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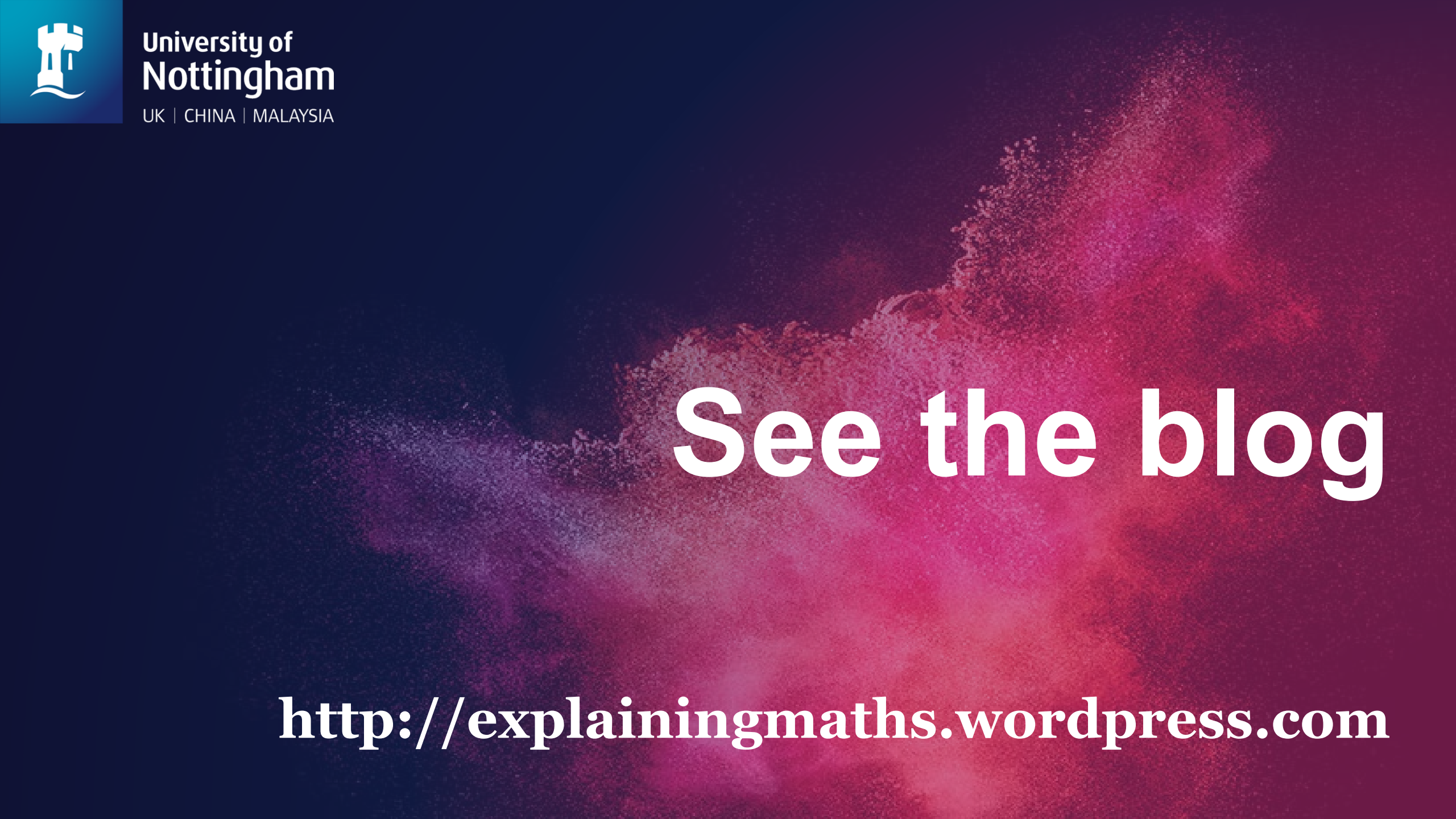
Taster Lecture on Pure Mathematics

Joel Feinstein

School of Mathematical Sciences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See the blog
http://explainingmaths.wordpress.com

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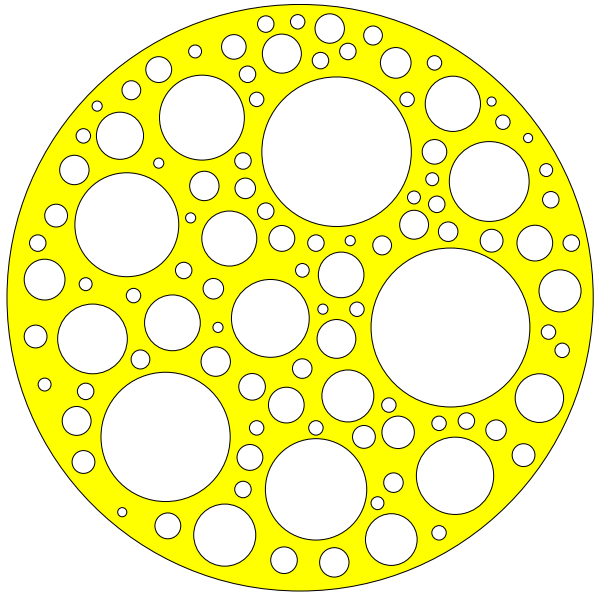
About me – Joel Feinstein

