Advanced Mathematics Support Programme®

Why **every** mathematics teacher needs to know about admissions tests

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Continuing Professional Development Standard

National Centre for Excellence in the Teaching of Mathematics

You will need…

- pencil and paper

- to join our desmos activity:

  www.student.desmos.com **BWF NNJ**

In this workshop….

- Why admissions tests?
- Who are they for?
- What do the mathematics university admissions tests look like?

Caveat…

- We don't really know what is going on this year!
  - We know STEP I is no longer available.
  - Some universities have changed their offers, including removing all incentives.
  - Others have simply removed STEP I (and possibly reduced the grade required for STEP II or III).
  - Still others have not yet published their decisions…
- We think it is more useful to focus on what *normally* happens, as this year is (hopefully) an anomaly.

…but we don't have 'that sort of student' at our school…

…it's only the Further Mathematics teachers who need to know…

…it doesn't happen until year 13, so ages away yet…

Are you ***sure***?

Which of these universities require or incentivise maths students with an admissions test?

Bath	**I**mperial	**O**xford
Cambridge	**L**ancaster	**Sh**effield
Cardiff	**LSE**	**S**outhampton
Durham	**N**ottingham	**W**arwick

What are the offers from these universities?

University	Standard offer for Mathematics	Typical offer including an admissions test
Bath	A*AA (inc. FM)	A*AB
Cambridge	A*A*A	**Test required**
Cardiff	AAB	Unclear – ABB?
Durham	A*A*A	A*AA or A*A*B
Imperial	A*A*A	**Test required**
Lancaster	AAA (AAB inc. FM)	‘more favourable’
LSE	A*AA (Maths & Econ.)	‘may help get offer’
Nottingham	A*AA – A*AB	‘taken into consideration’
Oxford	A*A*A (inc. FM)	**Test required**
Sheffield	AAB	‘additional consideration’
Southampton	AAA	AAB
Warwick	A*A*A*	A*A*A

Why do universities require or value these tests?

To differentiate between A* students

Because students develop better understanding and problem-solving skills by preparing for them.

