GET READY TO STUDY A LEVEL MATHEMATICS & FURTHER MATHEMATICS

Thank you for choosing to study A level Mathematics at Barnsley Sixth Form College. Mathematical techniques are important in the solution of problems in almost all areas of society today. Mathematics has been essential to the development of space travel, telecommunications, computing, power generation and the understanding of environmental issues. The uses of mathematics are:

- to explain
- to predict
- to make decisions.

The mathematics department is committed to ensuring that you make good progress throughout your two-year A level course. It is vitally important that you spend some time working through the questions - you will need to have a good knowledge of these topics before you commence your course in September. You should have met all the topics before at GCSE.

If you are planning to study A Level Maths with us in September, please review this document and complete the required activities. For A Level Maths you will need to complete questions online.

If you are also planning to study A Level Further Maths with us in September, please also complete the reasoning and Problem Solving questions. Please bring the completed activities with you at induction.

FAQ

What specification will I study?

You will be studying the Pearson Edexcel A Level Mathematics specification.

Use the weblink to read about the specification and you can also view past papers to see what the assessment looks like.

[A Level Mathematics Specification](#)

How many lessons will I have a week?

You will have four lessons per week with your maths teacher. In addition, we run supported study sessions that you can attend to get extra help and advice about your maths studies.

Who can I contact if I have a question about this subject?

Lesley Thorpe: l.thorpe@Barnsley.ac.uk

What subjects go well with Mathematics?

Maths is a challenging and demanding subject. We recommend you choose other STEM subjects such as biology, chemistry, physics, computer science to complete your study programme. Other complementary subjects include economics and geography.

What grades should I have?

In addition to the general sixth form entry requirements, you must have a minimum of grade 6 in GCSE maths (although grade 7 and above is preferred). You will also be required to pass an entrance exam.

What extracurricular activities can I get involved with?

We will have a problem-solving group from September and students are welcome to set up their own group or society. In the past we have also had chess club and Further Maths for Fun. Every November we offer students the chance to take part in the Senior Mathematical Challenge UK.

WHAT WILL I STUDY?

Over the two years you will study Pure Mathematics (which makes up two-thirds of the course), Statistics (one-sixth) and Mechanics (one-sixth). The course is examined by three 2-hour exams at the end of the two-year course. Papers 1 and 2 assess Pure Maths and Paper 3 assess the Statistics and Mechanics element.

Pure Maths

Pure Mathematics provides the formulae, techniques and basic knowledge required in applying Mathematics in the real world. Pure Mathematics starts by reviewing, consolidating, and developing knowledge achieved at GCSE level, and then progresses to new topic areas:

- Algebraic Techniques
- Functions
- Sequences and Series
- Co-ordinate Geometry

- Trigonometry
- Differential Calculus
- Integral Calculus
- Numerical Methods

Statistics

Statistics deals with the collection of data and its analysis, presentation and interpretation together with calculating probabilities and using probability distribution models. Statistical techniques and the use of mathematical models are now used throughout modern industrial societies for analysis of data, to explain observations and to help make rational decisions. Statistics starts by consolidating knowledge achieved at GCSE level and then progresses to new topic areas:

- Representing data
- Summary statistics
- Correlation and regression
- Sampling techniques

- Probability
- Random Variables
- Discrete distributions
- Continuous distributions

Mechanics

Mechanics applies Pure Mathematics to problems encountered in the real world by modelling situations which involve the behaviour of bodies or particles under the action of a system of forces. For example, the solution of the equations of motion for ballistics has helped design rockets of awesome power which can pinpoint targets. Mechanics develops and uses Pure Mathematics techniques in simplified real-world problems.

- Vectors
- Kinematics
- Projectiles

- Dynamics of a particle
- Statistics of a particle
- Moments

WHAT WILL I NEED?