- Associate Professor, Pure Mathematics
- Outreach Officer
- Teaching Support Officer
- I teach the first-year module **Foundations of Pure Mathematics**
- My research includes work on Swiss cheeses!



Pure Maths Taster

This Taster Lecture is based on part of the first lecture from our first-year module

Foundations of Pure Mathematics (FPM)

Some complete sets of videos from this module are available from https://tinyurl.com/uonfpm

To participate in the polls today using your mobile device, please visit https://tinyurl.com/uonpoll

About this session

Throughout my teaching I give students the opportunity to participate in polls during classes.

If you want to participate in the polls today using your mobile device, please visit https://tinyurl.com/uonpoll or use the link in the Teams chat

The importance of definitions – what is a prime number?

If you are unclear about the precise definitions of the concepts you are working with, it is very hard to be certain about the answers to questions concerning these concepts.

Problem 1

Is 1 a prime number?

A Yes
B No
C I don’t know the precise definition of ‘prime number’
D I’m not sure

The importance of definitions – what is a prime number?

Some problems to think about – two problems concerning prime numbers

Problem 2

How **many** prime numbers p are there such that $\sqrt{p+1}$ is an integer?

A No-one knows yet
B Infinitely many
C One
D Two
E Please explain the question again
F I'm not sure

Some problems to think about – two problems concerning prime numbers

Some problems to think about – two problems concerning prime numbers

Some problems to think about – two problems concerning prime numbers

Problem 3

How **many** prime numbers p are there such that $\sqrt{p-1}$ is an integer?

A No-one knows yet
B Infinitely many
C One
D Two
E Please explain the question again
F I'm not sure

For more information about this problem, you can look up Landau's problems on the web.

Some problems to think about – Simpson's Paradox

Two vets (Vet A and Vet B) each claim to be better at treating a certain animal disease than the other.

- Vet A points out that they cured a greater percentage of their male patients last year than Vet B did, and that they also cured a greater percentage of their female patients last year than Vet B did.

- However, Vet B points out that, overall, they cured a greater percentage of their patients last year than Vet A did.

Do you think this is possible? Can you find an example showing it is possible? Or can you prove it is impossible?

Here a convincing **example** has to include **four** numbers for **each** vet (numbers of male/female patients and the number of each that they cured).

Some problems to think about

In the following table, percentages have been rounded to the nearest integer

	Male patients	Female patients	All patients
Vet A	10 patients 10 cured **100% cured**	90 patients 50 cured **56% cured**	100 patients 60 cured **60% cured**
Vet B	90 patients 89 cured **99% cured**	10 patients 3 cured **30% cured**	100 patients 92 cured **92% cured**

For more on this phenomenon, look up **Simpson's Paradox**.

Situations like this really do turn up surprisingly often!

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Some useful links

University of Nottingham, School of Mathematical Sciences and our maths courses:

