OCCASIONAL ADDRESS

ROSS STREET

Chancellor, Vice-Chancellor, Acting Registrar, colleagues, guests and, of course, graduands,

We are receiving our degrees from a fine university.

In particular, it is an honour for me to receive this DSc for my mathematical research performed right here over the last 48 years. I began my employment at Macquarie in 1970 as a Lecturer and have not yet left!

Your understanding of mathematics and skill in its application will underpin whatever careers you pursue. Of course you know that mathematics is at the basis of contemporary areas such as online media, digital currency, drones, functional programming, finance market dynamics, and artificial intelligence. Design of the next generation is in your hands.

My plan today is to discuss a little Macquarie history from a personal viewpoint, discuss my field of research, and conclude with a little advice that I hope will help you make the world more intelligent and peaceful.

Macquarie University appointed the right people as far back as May 1965, with the first four professors including Frederick Chong as the Foundation Professor of Mathematics.

The original academic structure of Macquarie was strongly influenced by the expertise of the Founding Professors. There were ten Schools (rather than Divisions or Faculties). Fred Chong saw that physics provided motivation for most of the mathematics of the day. Consequently, we had the School of Mathematics and Physics with Chong as Head. He foresaw that computing would become central and should be taught as a tertiary subject. He appointed Mr Harry Hancock to oversee the introduction of computing to the School, thereby combining Harry's experience in industry with the mathematical content.

What vision! Today we have our own "Silicon Valley" excelling in the teaching of category theory, cyber security, cryptography, language technology, programming languages, advanced systems engineering and knowledge systems.

Professor Chong was so admired that this area where you now sit was officially named the "Frederick Chong Courtyard" by ex-Vice-Chancellor Di Yerbury. He is also remembered through the Frederick Chong Mathematics Prize, awarded for proficiency in 200-level and/or 300-level mathematics.

Question: How do you tell the extravert mathematicians?
Answer: When talking to you, they look at your shoes rather than their own.

Such stereotyping is reinforced by the story that logician Kurt Gödel delivered an entire lecture facing the blackboard which he didn't even write on! (That's Gödel as in the popular 1979 book *Gödel, Escher, Bach* .)

I claim that mathematicians can be classified into **three** types: those who can count and those who cannot.

Old jokes aside, mathematicians and scientists are practical, well-adjusted people, ranging over the full spectrum of personality types.

Mathematicians are involved in sport. Are you a member of the Sports Association? Attached to the Gymnasium you will have seen the Ted O'Keeffe Recreation Hall – but did you know that Ted O'Keeffe was a lecturer in Mathematics? He had won the 1968 men's individual inter-varsity squash championship at the University of New England and was President of the Macquarie University Sports Association from 1975 until 1990. The Ted O'Keeffe scholarship is the most prestigious scholarship awarded by the Macquarie University Sports Association.

These days there is world-wide encouragement for women to study STEM subjects; the "M" is for mathematics. Doris Wallent, a mathematics tutor in the early years of our School, felt this very strongly and bequeathed the Doris Wallent Scholarship in Mathematics to the University for that purpose. In her late years, Doris worked on preparing mathematical textbooks in Braille. This spirit of concern for *all* students continues to this day in our Numeracy Centre.

Sculpture, particularly if it has a mathematical basis, is of interest to us. I hope you have all looked at the silver sculpture called "Journey" just outside building E6A at 9 Wally's Walk. Sculptor John Robinson donated it to us. The way in which Journey models a Möbius band helps us imagine the projective plane which is a non-orientable surface living in four dimensional Euclidean space. Robinson's works adorn the Australian Academy of Sport in Canberra and the Newton Institute of Mathematics at Cambridge University, for example.

Macquarie consistently produces high quality mathematics research and teaching. In particular, we have the Macquarie University Research Centre of Australian Category Theory: CoACT. But what is category theory and how did I get into it?

At Sydney University, in my Mathematics Honours year 1965 I learnt about this exciting new field of mathematics. I took to category theory immediately. The reason I turned away from physics was a drive to understand the full explanation for natural phenomena. That led to mathematics. Yet, even there I needed unifying principles. I found them in category theory. Some say it is the mathematics of mathematics.

Living at home in the western suburbs of Sydney, I finished my USyd PhD in 1968. It was typed at Macquarie University in the German Dept on an old fashioned typewriter with two keyboards. The typist had been a mathematics secretary at USyd. She typed the text onto a stencil and back filled the Greek letters with the other keyboard. I filled

in script letters with a stylus. There were also diagrams involving lots of arrows that needed innovative typing and stylus techniques.

There was resistance to publishing journal articles on category theory because it was a new subject and because of the difficulty in typesetting the diagrams.

How things have changed in the last 50 years!

Just as science attempts to organize nature into understandable theories, category theory organizes mathematics itself while still remaining a part of mathematics. I recommend the book by Eugenia Cheng, originally called "Cakes, Custard and Category Theory" for the English publishers and "How to Bake Pi" for the Americans. Eugenia Cheng endeavours to explain category theory through an analogy with cooking desserts!

People worry about doing arithmetic in front of mathematicians. They expect mathematicians to be able to do mental arithmetic at lightning speed. Well, some can, just as some non-mathematicians can. Mathematics is much more than arithmetic and much more about getting the right answer.

Indeed, a take home slogan from this talk might well be: **correct beats fast!**.

Let me conclude with a quote from the Collected Works for the period 2002-2013 of the Oxford University mathematician Sir Michael Atiyah (who visited Macquarie in 1990):

In the broad light of day mathematicians check their equations and their proofs, leaving no stone unturned in their search for rigour. But, at night, under the full moon, they dream, they float among the stars and wonder at the miracle of the heavens. They are inspired. Without dreams there is no art, no mathematics, no life.

Thank you for your attention.