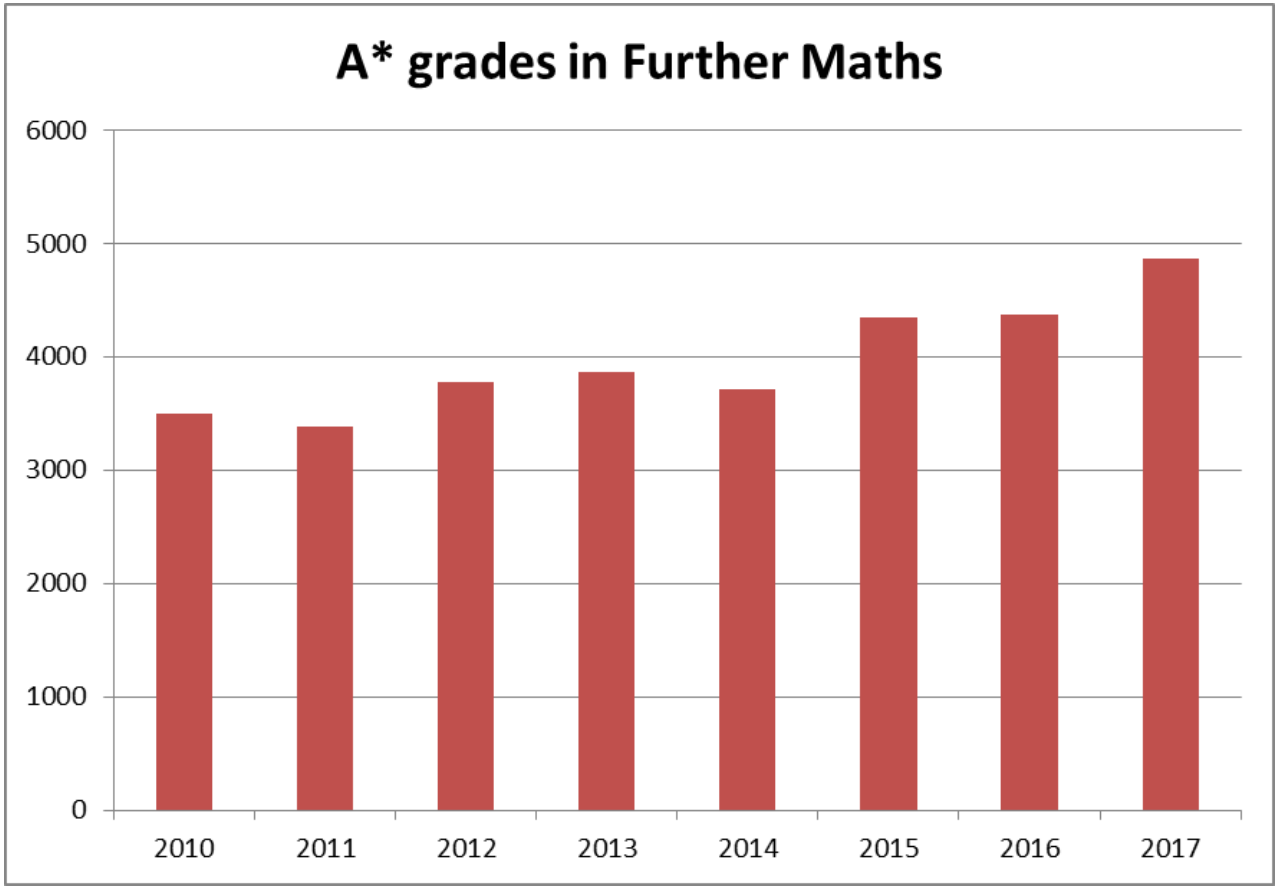
The rise of admission tests

Rise in top universities setting own entrance exams as they cannot rely on A-levels

The Telegraph Education, August 2017

- "several of the elite Russell Group universities have signalled that they can no longer rely on A-levels to select the brightest students"
- (Cambridge university tests are designed to) "maintain the effectiveness and fairness of our admissions system during ongoing qualification reform"

Because they need more information in order to select the best candidates



Because predicted grades are unreliable

- In 2016
  - more than half of students accepted on to degree courses missed their required results by two or more grades.
    - Mary Curnock Cook, UCAS chief executive

- AS levels are now “decoupled” from A levels
  - Students may not take an AS level in year 12

