Advanced Mathematics Support Programme®

The Maths in University Admissions Tests

Let's start with two problems

Find the value of

$$\sin^2 0° + \sin^2 1° + \sin^2 2° + \ldots + \sin^2 88° + \sin^2 89° + \sin^2 90°$$

In the triangle $PQR, PR = 2, QR = p$ and $\angle RPQ = 30°$.

What is the set of **all** the values of p for which this information uniquely determines the length of PQ?

A $p = 1$

B $p = \sqrt{3}$

C $1 \leq p < 2$

D $\sqrt{3} \leq p < 2$

E $p = 1$ or $p \geq 2$

F $p = \sqrt{3}$ or $p \geq 2$

G $p < 2$

H $p \geq 2$

The Maths in University Admissions Tests

The rise of admissions tests

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"

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

The rise of admission tests

- Teachers are more likely to be over-optimistic
  - 43% over estimated

  rather than pessimistic
  - 14% under estimated

- May forecast grades used for research
  - also used to set grade boundaries

The accuracy of forecast grades for OCR A levels in June 2014, Tim Gill and Tom Benton, July 2015

The rise of admission tests

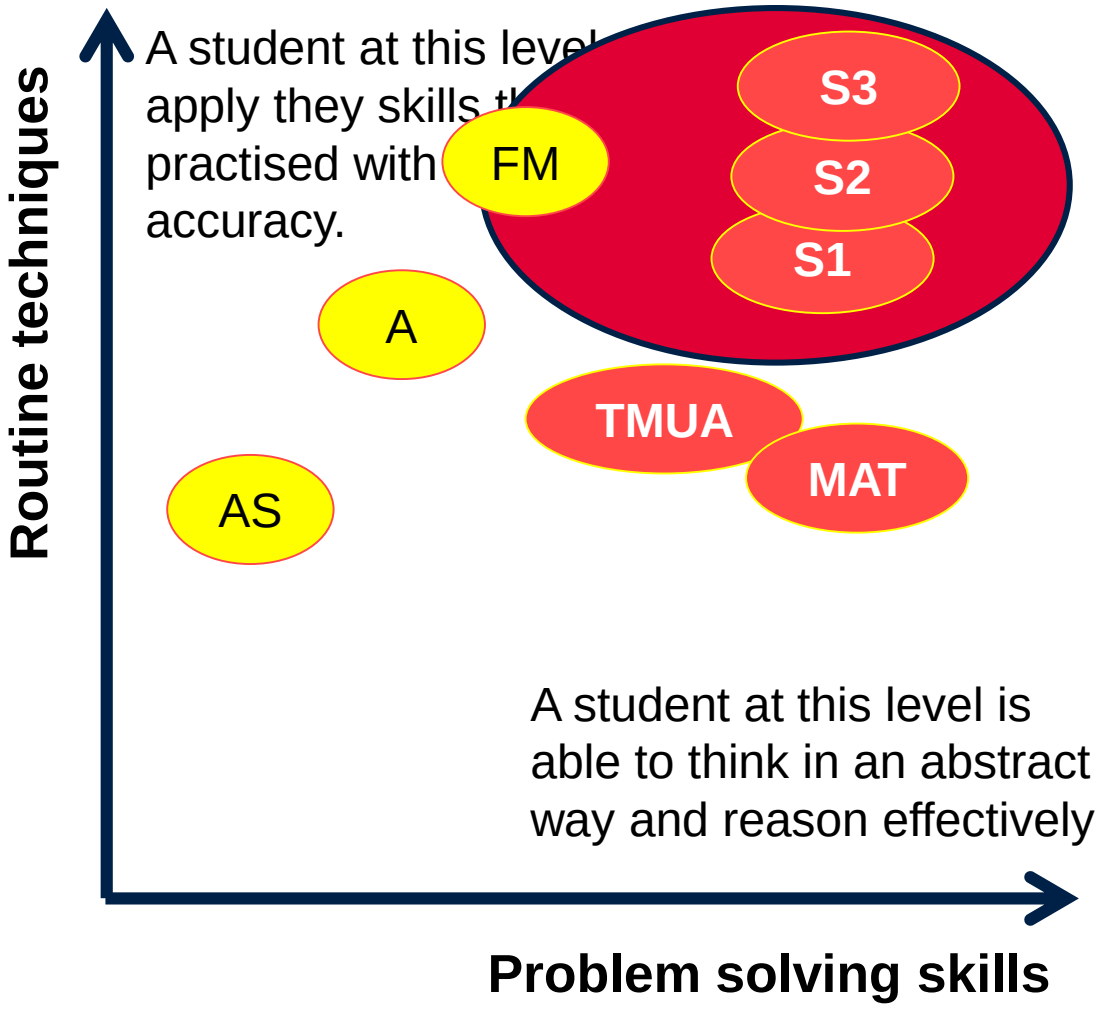
- In 2016 more than half of students accepted on to degree courses missed their required results by two or more grades.
  - Mary Curnock Cook, UCAS chief executive

- Competition is fierce for many STEM courses at certain universities

The rise of admission tests

- What does the “decoupling” of AS levels mean?