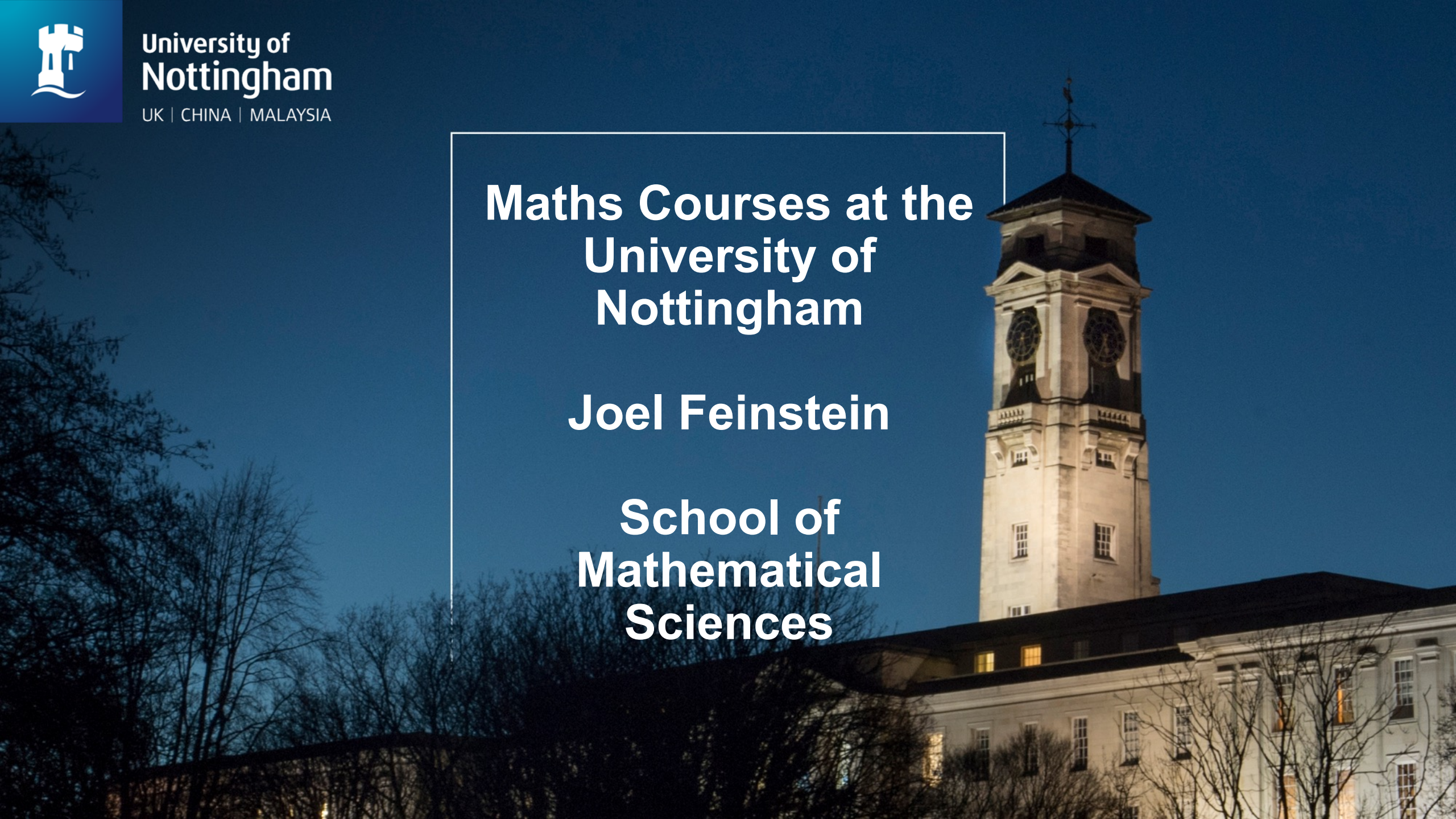
https://tinyurl.com/mathsuon

https://tinyurl.com/mathscourseuon

Complete sets of videos for the first-year module **Foundations of Pure Mathematics**:

https://tinyurl.com/uonfpm

Please give us feedback on this session using the link in the Q&A chat!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Maths Courses at the University of Nottingham
Joel Feinstein
School of Mathematical Sciences

School of Mathematical Sciences

- Department of Mathematics formed in 1919
- School of Mathematical Sciences formed in 1998
- Moved to current, purpose-built, home in 2011
- Situated in a lovely campus with great facilities
- Over 70 academic staff

Maths Courses at Nottingham

Single-Subject Degrees

- **Mathematics BSc** (3 years)
- **Mathematics MMath** (4 years)
- **Mathematics (International Study) BSc** (4 years)
- **Mathematics with a Year in Industry BSc** (4 years)
- **Mathematics with a Year in Industry MMath** (5 years)
- **Statistics BSc** (3 years)

Maths Courses at Nottingham

Joint Degrees

- **Financial Mathematics BSc** (3 years)
  - with Nottingham University Business School
- **Mathematics and Economics BSc** (3 years)
  - with School of Economics
- **Mathematical Physics BSc/MSci** (3/4 years)
  - coordinated by School of Physics & Astronomy
- **Natural Sciences BSc/MSci** (3/4 years)
  - coordinated across schools involved
  - available with a year abroad

Careers with Mathematics

The most popular employment sectors nationally for maths graduates are*:

- Business, HR and finance professionals (42%)

  e.g., Consultant, Actuarial Graduate, Analyst, Strategic Consultant, Accountant

- IT professionals (12%)

  e.g., Software Engineer, Data Analyst, Cyber Security Associate, Technology Analyst

- Education professionals (9%)

  e.g., Teacher of Mathematics, Teaching Assistant

*Source: *What do graduates do?* (HECSU 2018)

Top four employers for our graduates:

- Deloitte
- PwC
- Ernst & Young
- KPMG

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https://tinyurl.com/mathscourseuon

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Future Maths Taster Sessions: https://tinyurl.com/uonmathstaster

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Any questions?

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