

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 solving 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 at the end of this pack - 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 on paper showing all working out.

If you are also planning to study **A Level Further Maths** with us in September, please also complete the additional questions at the end of this section on separate paper, demonstrating all working out. 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'll have two single lessons lasting 1 hour and 10 minutes and one double lesson lasting between 1 hour and 40 minutes to 2 hours and 10 minutes per week depending on support session attendance and curriculum needs.

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, or 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 and National Problem Solving competitions such as Ritangle and MathsBombe.

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 assesses 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 also 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)**

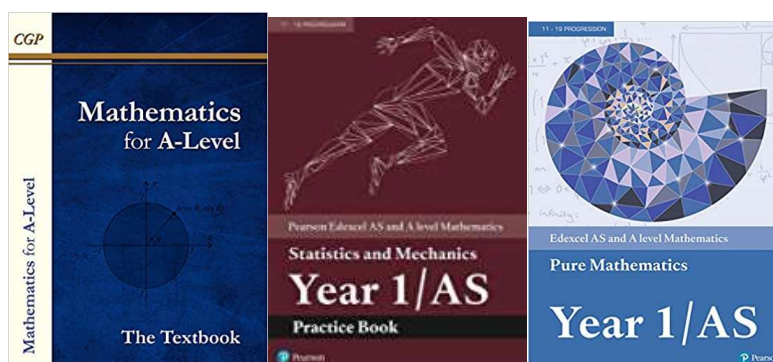
It is now a course requirement that all students use a specific calculator for A level Maths. You will need to purchase the **CASIO fx-991CW** (please be careful it is this exact code; the shift button must be gold) either before the start of the course or during the first few weeks of the term*. This 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 £30 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 be 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](#)

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)

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*.

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.

QUESTIONS TO SUBMIT (FOR A LEVEL MATHS)

The work we would like you to complete over the summer break is to continue to build on the algebraic problem-solving skills at grades 8 and 9 from GCSE. 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. There will be a formal assessment in the first week of lessons, so please use this task as an opportunity to review and practice these fundamental building blocks.

IMPORTANT: Formulae you were given for GCSE that you will be expected to know from memory at A Level:

Perimeter, area and volume

Where a and b are the lengths of the parallel sides and h is their perpendicular separation:

$$\text{Area of a trapezium} = \frac{1}{2}(a + b)h$$

Volume of a prism = area of cross section $\times$ length

Where r is the radius and d is the diameter:

$$\text{Circumference of a circle} = 2\pi r = \pi d$$

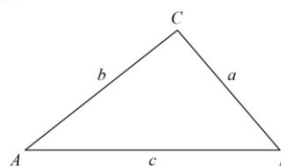
$$\text{Area of a circle} = \pi r^2$$

Quadratic formula

The solution of $ax^2 + bx + c = 0$
where $a \neq 0$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Pythagoras' Theorem and Trigonometry



In any right-angled triangle ABC where a , b and c are the length of the sides and c is the hypotenuse:

$$\sin A = \frac{a}{c} \quad \cos A = \frac{b}{c} \quad \tan A = \frac{a}{b}$$

In any triangle ABC where a , b and c are the length of the sides:

$$\text{sine rule: } \frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$\text{cosine rule: } a^2 = b^2 + c^2 - 2bc \cos A$$

$$\text{Area of triangle} = \frac{1}{2}ab \sin C$$

Please write your full solutions on A4 paper to hand in at induction.

1.a) Find an equation for the line perpendicular to $y = 7x - 2$ that passes through the point $(0, 4)$

b) Point A with coordinates $(a, -16)$ and point B with coordinates $(0, b)$ both lie on $y = 7x - 2$

Find the length of AB .

Give your answer in the form $c\sqrt{d}$ where c and d are integers.

2.a) (i) Simplify $\sqrt{27}$

(ii) Simplify $\sqrt{12} + \sqrt{27} - 4$

b) Rationalise $\frac{\sqrt{3}+2}{\sqrt{12}+\sqrt{27}-4}$

Give your answer in the form $\frac{a+b\sqrt{c}}{d}$ where a, b, c and d are integers.

3. a) (i) Simplify $32^{\frac{4}{5}}$

(ii) Write $\frac{1}{8^2}$ in the form 2^n

b) $16^{-\frac{3}{4}} \times 2^{3x-7} \times \frac{1}{8^2} \times 32^{\frac{4}{5}} = 1$

Find the value of x .

