Open Problems in Mathematics

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School of Mathematical Sciences
Queen Mary, University of London

Open Day Presentation 2016

What is Mathematics

Mathematics is not

- just "doing things with numbers and letters and other symbols"
- just a collection of facts and rote recipes
- just computational and arithmetic skills

Mathematics is

- a way of thinking
- the language of science
- a creative discipline
- a source of pleasure and wonder
- problem solving

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- Ability to work independently
- Ability to manage your own time
- Highly developed numerical skills
- Effective communication skills
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- Practical computational skills

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Seven Million Dollars Prize Money

7 Prize Problems, selected by Clay Mathematics Institute in 2000

- Birch and Swinnerton-Dyer Conjecture
- Hodge Conjecture
- Navier-Stokes Equations
- P vs NP
- Poincaré Conjecture
- Riemann Hypothesis
- Yang-Mills Theory

These are hard problems (it might be easier to rob a bank...)

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Solved Problems in Mathematics

Some "recently" proved problems:

- Fermat's last theorem (1637, proved 1994): If an integer n is greater than 2, then the equation

$$a^n + b^n = c^n$$

  has no solutions in non-zero integers a, b, and c.

  For $n = 2$, this is of course possible, for example

$$3^2 + 4^2 = 5^2 \ .$$

- The four colour theorem (1852, proved 1976): Given any plane separated into regions, such as a political map of the states of a country, the regions may be coloured using no more than four colours.

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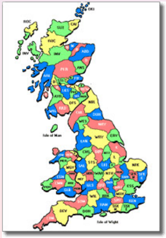

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Some unsolved problems:

- Goldbach's conjecture (1742): every even integer greater than 2 can be written as the sum of two primes.

  $$\text{For example, } 18 = 5 + 13 = 7 + 11.$$

  Goldbach's ternary conjecture, proved 2013: every odd integer greater than 5 *can be written as the sum of three primes.*

- The twin prime conjecture (300 BC): there are infinitely many primes p such that $p + 2$ is also prime.

  For example, 17 and 19 are twin primes.

  proved 2014: there are infinitely many primes that differ by at most 246.

more at http://en.wikipedia.org/wiki/Unsolved_problems_in_mathematics

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> *"The history of mathematics is a history of horrendously difficult problems being solved by young people too ignorant to know that they were impossible."*

Freeman Dyson, "Birds and Frogs", AMS Einstein Lecture 2008

MORE LATER

Three-Year BSc Degree Courses

Title	Code	Req.
Mathematics	G100	340
Pure Mathematics	G110	340
Mathematics and Statistics	GG31	340
Mathematics with Business Management	G1N1	340
Mathematics with Actuarial Science[1]	G1N3	340
Mathematics with Business Management and Finance	GN13	340
Mathematics with Finance and Accounting	G1N4	340
Mathematics, Statistics, and Financial Economics	GL11	340

A=120, B=100

[1] from 2016

Other Degree Courses

Degree	Years	Title	Code	Req.
MSci	4	Mathematics	G102	360
MSci	4	Financial Mathematics	GN1H	360
MSci	4	Mathematics with Statistics	G1G3	360
BSc	*3*	*Computer Science with Mathematics*	*GG41*	*340*
BSc	*3*	*Economics, Statistics, and Mathematics*	*LG11*	*340*
	1	Science & Eng. Foundation Programme	FGH0	180

- All classified degrees are honours degrees
- Course unit system instead of joint or combined honours

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Course Unit System

Advantages:

- Flexibility
- Opportunities to take modules in other departments
- Freedom to shape your programme of study
- Specialisation in penultimate and final year

Typically,

- take 8 modules in first year (no choice)
- choose 8 of 16 modules in second year
- choose 8 of 24 modules in third year

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Example: G100 Mathematics

Study Programme Structure

- Compulsory modules
- $+$ Optional compulsory modules
- $+$ Elective modules

Streams withing G100 include

- Algebra and Discrete Mathematics
- Analysis and Geometry
- Probability and Statistics
- Applied Mathematics

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The Academic Year

late September mid December	Teaching Semester A (12 weeks)
early January late March	Teaching Semester B (12 weeks)
late April early June	Examination Period (6 weeks)

Teaching

- 4 modules per semester
- 3 hours lectures + 1 hour exercise class (per module and week)
- $4 \times 4 = 16$ timetabled hours per week

Assessment

- Modules count 1:3:6 to final degree
- 10% in-term assessment + 90% final exam
- 2 attempts at exam (one resit)

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- Personal Academic Advisers (academic matters)
- Senior Tutor, Director of Undergraduate Studies
- Student Support Officer - "i^2 Keepin' it real"
- PASS (Peer Assisted Study Support)

College:

- Advice and Counselling Service
- Health Centre
- Disability Coordinator
- Careers Service
- The Students Union
- Student Accomodation

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