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# STEP Teacher Webinar 23/11/21

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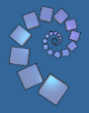

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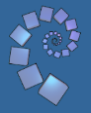
# What is STEP?

- “Sixth Term Examination Paper”
- Part of Cambridge University offers (maths and others)
- Other Universities require or recommend
- 2 papers (STEP 2 and STEP 3)



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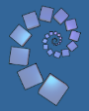
# Benefits of STEP

- Different style shows students what university maths might be like
- Students experience “Being Stuck”
- “Most useful” test for preparing for university compared to MAT/AEA *[Darlington, 2017]*
- Consistent baseline that can discriminate among high-performing students
- Don’t have to rely on interview
- Colleges have access to scripts (near misses)



# Example Question

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In this question $a$ and $b$ are distinct, non-zero real numbers, and $c$ is a real number.

**(i)** Show that, if $a$ and $b$ are either both positive or both negative, then the equation

$$\frac{x}{x-a}+\frac{x}{x-b}=1$$

has two distinct real solutions.

**(ii)** Show that, if $c \neq 1$, the equation

$$\frac{x}{x-a}+\frac{x}{x-b}=1+c$$

has exactly one real solution if

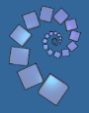
$$c^2=-\frac{4ab}{(a-b)^2}\,.$$

Show that this condition can be written

$$c^2=1-\left(\frac{a+b}{a-b}\right)^2$$

and deduce that it can only hold if $0 < c^2 \leqslant 1$.

STEP 1
2005



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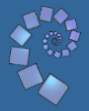
# Specifications

- New Specifications in 2019
- Indicates what is not in A levels
- Couple of small changes in 2020/21
- STEP specification mapping document



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# Specifications

Understand and use the structure of mathematical proof, proceeding from given assumptions through a series of logical steps to a conclusion; use methods of proof, including proof by deduction, proof by exhaustion, ***proof by induction***.

***Understand and use the terms 'necessary and sufficient' and 'if and only if'.***

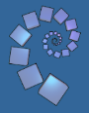
Disproof by counter-example.

Proof by contradiction (including proof of the irrationality of $\sqrt{2}$ and the infinity of primes, and application to unfamiliar proofs).

Simplify rational expressions including by factorising and cancelling, and algebraic division (by linear ***and higher degree*** expressions).

Understand and use graphs of functions; sketch curves defined by simple equations including polynomials, the modulus of linear ***and other*** functions, $y = \frac{a}{x}$ and $y = \frac{a}{x^2}$ ***and other rational functions such as*** $y = \frac{x}{(x-a)^2}$ (including their vertical and horizontal asymptotes); ***behaviour as*** $x \to \pm\infty$; interpret the algebraic solution of equations graphically; use intersection points of graphs to solve equations.

Both from "Mathematics 1" Specification



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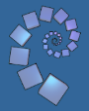
# Quick Site Tour - specifications



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# Example Question 2

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In this question, $x$, $y$ and $z$ are real numbers.

Let $\lfloor x \rfloor$ denote the largest integer that satisfies $\lfloor x \rfloor \leqslant x$ and let $\{x\}$ denote the fractional part of $x$, so that $x = \lfloor x \rfloor + \{x\}$ and $0 \leqslant \{x\} < 1$. For example, if $x = 4.2$, then $\lfloor x \rfloor = 4$ and $\{x\} = 0.2$ and if $x = -4.2$, then $\lfloor x \rfloor = -5$ and $\{x\} = 0.8$.

**(i)** Solve the simultaneous equations

$$\begin{aligned} \lfloor x \rfloor + \{y\} &= 4.9\,, \\ \{x\} + \lfloor y \rfloor &= -1.4\,. \end{aligned}$$

**(ii)** Given that $x$, $y$ and $z$ satisfy the simultaneous equations

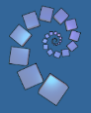
$$\begin{aligned} x + \lfloor y \rfloor + \{z\} &= 3.9\,, \\ \{x\} + y + \lfloor z \rfloor &= 5.3\,, \\ \lfloor x \rfloor + \{y\} + z &= 5\,, \end{aligned}$$

show that $\{y\} + \lfloor z \rfloor = 3.2$ and solve the equations.

STEP 2
2021

**(iii)** Solve the simultaneous equations

$$\begin{aligned} x + 2\lfloor y \rfloor + \{z\} &= 3.9\,, \\ \{x\} + 2y + \lfloor z \rfloor &= 5.3\,, \\ \lfloor x \rfloor + 2\{y\} + z &= 5\,. \end{aligned}$$



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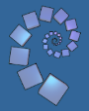
- Foundation modules
  - Preparation leading into STEP question
  - Hints and solutions
- STEP 2/3 modules
  - 4 questions on an area of the specification
  - Topic notes/Hints document/Solutions
- Worked papers
- Notes on topics outside standard A-level specs
- Help and support



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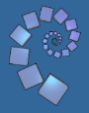

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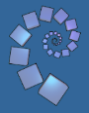
# Sitting the Exam

- No formula book – List of required formulae in the Specification
- Some formulae might be given in the question
- Crossed out work won't be marked (but don't need to cross out extra questions)
- 12 questions in each paper
- 3 hours long
- Each question marked out of 20
- Best 6 scores make the final score



