

Maths Independent Work

‘Learning can be defined as an alteration in long-term memory - If nothing has altered in long-term memory, nothing has been learned.’

Ofsted, 2021; drawn from Kirschner, Sweller, Clark, 2006

‘The only way to learn mathematics is to do mathematics.’

Paul R. Halmos

Something you’ve truly learned can be recalled readily, used fluently, applied in any context and at any time.

You don’t fully learn a thing if you only ever study it in the classroom.

We recommend that students spend on average **5 hours per week** on independent study for each subject – one hour for every hour spent in lessons. *Note that your lesson time includes the Wednesday remote work.*

Part of your independent work will be **directed by your teacher** – they may ask you to complete certain questions between lessons, or signpost you to a particular IntegralMaths quiz or past paper.

But a lot of your independent work will be **self-directed** – you’ll need to decide what would be most beneficial to work on, and develop sufficient discipline to hold yourself accountable. *Many students find small informal study groups beneficial for maintaining motivation and supporting one another’s learning.*

To help you plan your independent study, we’ve put together the [A-level Maths Topic Overview](#) pictured below (see also the [A-level Further Maths Topic Overview](#) if applicable), with a summary of the topics, sub-topics and learning objectives for each chapter, as well as any pre-requisites, and recommendations for further independent study, designed to be completed after you’ve finished studying the chapter in class:

Chapter	Subtopic	Learning objectives	Mixed Exercise Questions and Exam Questions	Recommended IM quizzes
Y1P1 Algebraic expressions Pre-req: GCSE	1.1 Index laws 1.2 Expanding brackets 1.3 Factorising 1.4 Negative and fractional indices 1.5 Surds 1.6 Rationalising denominators	Multiply and divide integer powers Expand a single term over brackets and collect like terms Expand the product of two or three expressions Factorise linear, quadratic and simple cubic expressions Know and use the laws of indices Simplify and use the rules of surds Rationalise denominators	4□ 6□ 7□ 8□ 13□ 15□ 21□ 23□ 24□ Y1P1 XMQs and MS.pdf	Y1P1 S1 (Surds) Y1P1 S2 (Indices)
Y1P2 Quadratics Pre-req: GCSE	2.1 Solving quadratic equations 2.2 Completing the square 2.3 Functions 2.4 Quadratic graphs	Solve quadratic equations using factorisation, the quadratic formula and completing the square Read and use $f(x)$ notation when working with functions Sketch the graph and find the turning point of a quadratic function	2□ 5□ 8□ 11□ 12□ 14□ Y1P2 XMQs and MS.pdf	Y1P2 Q1 (Quadratic graphs and equations) Y1P2 Q2 (Quadratic formula)

You will have encountered the 5 R’s in other subjects (Review, Revisit, Revise, Reapply, Read Ahead). These refer chiefly to the work you do *outside the classroom* to make sense of what you’ve already been introduced to *inside the classroom*. We can summarise what this looks like for maths:

Look Back	Look Around	Look Ahead
After completing a topic, plan to review your work after a few days, then again after a few weeks, and again after a few months. Check your understanding using the Mixed Exercise questions, the Exam Questions by Topic and the IM Quizzes provided in the topic overview. Identify any key ideas or types of question that you still struggle with, and ask a friend or teacher for help.	While working on a topic, make the most of the textbook, working through the examples provided and trying a good selection of questions from the relevant exercises (you’ll do some of this in class, but you’ll want to build on and consolidate your knowledge from one lesson to the next as well). You can use the Skills Checks and Key Results Quiz and corresponding Digital Flashcards to build your fluency with specific topics as well.	Since your brain needs to be exposed to an idea or process multiple times for it to ‘stick’, one really effective method is to read ahead – check your Scheme of Learning or the Curriculum Map to see what topics are coming up next, check that you’re up to speed with the pre-requisites, and skim the chapter beforehand; don’t worry if it doesn’t make much sense yet – this is just a first pass.

Each week, you should choose whatever seems the most relevant and useful from the suggested tasks, questions and quizzes, or get creative and come up with your own ways to look back, look around and look ahead in maths. Your teacher may ask you periodically to show evidence of your independent work, and they can also help you make and stick to a plan if you need.

I’m stuck!




Great – being stuck is not merely an unavoidable side-effect of learning, it’s an essential checkpoint on the journey to understanding. First, practice the skills you want to develop for exams – look for key information you may have missed, check your assumptions, jot down any topic-relevant results you know, check the formula book, take a break and come back with fresh eyes a bit later. If the whole topic is a mystery, go back to your notes, or work through an example from the book, watch a video, check Integral Maths and then retry. If you still can’t make headway, ask a friend or teacher for a hint (but not enough to spoil the question!) When you’ve done all you can, or you think you’re finished, then you can check answers and review your attempt.

Past papers

As you progress through the course, you'll want to start incorporating **timed past paper practice** into your independent work. This will not only help you review previous topics, by exposing you to a mixture of questions from across the specification, but also acclimatise you to doing maths under timed conditions, which will of course be essential for your final exams. You can find a list of links [past papers and mark schemes here](#). If you're studying Further Maths in year 13, you can access [Further Maths papers here](#).