  - Many students from state schools so not sit AS levels at the end of Year 12
  - AS levels used to form part of the admissions procedure
  - GCSE results are not necessarily a good indication of A level success


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

We're only talking about Oxbridge here….right?

- Partly….
  - The compulsory admissions tests do tend to be for Oxford or Cambridge
- BUT
  - Imperial College maths requires success in the MAT (or STEP if MAT was not possible)
  - Other universities give lower offers based on results in admissions tests.

The big 3

As far as mathematics admissions are concerned, the big 3 are

- STEP – Cambridge/Warwick
- MAT – Oxford/Imperial College/Warwick
- TMUA

The TMUA

- The Test of Mathematics for University Admissions
- Lowers A level grades for admissions
- Accepted by: Cardiff, Durham, Lancaster, LSE, Bath, Nottingham, Sheffield, Southampton, Warwick…

The Cambridge TMUA (CTMUA)

- The same paper as the “normal” TMUA
- **Required** by many Cambridge Colleges for Computer Science (6.5 grade)
- Replaced the CSAT

The TMUA

- Two papers taken consecutively, 75 mins each.

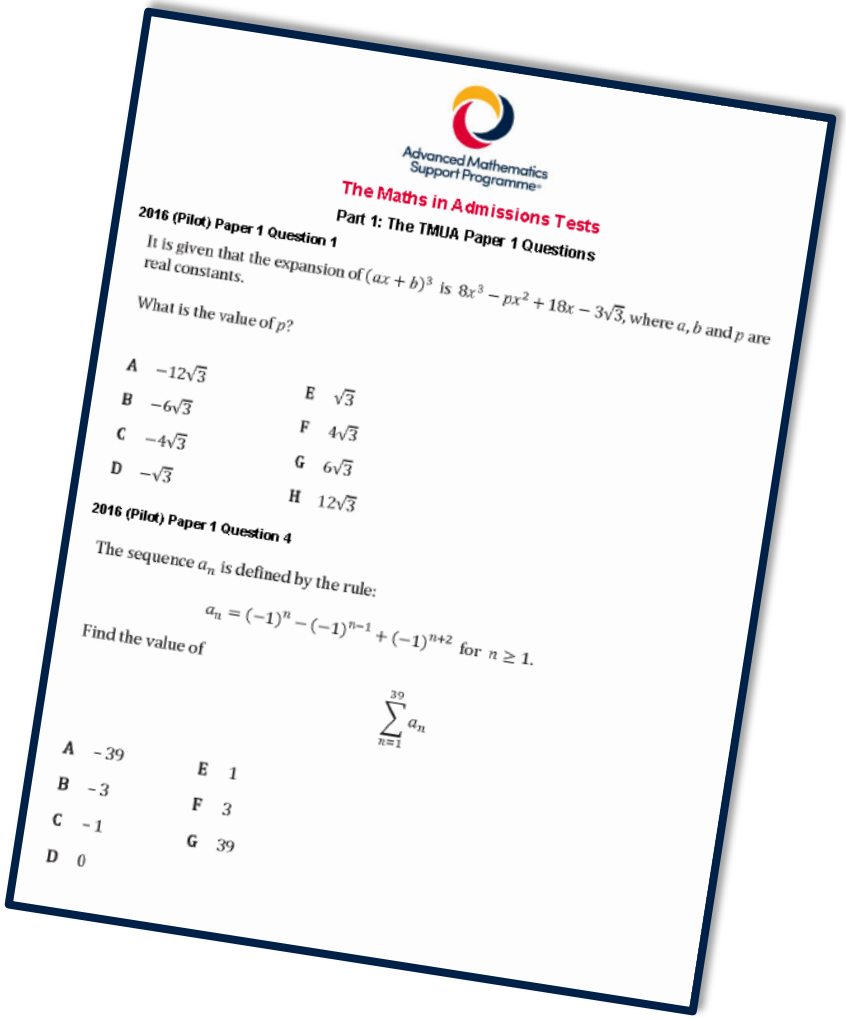
Paper	What does it test?	Questions	Timing
Paper 1: Mathematical Thinking	Focuses on assessing your ability to apply your knowledge of mathematics in new situations.	20 multiple-choice questions	75 minutes
Paper 2: Mathematical Reasoning	Focuses on assessing your ability to justify and interpret mathematical arguments and conjectures, and deal with elementary concepts from logic.	20 multiple-choice questions	75 minutes

The TMUA

- No calculators
- No formula sheet
- No dictionaries
- Let’s try some questions…

The TMUA

You have 3½ minutes per question



Advanced Mathematics Support Programme

The Maths in Admissions Tests

Part 1: The TMUA Paper 1 Questions

2016 (Pilot) Paper 1 Question 1

It is given that the expansion of $(ax+b)^3$ is $8x^3 - px^2 + 18x - 3\sqrt{3}$, where a, b and p are real constants.