To study A level Maths, you need to purchase a **pencil case** and fill it with the following essential equipment:

- **Black pen (more than one)**
- **Coloured pens (green, blue, red, etc.)**
- **Pencil, rubber, and sharpener**
- **Ruler and highlighters**

You also need to purchase a **lever arch file** and **ring binder** for each of your subjects. You will be given worksheets, course notes and booklets to complete over the two-years and these must be stored in a well-organised file with **dividers**. Unlike school where you may have been given exercise books to write in, for A level study, you will need to bring paper to write on. For maths we recommend:

- **A4 squared paper (lined paper is acceptable if not)**

It is now a course requirement that all students use a specific calculator for A level Maths. You will need to purchase the **CASIO fx-991EX** either before the start of the course or during the first few weeks of the term*. This version has certain functions and settings needed for A level, that the calculator you used at GCSE may not have. These can be purchased for around £25 from supermarkets (Tesco, ASDA, etc.) and online stores (Amazon). **When buying online please check that you are purchasing the UK version of the calculator.**
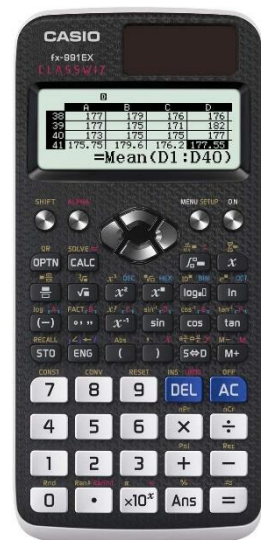
Students studying A level maths also find it useful to have:

- **Blank flashcards (or coloured cards)**
- **A mini-whiteboard and pens**

All students will be given a login to use online textbooks for the course that can accessed from anywhere, at any time. Homework and practice questions will be accessed from the site DrFrostMaths.com Textbooks and study guides are also available to buy*.
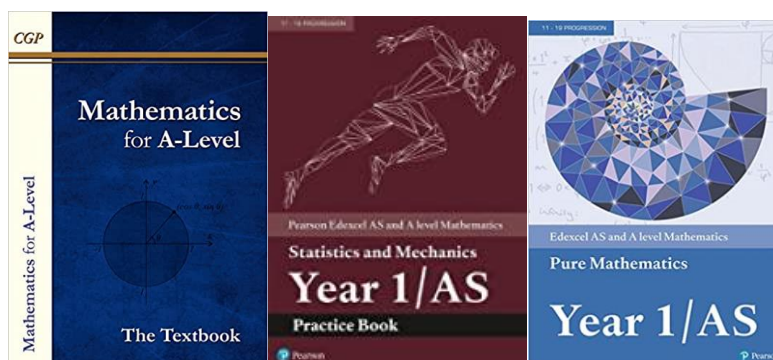
*Financial support is available for those learners that need help with study costs.

FIND OUT MORE

Use the suggested links in this section to find out more about the wonderful world of maths.

Careers information
Our students have gone on to study a wide range of courses at university and enter a number of exciting careers and job roles. Maths is a facilitating subject, meaning that it can open a lot of doors for you. Employers love maths graduates!

- What can I do with a maths degree?
- Maths careers
- Business and finance
- Exploring STEM careers
- Careers in mathematics and statistics

YouTube channels
There are many interesting and useful videos that will help to broaden your understanding and enjoyment of maths. We recommend subscribing to the following channels:

- 3Blue1Brown
- Numberphile
- Eddie Woo
- Stand-up Maths

Useful maths revision/preparation links
These links are designed to support your understanding of GCSE maths in preparation for studying this subject at an advanced level.

- Physics & Maths Tutor
- TLMaths
- DrFrostMaths
- MathsMadeEasy
- Maths Genie

Maths Films
There are some wonderful mathematical films (many based on true historical people and events) such as:

- *Hidden Figures*
- *The Imitation Game*
- *A Beautiful Mind*
- *The theory of Everything*
- *The Man Who Knew Infinity*
- *X+Y*
- *Good Will Hunting.*

\Further reading
There are loads of great mathematical books you can read. Here are a few of our favourites:

- *50 Mathematical Ideas You Really Need to Know* (Tony Crilly)
- *Alex's Adventures in Numberland* (Alex Bellos)

- *Cabinet of Mathematical Curiosities* (Ian Stewart)
- *The Calculus Wars* (Jason Socrates Bardi)
- *The Code Book* (Simon Singh)
- *How Many Socks Make a Pair?: Surprisingly Interesting Maths* (Rob Eastway)
- *Hello World: How to be Human in the Age of the Machine* (Hannah Fry)
- *Humble Pi: A Comedy of Maths Errors* (Matt Parker)
- *The Life-Changing Magic of Numbers* (Bobby Seagull)
- *The Num8er My5teries* (Marcus du Sautoy)
- *Fermat's Last Theorem* (Simon Singh)
- *The Simpsons and their Mathematical Secrets* (Simon Singh)

INDUCTION TASK

Choosing which combination of A Levels to study can be a challenge for many students. Completing these activities will give you a greater insight into what is expected at the start of A level Maths and to help ensure you have made the right choice.