- Competition is fierce for many STEM courses at certain universities

The rise of admission tests

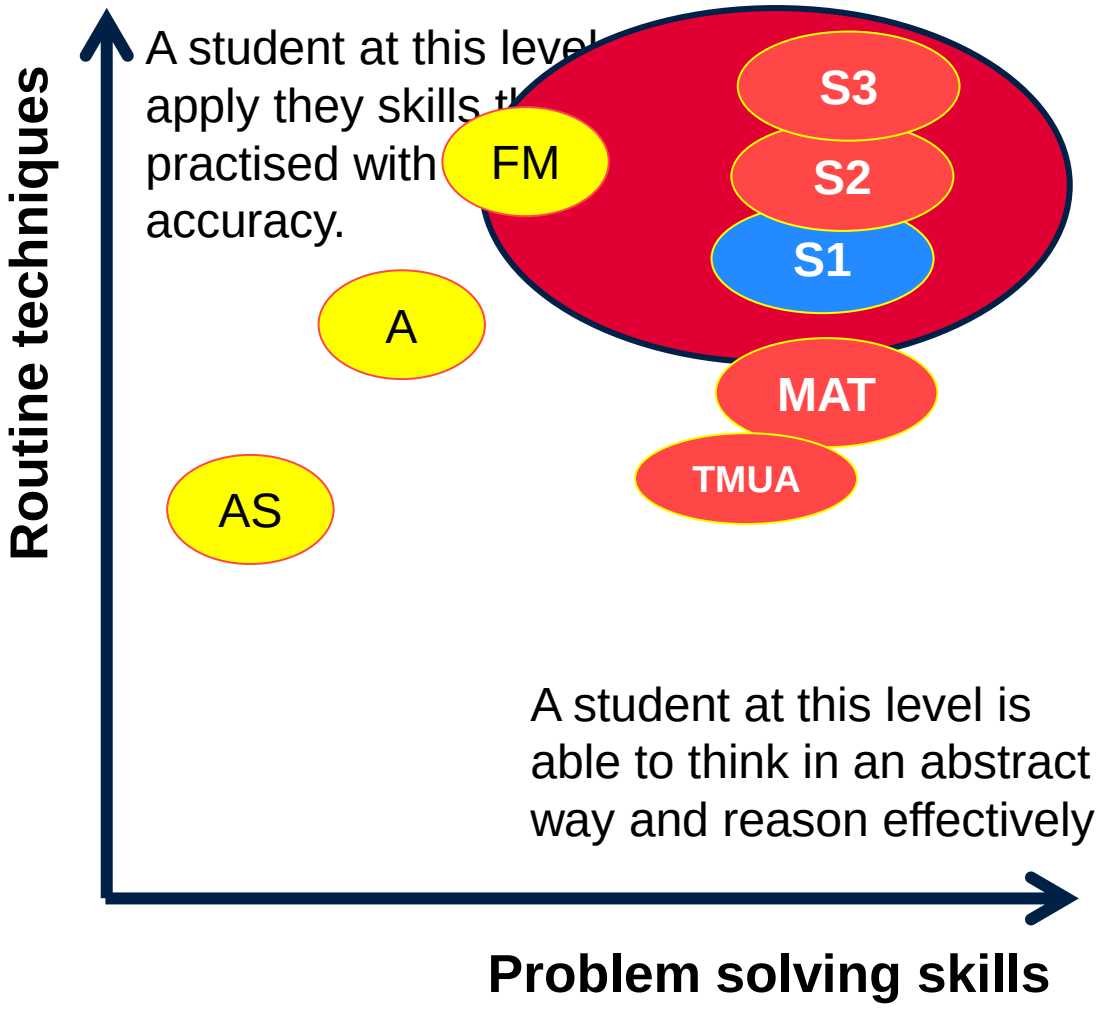
- Research by exam group Cambridge Assessment

- In 2012
  - 48% of A Level forecast grades were correct
  - 92% were correct or within one grade
  - 8% were more than one grade out

- In 2014
  - 43% of A Level forecast grades were correct
  - 88% were correct or within one grade
  - 12% were more than one grade out

Because they want students with a deeper experience of mathematics than A level provides

- Even the reformed A levels don't go as far as some universities would like, particularly in terms of problem solving and proof.


A student at this level
apply they skills th
practised with
accuracy.
FM
S3
S2
S1
A
MAT
TMUA
AS
Routine techniques
A student at this level is able to think in an abstract way and reason effectively
Problem solving skills

What tests are available?

- TMUA – early November – suitable for **many** students
- MAT – early November – **required** for Oxford; available for Imperial and Warwick; *not* available unless one of these three universities is chosen
- STEP 2 and STEP 3 – **required** for Cambridge; available for any student *but without STEP 1, only these more challenging options are available*

Test of Mathematics for University Admission (**TMUA**)

- Multiple-choice
- Good questions for challenging all A/B grade students
- Consider at least *preparing* **all** your able students for this exam
- Start preparation informally from the beginning of y12

Mathematics Admissions Test (**MAT**)

- The Oxford entrance exam
- Also used by Imperial
- Can also be accessed by students applying to Warwick

*NB results are not released if students are **not** applying to one of these three institutions*

- More challenging than TMUA
- Easier than STEP *only* in being designed for early in y13 not late
- More *accessible* because of varied multiple-choice section
- Start preparation early with TMUA questions from the beginning of y12

STEP 2 & 3

- Both exams use content from the full A level Mathematics specification
- STEP 2 also covers AS Further Mathematics
- STEP 3 also covers the full A level
- 3-hour papers
- Full written solutions required for all questions
- Start preparation early using TMUA, MAT and old STEP 1 resources through y12

Why is this a nice question?