What is the value of p?

A $-12\sqrt{3}$
B $-6\sqrt{3}$
C $-4\sqrt{3}$
D $-\sqrt{3}$
E $\sqrt{3}$
F $4\sqrt{3}$
G $6\sqrt{3}$
H $12\sqrt{3}$

2016 (Pilot) Paper 1 Question 4

The sequence a_n is defined by the rule:

$$a_n = (-1)^n - (-1)^{n-1} + (-1)^{n+2} \text{ for } n \geq 1.$$

Find the value of

$$\sum_{n=1}^{39} a_n$$

A -39
B -3
C -1
D 0
E 1
F 3
G 39

Some feedback

- Which question(s) did you look at?
- How would a student manage to get this down to 3½ minutes thinking and work?
- How should a student be thinking about each question?
- Are there quick techniques that the students forget about in the heat of the exam?

Some typical learning points

- If there is a sequence or series, work out the first couple of terms or vary the order
- Try estimating or substituting easy values – can you eliminate any options?
- Be suspicious of repetitive calculation
- Look for routine AS level techniques that might get you started
- Be familiar with standard tricks, such as

$$a^2 + b^2 = (a + b)^2 - 2ab$$

The TMUA

- No pass/fail mark – a score is awarded on a scale of 1.0 to 9.0, with 1.0 being the lowest and 9.0 the highest.
- Final scores are based on the number of correct answers; no penalties for incorrect answers.
- The mark is based on both papers, but students do get individual scores (for info only)

The TMUA

- Results are released to students, last year at 0900 UK time on 27 November, via the Metritests system

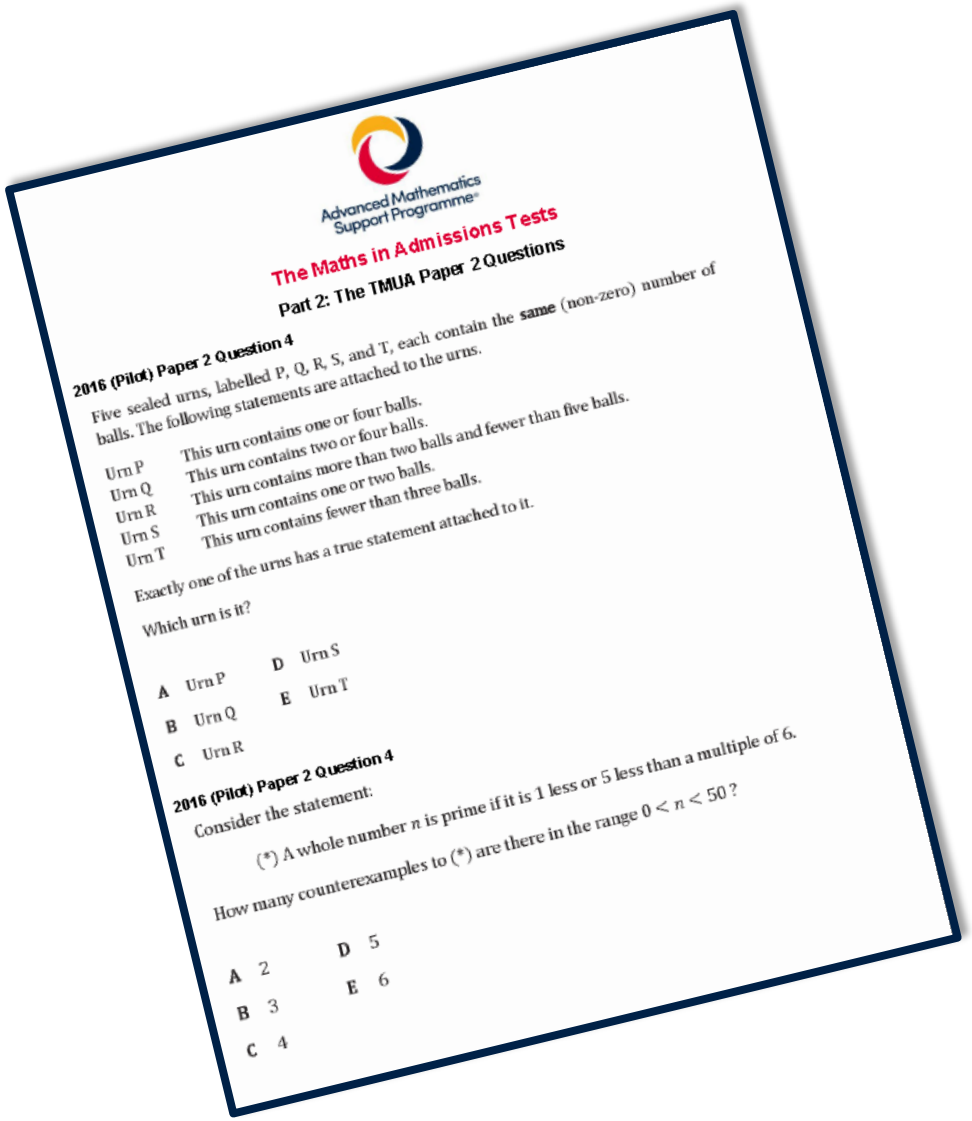
- Results are not sent to institutions automatically – candidates can chose