Interested in taking A level Further Maths? There is a separate set of questions at the end of this document. These need to be completed in addition to the A level Maths questions.

The work we would like you to complete over the summer break is split into four sections and is accessible online through the Dr Frost Maths Website. Remember that two-thirds of the course is Pure Maths. It is assumed that students beginning the course will have strong algebra and problem-solving skills. Some important early topics are algebra, equations, and graphs. These are the fundamental building blocks.

Section A – Algebraic Expressions

Key skills developed in this section include:

- Simplifying algebraic fractions, indices and surds
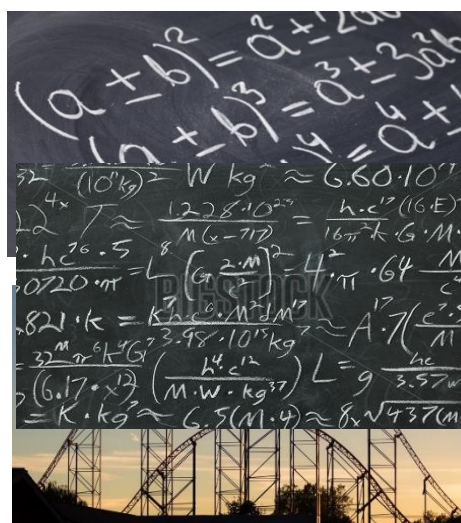- Expanding brackets and factorising expressions

Section B – Quadratics

Key skills developed in this section include:

- Solving quadratics and completing the square
- Sketching graphs and using the discriminant

Section C – Equations and Inequalities

Key skills developed in this section include:

- Solving linear and non-linear simultaneous equations
- Representing linear and quadratic inequalities by regions on graphs.

Section D – Straight line graphs

Key skills developed in this section include:

- Finding the equation of a straight line
- Finding intersections of lines as well as, distances and areas.

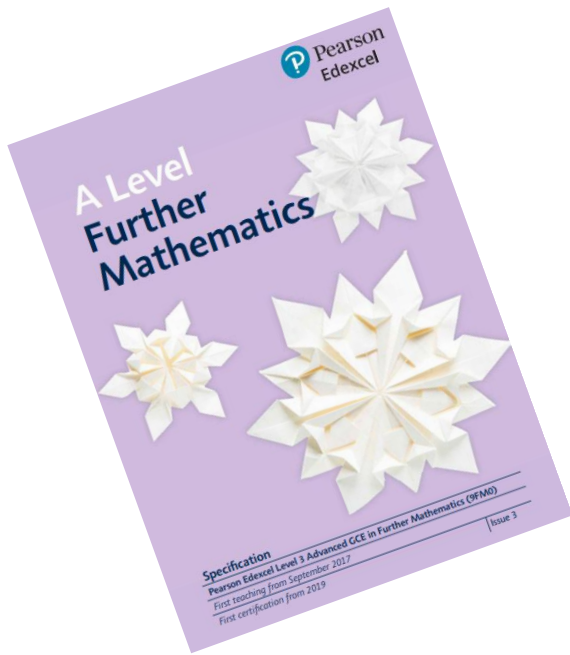Access the class and the tasks using this link:

https://www.drfrostmaths.com/register.php?cid=274939&passcode=39955
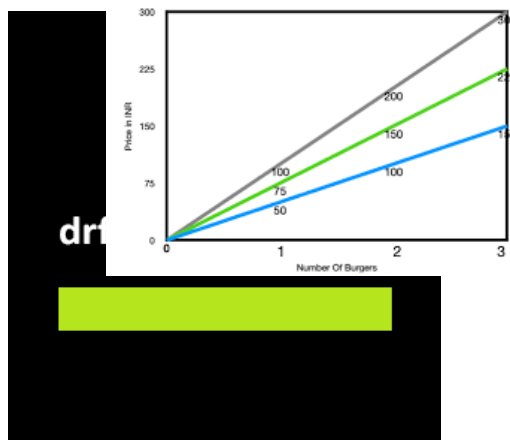
You will need to set up your account using your own email address and create your own password. If you experience any problems accessing the questions, please contact:

Lesley Thorpe: l.thorpe@Barnsley.ac.uk

THIS WORK IS DUE FOR: 31 AUGUST 2023

A Level
Further
Mathematics

Specification
Pearson Edexcel Level 3 Advanced GCE in Further Mathematics (9FM0)
First teaching from September 2017
First certification from 2019
Issue 3

Fancy trying
some Further
Maths –
Read on for
the additional
task.