Use of technology

The advance of mathematics – and our understanding of mathematics – can be greatly accelerated by the appropriate use of technology. AI, dynamic graphing software, electronic calculators, and even paper itself were viewed with suspicion when they were new (as late as 1826, parliament were still using tally sticks to record financial transactions because they didn't trust paper-based approaches!) At A-level you are encouraged to make appropriate use of any and all technology, but what does 'appropriate use' look like?

Technology	Appropriate use	What can go wrong
Calculator 	Tricky numerical calculations, simplifying surds, advanced functions (trig, exponentials), solving quadratics or simultaneous equations, statistical distribution calculations.	An over-reliance on calculators for simple arithmetic can cause even very capable mathematicians to miss otherwise obvious errors. Not noticing that a fraction can be simplified, or making a fat-fingers error and not realizing that the answer doesn't make sense.
GeoGebra / Desmos / WolframAlpha 	Visualising functions, exploring graph transformations, understanding calculus (eg rates of change, areas under curves), investigating properties of shapes or functions, checking algebraic results.	Over-use of graphing apps as a go-to tool when working on a problem can make it harder to sketch them by hand when that tool isn't available. And relying on WolframAlpha to check your integrals or binomial expansions is great, but you also need to develop methods for verifying your answers in an exam, with just a calculator.
ChatGPT / Gemini / Copilot 	A quick way to bounce ideas back and forth, when trying to make sense of a problem or concept. A good way to generate similar questions, or to see a possible solution, or even get starter hints. AI can often suggest what mistakes you may have made, or what misconception you might have.	The current AI models are effectively glorified predictive text engines. They don't 'think' in the usual sense of the word, and will often produce correct-seeming responses that nevertheless contain errors or even important misconceptions. The biggest problem when using them for learning is that you can develop a dependence on AI for guiding you through problems or straight up giving you the solutions, and then become helpless to tackle those same problems on your own.

Useful links:

Year 12 Padlet – A collection of resources aimed primarily at year 12 students studying A-level Maths:
https://padlet.com/james_townsend/y12-maths-resources-7msj7dsp3gl7m7vj

IntegralMaths – access relevant notes, examples, questions, interactive books, videos and quizzes:
<https://integralmaths.org/>

SolutionBank – fully worked solutions to the textbook exercises (not just answers):
<https://www.physicsandmathstutor.com/maths-revision/solutionbanks/>

TheChalkface.net – past papers & mark schemes, exam questions by topic, key results quiz, digital flashcards:

A-level Maths	A-level Further Maths
https://thechalkface.net/resources/TopicOverview.pdf https://thechalkface.net/resources/skillscheck.pdf https://thechalkface.net/resources/keyresults.pdf https://thechalkface.net/p5/flashcards/ https://thechalkface.net/xmqqs/ https://thechalkface.net/papers/	https://thechalkface.net/resources/TopicOverviewFM.pdf https://thechalkface.net/resources/keyresultsfm.pdf https://thechalkface.net/p5/flashcardsfm/ https://thechalkface.net/xmqqs/further/ https://thechalkface.net/papers/further/

Remember, doing maths independently between lessons is the single most effective driver of progress.

A-level Maths Exam Question Checklist

Layout	Set out written work clearly and neatly, leaving spaces between lines of working to aid readability and the process of making corrections. Often it's helpful to lay out your solution down the left-hand-side of the page, and reserve the right-hand-side for rough notes, verification steps etc, so as not to break the flow of your solution or proof.
Accuracy	Try to verify the validity of each step of your working, especially in a multi-step process. Each statement should be correct, employing the appropriate mathematical notation, and lines of reasoning should follow logically from one another.
Structure	Plan out your answer for more involved problems, possibly with brief bullet points. Include a diagram where appropriate, and make sure your solution follows a clear logical path, especially for a complex proof or multi-step procedure.
Explanation	Use brief comments or annotations to justify steps in your method which will make it easier for an examiner to follow your solution and for you to more easily error-check your work. Also helpful if you revisit a solution to revise.
Review	After completing a question, <i>always</i> re-read the question to ensure you have an appropriate answer in the desired form. It's usually possible to verify answers as well – check with a calculator that two algebraic expressions are really equivalent or that your solution does satisfy the equation. In some cases, you can use estimation or use the context of the question to see if your answer is sensible.

Problem Solving

Understand the question.

“What do I know?”

- Skim-read the entire question, including diagrams, to get a sense of the context and overall themes.
- Read a second time, more carefully, underlining or highlighting key information, and annotating any diagrams to make sure all the important bits are at your fingertips.
- Jot down any key points that occur to you as you read, such as relevant formulae or possible approaches to use.

Identify what the question is asking.

“What do I want?”

- What is required? What form should it take?
 - A number? Rounded, or left in an exact form?
 - A measurement? What will the units be?
 - A diagram? What are the key features?
 - A graph? What will we need to know to draw it?
 - Proof/reasons? How should you set out your explanation?
- What would a sensible answer look like?
 - Can you generate a quick estimate?
 - Can you use context to have an intelligent guess?
 - Can you verify your answer directly in some way?

Decide what mathematics to use.

“What should I do?”

- Taking into account the information given, and what the question is asking for, which bits of your maths toolkit may come in useful?
- What clues might there be within a question to suggest a suitable method? (eg if it involves angles and side lengths, think: “Trig”. If it talks about gradients, think “Differentiation”).
- Can you break down larger problems into smaller ones? What should you do first, and how will it all fit together to give a final answer?