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**A-Level Mathematics A level Guide**

**How Mathematics will be taught:**

A level Maths is taught through a series of interleaving topics building on aspects that have already been met at GCSE but also introducing completely new areas of study. Your teachers introduce a topic with an overview of the elements within it and its links with your prior learning and then take you through the techniques and reasoning behind key worked examples. Students are encouraged to participate in shared solutions of problems, to ask questions in search of deeper understanding and to reflect on where new learning may develop later. Students are supplied with exercise books to use for practice exercises and notes. Textbooks published by Pearsons (Edexcel) are often used for practice both in and out of lessons. The department has a comprehensive VLE set up through Moodle, which has a rich collection of supporting resources as well as topic based Review homeworks based on exam board questions and examiners’ mark schemes.

**Working expectations:**

You are expected to spend time after every lesson reflecting on the work covered and completing further practice (there is not sufficient time in lessons to put in the necessary practice). Only through working through questions do you establish mastery of techniques and developing strategies to solve problems does secure learning take place. However independent you may be as a learner, opportunities to discuss your reasoning with other students and compare strategies will all lead to refined practice and deeper understanding. A level Maths places a far greater emphasis on proof than GCSE and so the quality of your mathematical writing is crucial – students are therefore expected to make detailed comparisons between their own solutions and the model solutions that are shared with them.

**What 100% effort in this subject looks like:**

* You need a level of stamina that means you will put in the routine practice needed, usually involving about the same time out of lessons as that committed during lesson time.
* A curiosity about the subject which means you always want to know why, as well as how.
* A self-discipline to look for any mistakes in your work and to uncover their cause and resolve them.
* Sufficient resilience that means you might walk away from a challenging problem to make a cup of tea, but only to come back to it again later and seek out further support if you still haven’t found a method of solution.
* An appreciation of what rigour in mathematical reasoning looks like, so that your own mathematical writing continues to develop and improve.
* Seeking out further exam practice through a variety of online options.
* An interest and appreciation of how A level Maths relates to the other subjects you are studying, as well as future university and career aspirations. This includes asking questions to ascertain some differences in notation and language between subjects and applications.

**Book and Folder Policy:**

In mathematics students are supplied with A4 exercise books which are used in lessons and at home for class notes and textbook exercises.

*Each exercise books should:*

* reflect that regular practice is taking place outside lessons, building on from work done in class
* be well organised with lesson and content headings as well as highlighted examples and notes that can be easily revisited when work is reviewed
* evidence regular reflective marking of all work such that mistakes are quickly identified and resolved

and useful learning is gained from these errors (students are asked to mark in a different coloured pen to help emphasise errors for future reference).

All students must also have an assessment folder, which is shown to staff when requested:

*Your folder should have:*

* + dividers separating the work into sections, organised by topic
  + Moodle chapter review homework tasks, marked by the student, submitted for teacher checking and sorted by topic
  + All chapter tests, organised with the corresponding homework, which have been teacher marked. Corrections and any other necessary development tasks having been completed.
  + Mock exams which have been teacher marked and related corrections and model solutions are included.
  + Evidence of folder review sheets where peer assessment informs ways to improve your folder.

**What Marking looks like:**

* Student self-marking of routine practice exercise is visible confirming correct solutions but also builds on errors by repeating the aspect of the question that has caused the mistake (self-reminder notes can also be helpful).
* Teacher checking of chapter reviews will be recorded classified by whether or not the task shows evidence of a student’s confident understanding and application of the content learned and appropriate reflection from marking, making appropriate use of the given markschemes.
* Teacher marking will follow examiners’ practice, distinguishing between marks awarded for correct methods (M), from accuracy marks (A) or those independent of methods (B). This reflects the importance placed on proof in A level maths such that evidence of reasoning and mathematical justification, using good mathematical notation is required.

**What Homework looks like:**

* Routine continued practice, usually set from text book exercises. Further practice exercises are also supplied in Moodle for each topic.
* Further exploration of reasoning by looking at other sources such as online tuition videos and looking at solution bank model solutions. This can also be valuable time spent talking through your thinking with another student.
* Solving and reviewing topic based past exam questions in end of chapter Moodle homework tasks
* Practice exam papers, helping to develop confidence in managing identification of the maths used to solve a wide variety of problems.