QUESTIONS TO SUBMIT (FURTHER MATHS ONLY)

Please write your full solutions on A4 paper to hand in at induction. This work must be **separate** from the A level Maths work.

Remember that A level Further Mathematics is an additional A level to Maths. You must score highly on the Maths Skills Assessment as well as complete the following summer work to be suitable for this course. Although the following questions are challenging, they are based on GCSE skills and knowledge; you should know everything you need to know already, but they will require some **problem-solving** skills. What we are looking for is how well you can communicate mathematically. A list of correct answers will score you some marks, but **well explained**, **coherent** and **concise** solutions will score you many more marks.

Section 1 – Algebraic reasoning

1. Expand and simplify $(x + y)^4$

2. Write $4x^4 - 13x^2 + 9$ as the product of four linear factors

3. (a) Simplify $(\sqrt{a} + \sqrt{b})(\sqrt{a} - \sqrt{b})$
    (b) Hence show that
    $$\frac{1}{\sqrt{1} + \sqrt{2}} + \frac{1}{\sqrt{2} + \sqrt{3}} + \frac{1}{\sqrt{3} + \sqrt{4}} + \cdots + \frac{1}{\sqrt{24} + \sqrt{25}} = 4$$

4. Given that x is positive, solve the equation
$$\frac{1}{x} + \frac{1}{x+2} = \frac{28}{195}$$

5. A straight line passes through $(7a, 5)$ and $(3a, 3)$.
   An equation of this line is $x + by - 12 = 0$. Find the values of a and b.

6. Ben is using the quadratic formula to solve an equation of the form $ax^2 + bx + c = 0$. He has got to this point in his working out:
$$x = \frac{3 \pm \sqrt{29}}{2}$$
   Find the values of a, b and c for the equation he is solving.

7. Shown are two straight lines drawn on the grid. Line 1 has equation $y = 3x - 12$. Find the equation of line 2 and explain whether the lines are perpendicular.
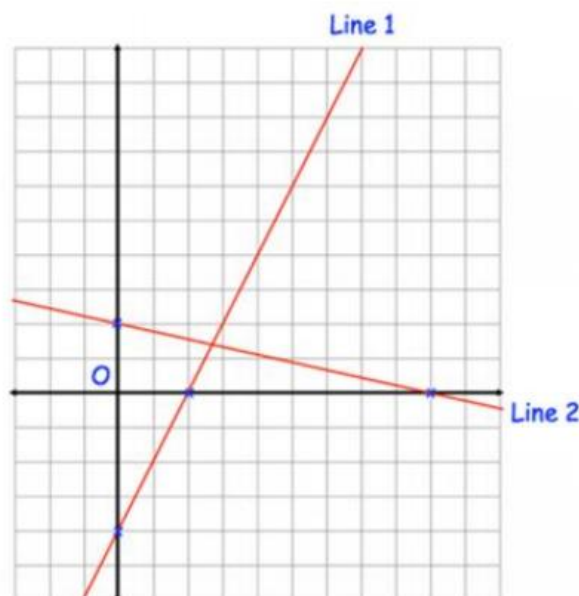
8. The graph of $y = ax^2 + bx + c$ has a vertex at $(5, -3)$ and the curve passes through $(4,0)$. Find the values of a, b and c.

9. A swimmer dives into a pool. Her position, p metres, underwater can be modelled in relation to her horizontal distance, x metres, from the point she entered the water as a quadratic equation $p = \frac{1}{2}x^2 - 3x$. The position of the bottom of the pool can be modelled by the linear equation $p = 0.3x - 6$. Determine whether this model predicts that the swimmer will touch the bottom of the pool.

