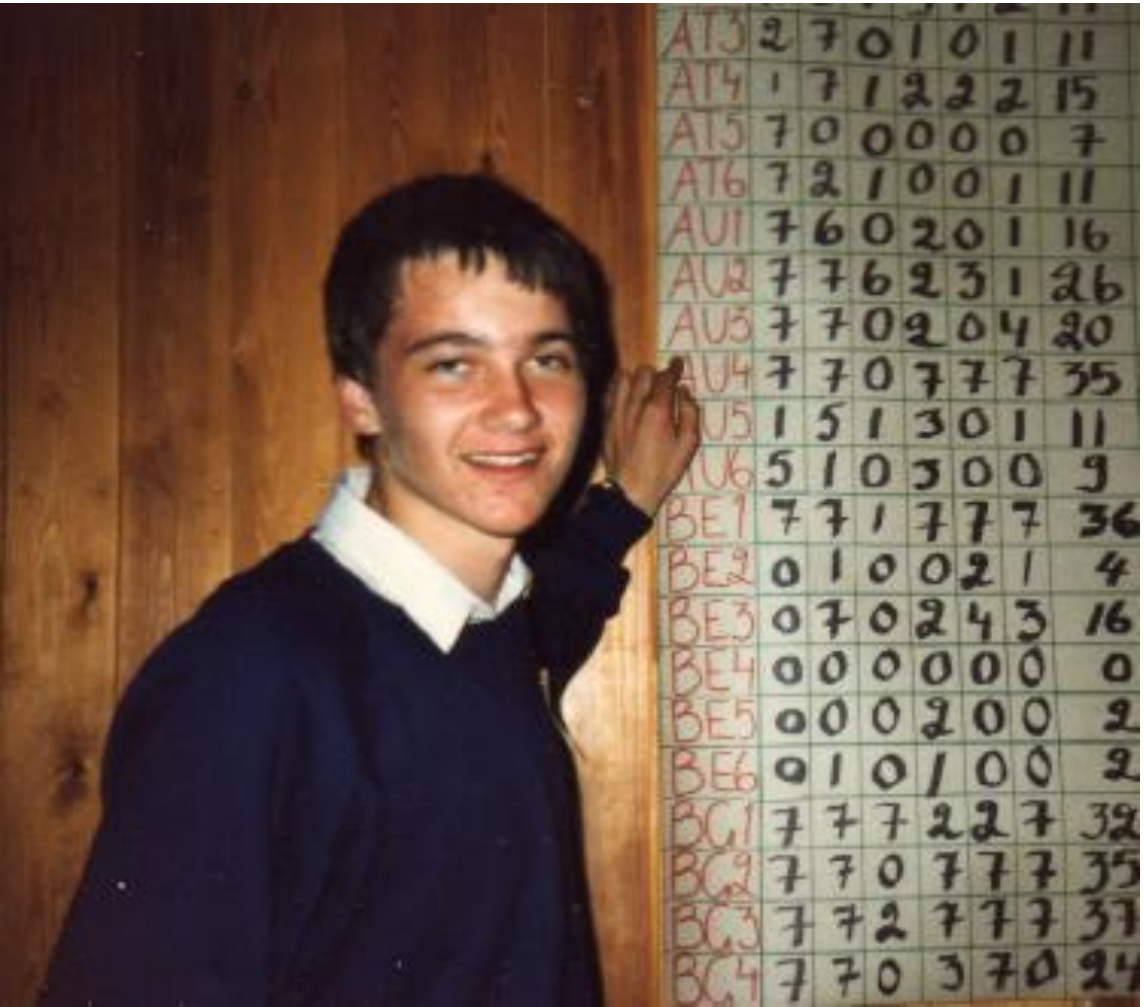
Who is Terry Tao?

- Youngest ever Bronze Medalist in International Mathematics Olympiad 1986, aged 10
- Silver Medal 1987, Gold Medal 1988

Australian from Adelaide

- Honours 1, Flinders aged 15
- PhD Princeton aged 21
- Full Professor UCLA aged 24
- Still very committed to Australia – runs web site "Mathematics in Australia"

How about WA?



Andrew Hassel

First Australian

IMO Gold Medallist 1985

PhD at MIT

Postdoc Stanford

ARC Future Felllow at the ANU

Peter McNamara: First ever to win 2 gold and 1 bronze medal in the International Mathematics Olympiads 1999, 2000 and 2001

with Terry Tao
IMO 2001
Washington

2009 PhD MIT

Now at Stanford

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Akshay Venkatesh IMO Bronze Medal 1994

- Akshay Venkatesh 2010 International Congress of Mathns
- 1997 Honours Mathematics UWA
- 2002 PhD Princeton
- 2008 Professor Stanford

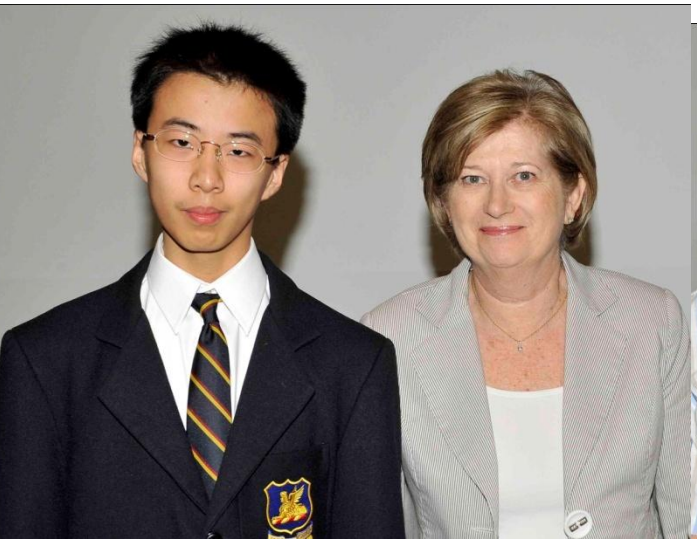
How about WA?

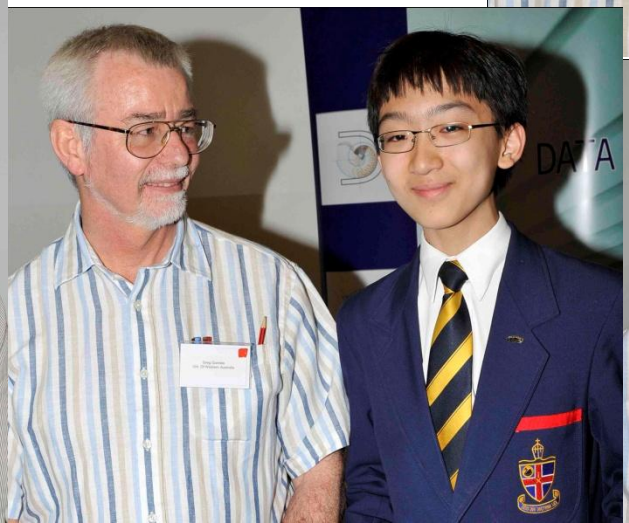
Four WA students to attend the December 2010 School of Excellence, Melbourne

an IMO Training School

Angel Yu
Alexander Chua
Kathleen Dyer
Edward Yoo

How about WA in 2010?





Again CONGRATULATIONS on your 2010 successes

- I look forward to your even greater future achievements in mathematics
- An IMO medal? A Fields Medal? An Abel Prize?

Thank you