Trinity College NST Mathematical Fluency Test

Some words of guidance

In the 2020 admissions round, you will be asked to sit a short test of mathematical fluency under conditions of remote invigilation in the week before your interviews.

All first-year students in Natural Sciences must take Mathematics. The purpose of the mathematical fluency test is to check that you have the necessary skills to be able to cope with this compulsory part of the Tripos. By asking candidates to sit a test, we do not have to probe such skills at interview, leaving more time to discuss scientific topics.

The maths test is meant to test your fluency and accuracy with some relatively straightforward mathematical manipulations. You will not generally be asked to discuss these questions at interview, except in the case that there is a question set on a topic which you have not yet encountered at school.

The intention is that the questions set in this brief test will cover core A-level topics which the majority of applicants will have encountered at school by the time they sit this test in December. Questions will be set at the level of (single) A-level Maths. We expect to set questions corresponding to sections A–H and M of the official A-level syllabus available at https://www.gov.uk/government/publications/gce-as-and-a-level-mathematics. [The material in sections P–S will not be examined in the mathematical fluency test, but may be useful in physics questions at interview.]

We recognise that the relevant content may be covered at different times by different schools, and indeed many applicants will be taking qualifications other than A-levels, and so may cover different material from that specified above. You should certainly not feel that you need to read ahead and learn material you have not yet been taught. If you do come across a question on material you have not yet encountered at school, we ask you to make a note of this in your answer: we may briefly discuss it with you if time permits, but primarily we ask you to do this in order to ensure that we interpret the mark you obtain on this test appropriately given your individual educational context.

Your performance on the maths test will also always be taken into account in the broader context of your application. For example, if you are particularly interested in the biological sciences, you may not necessarily need to be quite as confident of your mathematical skills as a prospective physical scientist would.

Finally, a practical point about the test: you need not show your working for questions, which will simply be marked 'right' or 'wrong'.

Natural Sciences
Mathematical Fluency Test

[sample paper]

Time allowed: **30 minutes**

You should attempt **all** questions.

The number of marks for each question is shown in the right-hand margin. Marks are awarded only for the final answer.

Should a question be set on a topic which you have not yet covered at school, skip it and make a note of it in your answers.

Calculators may **not** be used on this test.

1. Solve the inequality $2x^2 + x \le 6$ for x. [2]

2. Find the centre and radius of the circle $x^2 - 4x + y^2 - 6y = -12$. [2]

3. Differentiate the following functions with respect to x.

   (a) $\cos 5x$ [1]

   (b) $x^2 e^x$ [1]

4. Integrate the following functions with respect to x.

   (a) $\dfrac{1}{\sqrt{3 + 2x}}$ [1]

   (b) $x \ln x$ [1]

5. Evaluate

   (a) $\displaystyle\sum_{n=2}^{101} 2n$ and [1]

   (b) $\displaystyle\sum_{n=1}^{5} 4^n$. [1]

6. Find all solutions of $x^4 - 3x^2 + 2 = 0$. [2]

7. Sketch a graph of $y = e^{-x} \sin x$. [2]

8. You roll three fair 6-sided dice. What is the probability that at least one die rolls a 6? [1]

END OF PAPER