10. By completing the square, show that the solutions to the equation $ax^2 + 2bx + c = 0$ are given by

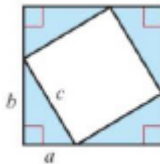$$x = -\frac{b}{a} \pm \sqrt{\frac{b^2 - ac}{a^2}}$$

11. The graph of $y = x^4 + ax^3 + bx^2 + cx + d$ is shown, where a, b, c and d are real constant. The curve crosses the y-axis at point P.
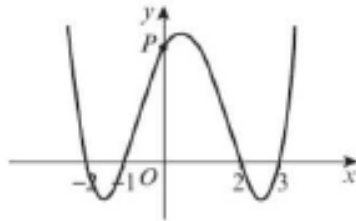
    (a) Find the coordinates of point P
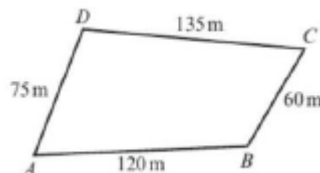
    (b) Find the values of a, b, c and d.

Section 2 – Geometrical reasoning

1. The diagram shows a square and four congruent right-angled triangles.


Use the diagram to prove that $a^2 + b^2 = c^2$.

2. A farmer has a field in the shape of a quadrilateral as shown. The angle between fences AB and AD is $74°$. Find the angle between fences BC and CD.


3. Consider the circle with equation $x^2 + y^2 = 13$ sketched below. The point A lies on the circle and has a y-ordinate of 2. The tangent to the circle at A intersects the x-axis at the point B. Find the coordinates of B.


Not Drawn accurately
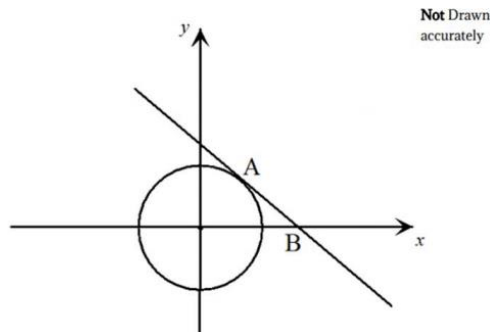
4. Points A, B, C and D are all on the circumference of the circle. O represents the centre. Angles AOB and ADB are expressed in terms of x. Calculate the value of x, giving reason for each stage of your working.
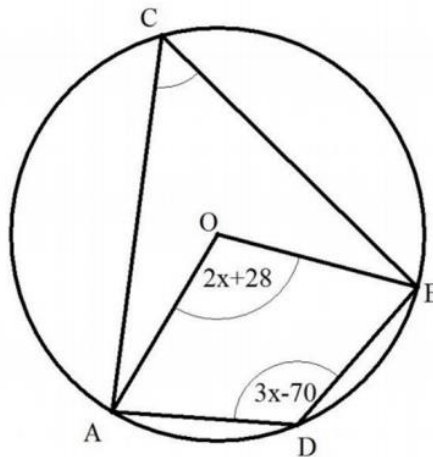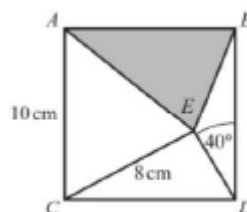

5. In quadrilateral ABCD, various lengths and angles have been labelled. Calculate the length of BC. Given your answer correct to 3 significant figures.
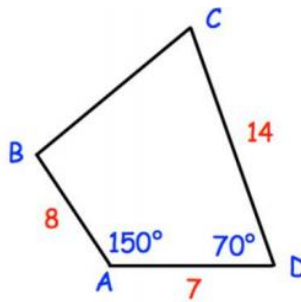
6. The diagram shows two squares and a circle. Given that π is defined as the circumference of a circle of diameter 1 unit, prove that $2\sqrt{2} < \pi < 4$.
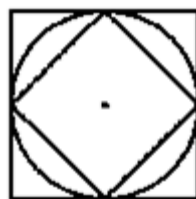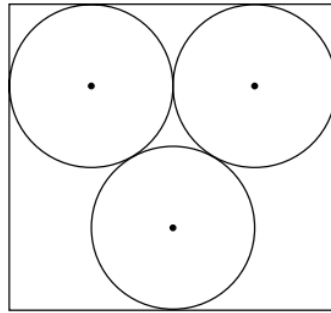

7. $ABCD$ is a square. Angle CED is obtuse. Find the area of the shaded triangle.

8. The diagram shows 3 identical circles inside a rectangle. Each circle touches the other two circles and the sides of the rectangle, as shown in the diagram. Given that the radius of each

circle is 24mm, work out the area of the rectangle. Give your answer correct to 3 significant figures.

THIS WORK IS DUE FOR:

Your Induction Lesson. Please ensure you bring it with you!!

If there are any questions about this work, you can email:

Lesley Thorpe: l.thorpe@barnsley.ac.uk