The TMUA

- Entries open at the start of September and close on 15 October (late fee after 1 October)
- The test takes place on the same day as many other admission tests (for 2020 this is 4 Nov)
- The cost is £31 for UK students but is free for many (e.g. those who qualify for FSM)

Time for some more TMUA questions

- Paper 2 contains a number of reasoning, logic and proof questions
- This distinguishes it from the other maths admissions tests
- The best way to explain what they are like is for you to try some out!



Advanced Mathematics Support Programme

The Maths in Admissions Tests

Part 2: The TMUA Paper 2 Questions

2016 (Pilot) Paper 2 Question 4

Five sealed urns, labelled P, Q, R, S, and T, each contain the **same** (non-zero) number of balls. The following statements are attached to the urns.

Urn P This urn contains one or four balls.
Urn Q This urn contains two or four balls.
Urn R This urn contains more than two balls and fewer than five balls.
Urn S This urn contains one or two balls.
Urn T This urn contains fewer than three balls.

Exactly one of the urns has a true statement attached to it.

Which urn is it?

A Urn P
B Urn Q
C Urn R
D Urn S
E Urn T

2016 (Pilot) Paper 2 Question 4

Consider the statement:

(*) A whole number n is prime if it is 1 less or 5 less than a multiple of 6.

How many counterexamples to (*) are there in the range $0 < n < 50$?

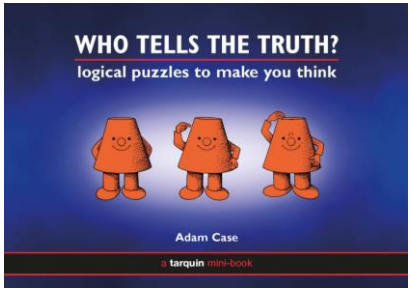
A 2
B 3
C 4
D 5
E 6

Some feedback

- Would your students be ready for these types of questions?
- How do they have to think?
- How could they prepare for them?

Preparing for the Reasoning, Logic and Proof Questions

- There is a free booklet about Reasoning Logic and Proof on the ATS TMUA page
- Students must read this
- There is some merit in starting with the “Who Tells the Truth?” book by Tarquin



Summary

- This session has focused on the TMUA
- This is a relatively new admissions test that is being used an increasing number of universities.
- The questions tend to be more straightforward than those for STEP or the MAT
- It may be useful for students not aiming for Oxford, Cambridge or Imperial College to sit the TMUA to increase their chances of getting in to the university of their choice

Summary

- Speed is important in the TMUA
- Techniques need to be embedded
- Students need to think quickly
- Reasoning, Logic and Proof needs to be studied (at least a little)

Further support

- The AMSP runs several courses, both online and face-to-face, to support both students and teachers with admissions tests.
- For further information visit https://amsp.org.uk/teachers/university-admission-tests/professional-development

Session resources

All information sheets and example questions used in the session can be downloaded for free from the Admissions Testing Service website:

www.admissionstestingservice.org

This is also where you will find the solutions to all the problems!

About the AMSP

- A government-funded initiative, managed by MEI, providing national support for teachers and students in all state-funded schools and colleges in England.
- It aims to increase participation in AS/A level Mathematics and Further Mathematics, and Core Maths, and improve the teaching of these qualifications.
- Additional support is given to those in priority areas to boost social mobility so that, whatever their gender, background or location, students can choose their best maths pathway post-16, and have access to high quality maths teaching.

Contact the AMSP

01225 716 492

admin@amsp.org.uk

amsp.org.uk

Advanced_Maths