4. A triangle has vertices $A(-7, 5)$, $B(6, -2)$ and $C(-4, -3)$

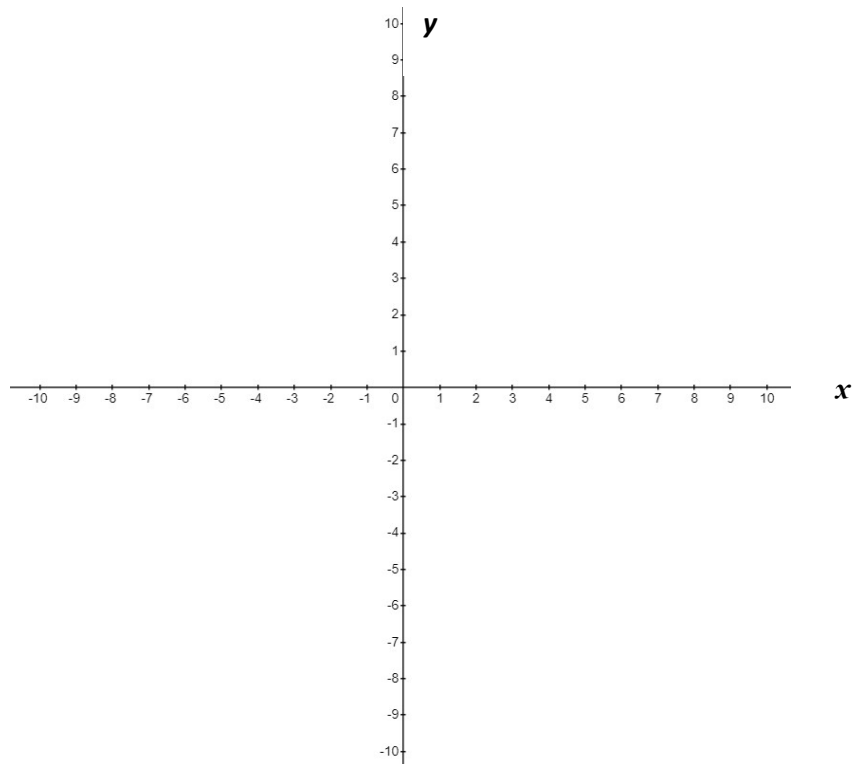
a) Find the length of the sides of the triangle, AB , AC and BC

b) Hence, or otherwise, Work out the size of angle ABC .

Give your answer correct to 3 significant figures.

5. A circle **C** has centre $(3, 0)$ and area 25π .

a) Sketch the graph of **C**. State the co-ordinates of the y- intercepts.



The line **L** has equation $y - 3x = -4$

b) Find, algebraically, the coordinates of the points of intersection of **C** and **L**.

6. There are only green sweets, blue sweets and red sweets in a jar.

There are 14 green sweets.

The number of blue sweets is three times the number of red sweets.

Two sweets are taken at random from the jar.

Given that $P(\text{both sweets are green}) = \frac{91}{561}$

work out the probability that both sweets are blue.

7. Sue buys footballs and rugby balls.

She has a maximum of £1800 to spend on these balls.

Sue buys footballs for £5 each and rugby balls for £7.50 each.

Let x be the number of footballs she buys.

Let y be the number of rugby balls she buys.

- a) Use this information to show $2x + 3y \leq 720$

Sue makes a further decision about buying the balls, resulting in a second inequality