8. Given that $a^x b^{2x} c^{3x} = 2$, where a, b, and c are positive real numbers, then $x =$

A $\log_{10}\left(\frac{2}{a+2b+3c}\right)$

B $\frac{\log_{10} 2}{\log_{10}(a+2b+3c)}$

C $\frac{2}{\log_{10}(a+2b+3c)}$

D $\frac{2}{a+2b+3c}$

E $\log_{10}\left(\frac{2}{ab^2c^3}\right)$

F $\frac{\log_{10} 2}{\log_{10}(ab^2c^3)}$

G $\frac{2}{\log_{10}(ab^2c^3)}$

H $\frac{2}{ab^2c^3}$

TMUA Specimen Paper 1

Why is this a nice question?

15. The smallest possible value of $\int_0^1 (x-a)^2\,dx$ as a varies is

A $\frac{1}{12}$

B $\frac{1}{3}$

C $\frac{1}{2}$

D $\frac{7}{12}$

E 2

TMUA Specimen Paper 1

Why is this a nice question?

3. Consider the following attempt to solve an equation. The steps have been numbered for reference.

$$\sqrt{x+5} = x+3$$

(1)

$$x+5 = x^2+6x+9$$

(2)

$$x^2+5x+4=0$$

(3)

$$(x+4)(x+1)=0$$

$$x=-4 \text{ or } x=-1$$

Which one of the following statements is true?

A Both -4 and -1 are solutions of the equation.

B Neither -4 nor -1 are solutions of the equation.

C One solution is correct and the incorrect solution arises as a result of step (1).

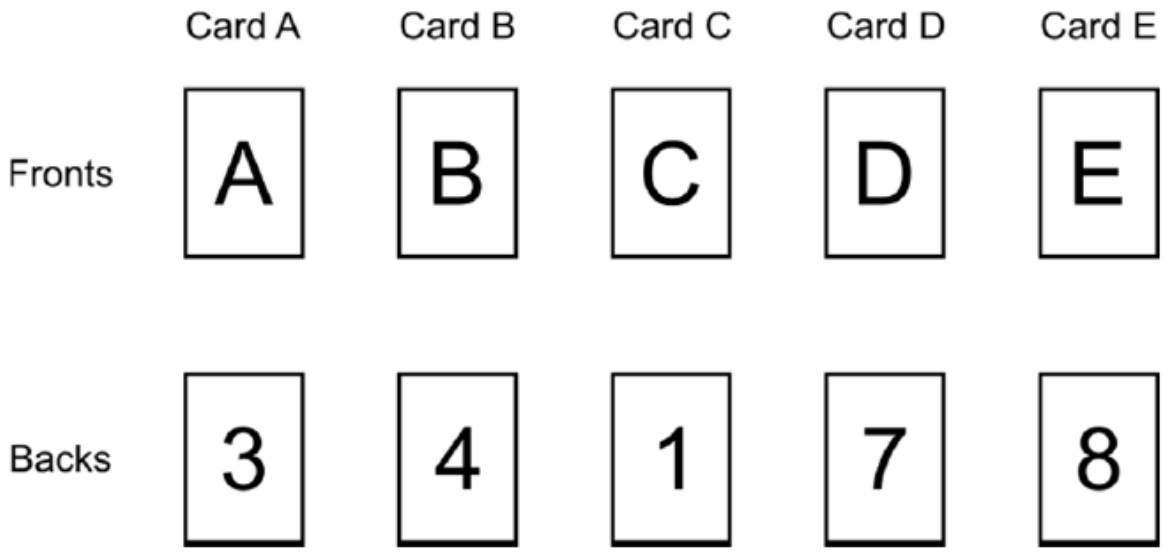
D One solution is correct and the incorrect solution arises as a result of step (2).

E One solution is correct and the incorrect solution arises as a result of step (3).

TMUA Specimen Paper 2

Why is this a nice question?

4. A set of five cards each have a letter printed on their front and a number printed on their back, as follows:



Which one of the five cards (**A**, **B**, **C**, **D** or **E**) provides a counterexample to the following statement?

Every card that has a vowel on its front has an even number on its back.

TMUA Specimen Paper 2

Why is this a nice question?

