



Sixth Form Handbook
Mathematics

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About the course

The course will be delivered through 11 fortnightly lessons by two Maths teachers. This is a linear course, meaning all exams will be sat at the end of your second year.

Mathematics studies beautiful patterns and creates ways to solve difficult problems. It is a highly valued subject by employers and Universities alike. Over the next 2 years you will explore deeper links between algebra and geometry. In the applied units; we will explore how Mathematics is extremely useful for modelling real world situations in Mechanics, and how we can apply Maths to analyse data in Statistics.

First year assessment

You will have regular topic assessments online as each topic is completed. You will also have formal exams in school to track your progress throughout the year.

Homework will be set differently to main school. You will be expected to read around each topic outside of lessons, as well as keep up with lots of tasks that you will be set. It is up to you to be independent and keep up with your learning.

Second year assessment

You will sit three exam papers. Paper 1 and paper 2 will be on 'pure' Mathematics and paper three will examine mechanics and statistics. There is no coursework in A-level Mathematics.

In September you will be issued with sheets to set up folders. The cover sheets are where you need to keep a record of any work you have done, and comment on how it has gone. Also, you should be recording group study sessions you have arranged with friends.

Course Reading List & Materials

Calculators: The new A-level requires a more powerful calculator than your trusty Casio fx-83G PLUS (still a great and classic calculator. Keep it!) We will be using the brand new Casio fx-991EX, dubbed the 'classwiz'. These are available to buy on wisepay.

You will also need folders for your class notes and examples, and lots of paper for practice exercises.

Books:

On this webpage you will find a list of interesting books – at least one will make an interesting read this summer! <http://mei.org.uk/books2>

Useful websites:

<https://www.youtube.com/user/numberphile>

Numberphile is a fantastic YouTube channel that has now hundreds of videos about Mathematics! Some are more complicated than others, but many have engaging animations to help you understand the puzzles.

Many are filmed at the Mathematical Sciences Research Institute – and feature professional Mathematicians talking about their current research!

Mr Miller's favourite three presenters are:

- Simon Pampena
- Zvezdelina Stankova - Professor of Mathematics at Mills College
- And of the more recent videos - Tadashi Tokieda – who has many puzzles and tricks you can try to create with simple objects such as paperclips, rubber bands and strips of paper. Give them a go and consider what is happening – try to create rules and your own patterns!

<https://www.mymaths.co.uk/>

MyMaths is excellent for topping up your skills on any area of our brilliant subject. There are transition tasks to prepare you for A-level, and you can even look ahead to some of the new content.

There is also a great APP from MEI – search for #SUMAZE. This app requires you to solve a series of puzzles, starting with simple skills – working up to the almost impossible, almost! 😊

Senior Maths Challenges



Poole High School will be hosting the Senior Team Maths Challenge in Autumn and are hoping to field a strong team of 4 (2 from each year 12 & 13).

Separate to this we will also be entering all students who are interested into the individual Senior Maths Challenge. This is an individual competition with lots of tricky, but fun, questions to try and answer – so please make yourself known if you are interested in this!



Tasks before September

The only way to learn mathematics is to do mathematics. *Paul Halmos*

(1916-2006; Hungarian-born mathematician)

You have a few tasks to do this summer.

1. Complete the skills sheet – 2 sides of questions – to be handed in to Mr. Miller on your first day back.
2. If you struggle with any of these skills – it is up to you to do a little bit more practice. MyMaths/mathedup.co.uk – GCSE takeaway, is a great place to find explanations and extra practice questions with answers.

You need to show evidence of having done this work. Bringing in completed questions along with your skills sheet will be the easiest way to do this.

There will be a quiz shortly after you are back. Those lacking in ‘back pocket’ skills will sit down with Mr. Miller and you will then be given extra work that you must catch up on. You will not make the jump to A-level unless your number and algebra skills from GCSE are razor sharp. You need to be CONFIDENT with: indices, factorising, expanding brackets, surds, fractions, solving equations, rearranging formula, ratio and many more skills need to be fluent. Make sure you are ready for September.

Who can I contact for help?

For help – please find any of the following teachers at any point where you need help or advice about the course:

Teacher

Mr. Miller

Miss Birt

Mrs. Nash

Mrs. Scott-Brown

Miss Pipe

Can be found at...

Room 36

Room 35

Sixth form office

Maths office

Room 34

The Mathematics department is looking forward to meeting you in September.

The journey starts NOW! Good luck with the tasks, and enjoy your summer break.

**The study of mathematics,
like the Nile,
begins in minuteness
but ends in magnificence.**

Charles Caleb Colton

(1780-1832, English cleric, writer and collector)



Mr. Miller's skills sheet

****There are 2 questions that don't solve, can you find them and explain why?***

Surds

Express $\frac{6}{\sqrt{2}}$ in the form $a\sqrt{b}$, where a and b are positive integers.

Expand and simplify $(\sqrt{3} + \sqrt{15})^2$ give your answer in the form $n + m\sqrt{5}$, where n and m are integers.