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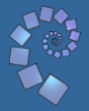
# Grade 1 Boundaries

| | STEP 2 | STEP 3 |
|---|---|---|
| 2016 | 74 | 64 |
| 2017 | 80 | 69 |
| 2018 | 77 | 59 |
| 2019 | 68 | 57 |
| 2020 | 54 | 67 |
| 2021 | 67 | 67 |



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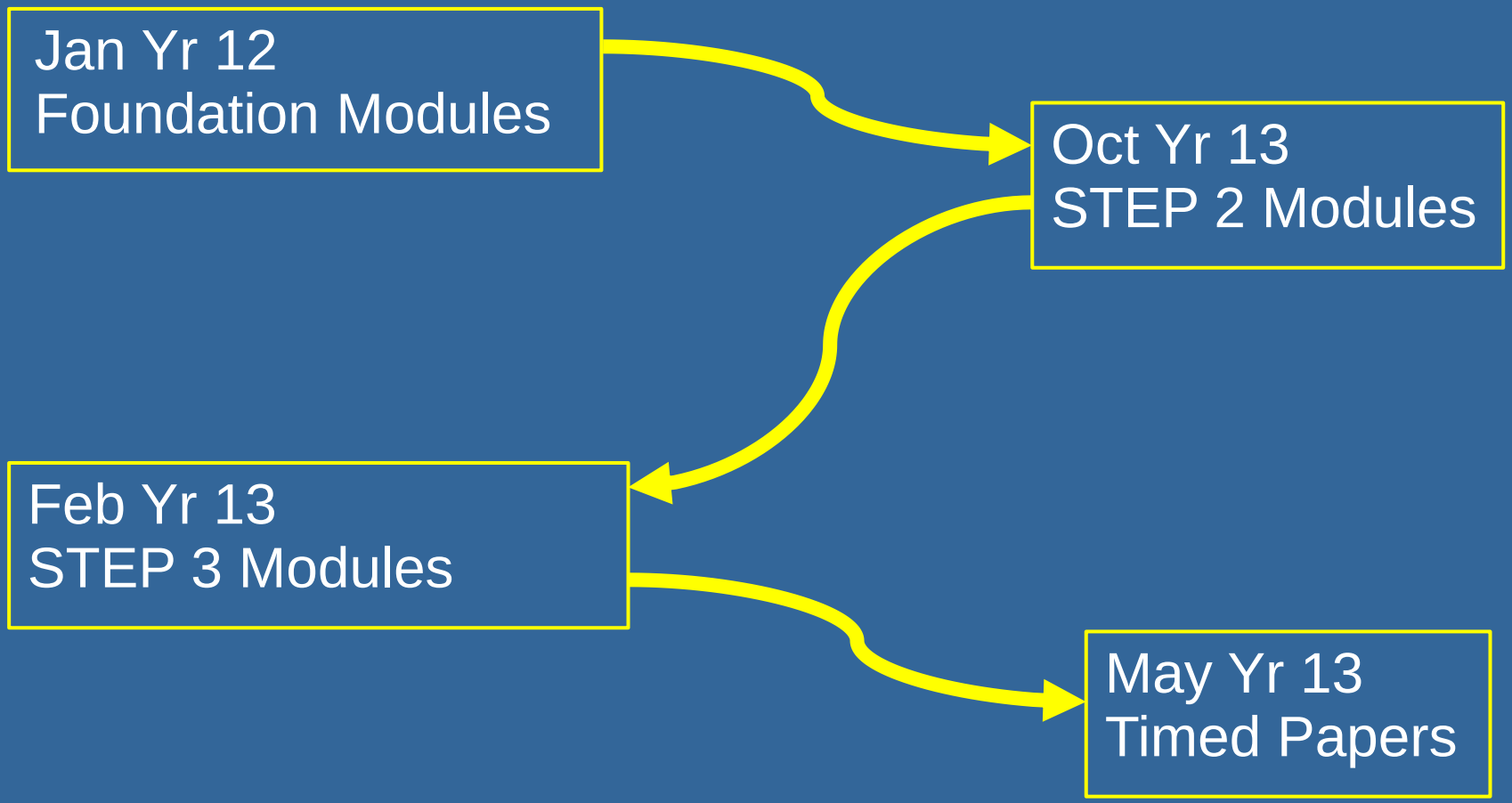
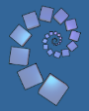
# A suggested route



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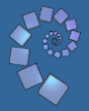
# Other entrance Tests

- MAT (Oxford, Imperial, Warwick)
- TMUA (Various)
- Also maths bits in PAT (Oxford), BMAT
- ENGAA, NSAA, ECAA, PBSAA (Cambs)
- All of these are administered by Cambridge Assessment Admissions Testing



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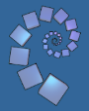
# Student preparation

- Could look at TMUA/NSAA/MAT for early prep (Year 12)
- Do lots and lots (and lots) of questions!
- Use the assignments on maths.org/step
- Earlier they can start the better
- Use hints and solutions to help through
- Near the exams try some timed papers
- Ask for help!



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# Websites

- maths.org/step
- admissionstestingservice.org
- mei.org.uk/step-aea-solutions
- stepdatabase.maths.org
- openbookpublishers.com/product/1050