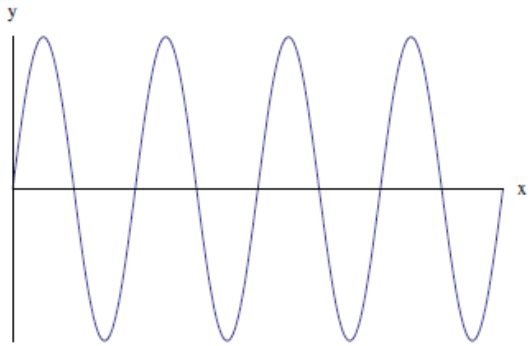
A. The values of k for which the line $y = kx$ intersects the parabola $y = (x-1)^2$ are precisely

(a) $k \leqslant 0$, (b) $k \geqslant -4$, (c) $k \geqslant 0$ or $k \leqslant -4$, (d) $-4 \leqslant k \leqslant 0$.

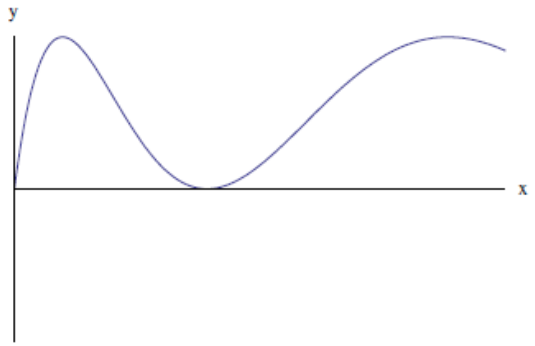
MAT 2010

Why is this a nice question?

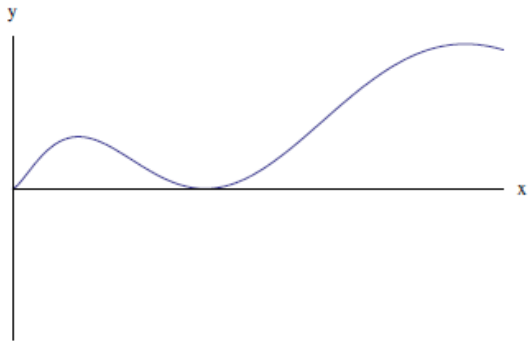
D. The graph of $y = \sin^2\sqrt{x}$ is drawn in



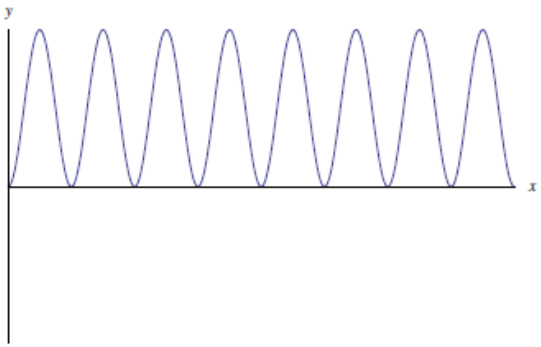
(a)



(b)



(c)



(d)

MAT 2010

Why is this a nice question?

E. Which is the largest of the following four numbers?

(a) $\log_2 3$, (b) $\log_4 8$, (c) $\log_3 2$, (d) $\log_5 10$.

MAT 2010

Why is this a nice question?

2 The curve $y = \left(\frac{x-a}{x-b}\right)e^x$, where a and b are constants, has two stationary points. Show that

$$a - b < 0 \quad \text{or} \quad a - b > 4\,.$$

(i) Show that, in the case $a = 0$ and $b = \frac{1}{2}$, there is one stationary point on either side of the curve's vertical asymptote, and sketch the curve.

(ii) Sketch the curve in the case $a = \frac{9}{2}$ and $b = 0$.

STEP I 2010

Why is this a nice question?

1 Find all values of a, b, x and y that satisfy the simultaneous equations

$$\begin{aligned} a + b &= 1 \\ ax + by &= \tfrac{1}{3} \\ ax^2 + by^2 &= \tfrac{1}{5} \\ ax^3 + by^3 &= \tfrac{1}{7}\,. \end{aligned}$$

[**Hint**: you may wish to start by multiplying the second equation by $x + y$.]

STEP III 2008

Where next?

- Next Steps for your A level students
  - next course 10th and 17th March
- On Demand Professional Development
  - MAT and TMUA
  - STEP
- For students:
  - Regular Problem Solving Workshops – contact your AMSP Area Coordinator
  - Problem Solving Matters – applications opening shortly