Rationalise $\frac{(6-\sqrt{2})}{(10+\sqrt{2})}$

QUADRATICS

(1) Solve the following quadratics using the quadratic formula (which we use when we cannot complete the square or factorise).

$$3x^2 - 7x - 20 = 0$$

$$6x^2 - 11x - 7 = 0$$

$$2y^2 - 5y + 1 = 0$$

$$\frac{1}{2}y^2 + 3y + 1 = 0$$

$$2x^2 + 11x + 5 = 0$$

(2) Put the following in the form $(x + a)^2 + b$ where a, b are integers.

i) $x^2 + 4x + 1$

ii) $x^2 - 6x + 9$

iii) $x^2 + 2x - 15$

iv) $x^2 + 3x$

v) $x^2 + 16x + 5$

(3) Solve the following by completing the square:

$$x^2 + 4x - 3 = 0$$

$$x^2 - 3x - 2 = 0$$

$$x^2 + 12x = 1$$

(4) Find the turning point of $x^2 + 6x + 10 = 0$ What does the turning point tell you about the solutions to $x^2 + 6x + 10 = 0$?

(5) $f(x) = x^2 + 4x + 7$

(i) Give the equation for the line of symmetry through $f(x)$

(ii) What is the coordinate of the minimum point of $f(x)$?

(iii) What is the GREATEST (maximum) value of: $\frac{1}{x^2 + 4x + 7}$?

(6) Solve these equations by factorising

$$x^2 + 5x - 14 = 0$$

$$x^2 = 6 - x$$

$$x + 3 = \frac{14}{x}$$

$$2x + 2 = \frac{13}{x} - 23$$

$$2p^2 - 32 = 0$$

$$\frac{2}{x-2} + \frac{4}{x+1} = 3$$

Straight lines: Find the equation of the line passing through: i) (5, 9) & (8, 3) ii) (4,7) & (8, 12)
Find the equation for the perpendicular bisector between (7, 10) and (4, 11).



Manipulating algebraic expressions:

Simplify: $\frac{8x^2}{2x^2}$ $\frac{8ab^2}{12ab}$ $\frac{5ab}{10b}$ $\frac{12a^2b}{4ab^2}$

Write as a single fraction and simplify:

$\frac{3x}{2} \times \frac{2a}{3x}$ $\frac{3y^2}{3} \times \frac{2x}{9y}$ $\frac{x^2}{x^2+2x} \div \frac{x}{x+2}$ $\frac{a^2}{5} \div \frac{a}{10}$ $\frac{x}{5} \times \frac{y^2}{x^2}$

Simplify:

$\frac{7a^2b}{35ab^2}$ $\frac{(2a)^2}{4a}$ $\frac{7yx}{8xy}$ (Use factorising for the following) $\frac{5x+2x^2}{3x}$, $\frac{4a+5a^3}{5a}$, $\frac{5ab}{15a+10a^2}$

Harder:

$\frac{18a-3ab}{6a^2}$, $\frac{4ab+8a^2}{2ab}$, $\frac{x^2+2x}{x^2-3x}$, $\frac{x^2-4x-21}{x^2-5x-14}$, $\frac{x^2+6x+5}{x^2-x-2}$, $\frac{x^2+7x+10}{x^2-4}$

Adding/subtracting fractions with unknowns.

$\frac{x-1}{3} + \frac{x+2}{4}$, $\frac{x+1}{3} - \frac{2x+1}{4}$, $\frac{3}{x-2} + \frac{4}{x}$, $\frac{3}{x-2} - \frac{4}{x+1}$, $\frac{x-6}{x+2} + \frac{2x}{x-3}$

INDICES / INDEX LAWS

Simplify: $a^5 \times a^{12}$ $(m^2)^3$ $b^4 \times b \times b^{12}$ $(a^3)^3 \times (a^4)^2$

$7^5 \div 7^0$ $4a \times 5a^2$ $40b^5 \div 5b^3$ $(a^8)^2 \div (a^5)^3$

$(2b^2)^3 \times (3b^4)^2$ $(4b^4)^2 \div (2b^3)^3$ $(ab)^3 \times (ab)^2$

Which of the following expressions are square?

$2^6 \times 2^5$ $(6^5)^2$ $4^9 \times 4^9$ 36 3^6 $(7^3)^3$ $(14^{12})^4$

Showing ALL STEP BY STEP WORKING, calculate:

4^{-2} $81^{\frac{1}{2}}$ $32^{\frac{2}{5}}$ $27^{\frac{2}{3}}$ 15^{-2} $2.25^{\frac{1}{2}}$ $\left(\frac{9}{4}\right)^{\frac{1}{2}}$

$16^{-\frac{3}{2}}$ 16^0 $64^{-\frac{5}{6}}$ $49^{-\frac{3}{2}}$ $\left(\frac{8}{27}\right)^{-\frac{1}{3}}$ $\sqrt{125} = 5^x, \text{ so } x =$

CIRCLES: The line l is a tangent to the circle $x^2 + y^2 = 68$ at the point P, (2, 8).

- Find the x and y intercepts of l

COMBINATIONS: If you were to flip a coin a) 4 times b) 5 times c) 6 times. How many outcomes would have i) All heads. ii) All but 1 heads. iii) All but 2, heads iv) All but 3 heads? Now – look at ‘Pascal’s triangle’ – what do you notice?