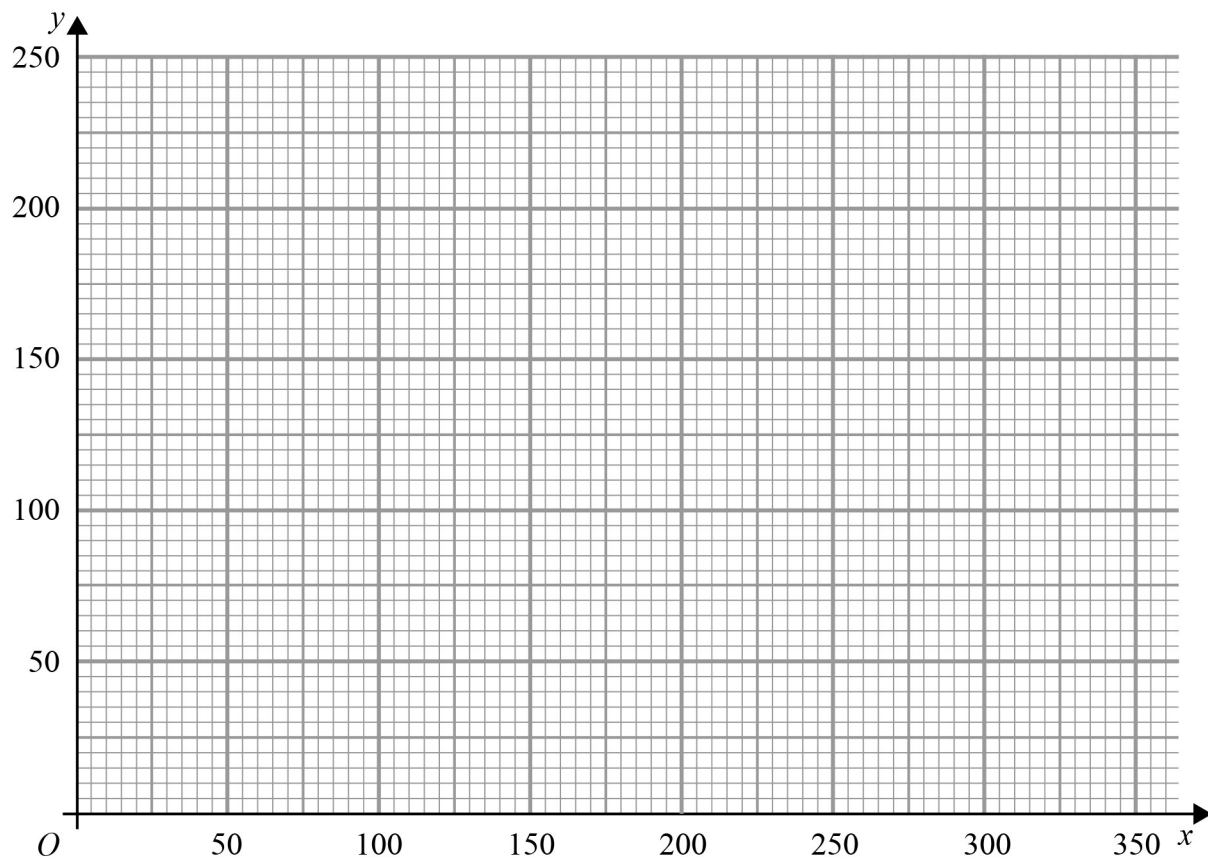
$$0 < x \leq 300$$

- b) Explain what this inequality means in context.

- c) On the grid below, identify the region that satisfies the three inequalities,

$$2x + 3y \leq 720 \quad 0 < x \leq 300 \quad 0 < y \leq 200$$

Label the region **R**.



8. Rearrange $ef = \frac{5e+4}{3}$ to make e the subject.

9. Solve the simultaneous equations

$$x - y = 19$$

$$4xy = -3$$

Do not use trial and improvement.

You must show your working

10. Solve $3p^2 - 3p - 7 = 0$

Give your solutions correct to 3 significant figures.

THIS WORK IS DUE FOR: 29th AUGUST 2025



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.

- 1 Simplify these expressions as far as possible.

a $\frac{x^2 - 2x - 3}{x^2 + 2x + 1}$ (3 marks)

b $\frac{x^2 - 25}{x^2 + 6x + 8} \div \frac{x^2 - 2x - 15}{x^2 - 16}$ (4 marks)

- 2 The line l is a tangent to the circle $x^2 + y^2 = 20$ at the point $P(2, 4)$.

The tangent intersects the y -axis at point A . Find the area of the triangle OPA . (5 marks)

- 3 Expand and simplify $(\sqrt{p} + 2\sqrt{q})(2\sqrt{p} - \sqrt{q})$ (3 marks)

- 4 a Write $3x^2 - 12x + 7$ in the form $a(x + b)^2 + c$ (3 marks)

b Hence, or otherwise, write down the coordinates of the turning point of the graph of $y = 3x^2 - 12x + 7$ (1 mark)

- 5 Prove algebraically that the product of three consecutive **odd** numbers is always an odd number. (4 marks)

- 6 The functions g and f are defined as $g(x) = \frac{2x}{4-x}$ and $f(x) = 3x - 1$

Given that $x \neq 4$, find the value(s) of x such that $g(x) = f(x)$, giving your answer(s) to 2 decimal places. (6 marks)

- 7 The line l_1 has equation $y = -\frac{1}{2}x + 3$ and intersects the x - and y -axes at the points A and B respectively.
- a Find the exact length of the line segment AB . (3 marks)
- b Find the equation of the line l_2 perpendicular to l_1 which passes through the point $P(-1, -2)$. (2 marks)
- The line l_2 intersects l_1 at the point C .
- c Find the midpoint of the line segment AC . (4 marks)
- 8 A triangle ABC has side lengths $AB = 10$ cm, $BC = 15$ cm and $AC = 8$ cm.
- a Find the size of the largest angle, giving your answer to 2 decimal places. (3 marks)
- b Find the area of the triangle, giving your answer to 2 decimal places. (2 marks)
- 9 a Sketch the graph of $y = \cos x$ for $-180 \leq x \leq 360^\circ$, showing the points where the graph cuts the axes. (2 marks)
- b Hence find the exact values of x in the interval $-180 \leq x \leq 360^\circ$ for which $\cos x = -\frac{\sqrt{3}}{2}$ (3 marks)

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:**

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