**Check your reasons for wanting to study maths at A level**

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| http://www.best4balls.com/media/catalog/product/cache/1/thumbnail/700x/9df78eab33525d08d6e5fb8d27136e95/h/a/happy-face.png | **I have always enjoyed maths**  This is the best reason for choosing maths A level because you will need to work hard at it, so enjoying the challenge and being willing to persevere and put the time into practising new skills is an essential aspect of your studies. |
| http://1.bp.blogspot.com/-yMhXsCzlff0/VhngtMScc5I/AAAAAAAARH0/_PMtCdgOT2Q/s1600/gorgeous-graduate-smiley.png | **Universities respect a Maths A level above many other subjects**  This is certainly true but take care as your offer from university depends on the grades that you are going to get. Be certain that you have the mathematical ability and interest in the subject to ensure that you will achieve a high grade. It is not sensible to choose A level maths if your GCSE grade is below grade 7. |
| http://rlv.zcache.com/i_love_science_postcard-r63fd98af0c6342dba30b2746715e541c_vgbaq_8byvr_512.jpg | **They won’t let me study Physics unless I do maths**  This is often the rule in many sixth forms because A level physics relies heavily on good algebra skills and the mechanics component of A level maths supports physics. Watch out though, this might just mean that you will struggle in both physics and maths if these skills are not secure enough, or if you are not prepared to put in the practice needed. |
| http://4.bp.blogspot.com/-6S0Vdodlxfs/VZ_ltgR9q5I/AAAAAAAAQbg/IB5ECpALnOw/s1600/good-report-card.jpg | **I have always been good at maths**  Being confident about your mathematical skills is certainly an essential quality, as you need to be willing to show resilience with problem solving and persevere with brand new concepts. Remember that the A level maths curriculum is heavily dependent on advanced algebra skills and applied problem solving skills are key components of the course. |
| http://www.i2symbol.com/templates/a/b/8/c/ab8cde635b34136a9f0178013b09ba1d/canvas.jpg | **I want to be an engineer so I need to improve my algebra skills**  Engineering is a broad and varied career aspiration. Degree level engineering is highly dependent on A level maths skills but a certain level of existing skills are essential to access the A level maths course, as we do not reteach skills that you should have already developed at GCSE. You need to have studied the higher tier syllabus at GCSE and be confident with most of the algebra content to study maths at A level. |
| https://imconfident.files.wordpress.com/2013/04/writing-on-paper1.jpg | **I’m not good at writing and there isn’t much writing in maths**  This might be true but watch out, our students often run into problems in exams if they are not prepared to take the time to read all the detail of lengthy wordy questions. Most importantly, A level maths involves developing the art of good mathematical writing – constructing well-structured algebraic reasoning to prove a result as well as explaining. A level maths is certainly not just about finding answers. |
| A picture containing clipart  Description automatically generated | **I’ve got to choose three subjects so I might as well choose maths**  If this is your only reason for choosing maths, think again. Maths A level requires hard work and self-discipline. If you are not enthusiastic about the subject you are very unlikely to be successful. This goes for your other subject choices too. |

**Specification at a glance:**

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| **Y1 Pure Content Summary** | **Y1 Applied Maths Content** |
| **Algebra and functions (part 1)** | **Statistics** |
| Algebraic expressions – basic algebraic manipulation, indices & surds  Quadratic functions – factorising, solving, graphs and the discriminants  Equations – quadratic/linear simultaneous | **Data presentation and interpretation (part 1):** Calculation and interpretation of measures of location; Calculation and interpretation of measures of variation; Understand and use coding |
| **Further algebra**  The binomial expansion  Algebraic division, factor theorem and proof | **Statistical distributions:** Use discrete distributions to model real-world situations; Identify the discrete uniform distribution; Calculate probabilities using the binomial distribution (calculator use expected) |
| **Differentiation**  Definition, differentiating polynomials, second derivatives  Gradients, tangents, normals, maxima and minima | **Probability:** Mutually exclusive events; Independent events  Introduction to sampling terminology; Advantages and disadvantages of sampling  Understand and use sampling techniques; Compare sampling techniques in context  Language of hypothesis testing; Significance levels Carry out hypothesis tests involving the binomial distribution |
| **Integration**  Definition as opposite of differentiation, indefinite integrals of *xn*  Definite integrals and areas under curves | **Data presentation and interpretation (part 2):** Interpret diagrams for single-variable data; Interpret scatter diagrams and regression lines; Recognise and interpret outliers; Draw simple conclusions from statistical problems |
|  | **Mechanics** |
| **Vectors (2D)**  Definitions, magnitude/direction, addition and scalar multiplication  Position vectors, distance between two points, geometric problems | Introduction to mathematical modelling and standard S.I. units of length, time and mass  Definitions of force, velocity, speed, acceleration and weight and displacement; Vector and scalar quantities |
| **Coordinate geometry in the (*x*, *y*) plane**  Straight-line graphs, parallel/perpendicular, length and area problems  Circles – equation of a circle, geometric problems on a grid | Graphical representation of velocity, acceleration and displacement |
| **Trigonometry**  Trigonometric ratios and graphs  Trigonometric identities and equations | Motion in a straight line under constant acceleration; *suvat* formulae for constant acceleration; Vertical motion under gravity  Newton’s first law, force diagrams, equilibrium, introduction to **i**, **j** system  Newton’s second law, ‘*F* = *ma*’, connected particles (no resolving forces or use of *F* = *μR*); Newton’s third law: equilibrium, problems involving smooth pulleys |
| **Algebra and functions (part 2)**Inequalities – linear and quadratic (including graphical solutions)  Graphs – cubic, quartic and reciprocal  Transformations – transforming graphs – f(*x*) notation | Variable force; Calculus to determine rates of change for kinematics  Use of integration for kinematics problems i.e. |
| **Exponentials and logarithms:**  Exponential functions & natural logs |  |

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| **Y2 Pure Content Summary** | **Y2 Applied Maths Content** |
| **Algebraic and partial fractions** | **Statistics** |
| Simplifying algebraic fractions  Partial fractions | **Probability**  Using set notation for probability |
| **Trigonometry** **(part 1)**  Radians (definition and exact values)  Small angles  Secant, cosecant and cotangent (definitions, identities and graphs)  Inverse trigonometrical functions  Compound angle formulae | Conditional probability  Questioning assumptions in probability |
| **Differentiation**  Differentiating sin *x* and cos *x* from first principles  Differentiating exponentials and logarithms  Differentiating products, quotients and implicit functions.  Second derivatives (rates of change of gradient, inflections)  Rates of change problems (including growth and kinematics) | **The Normal distribution**  Understand and use the Normal distribution  Use the Normal distribution as an approximation to the binomial distribution  Selecting the appropriate distribution Statistical hypothesis testing for the mean of the Normal distribution |
| **Integration**  Integrating *xn*, exponentials and trigonometric functions  Integration by substitution  Integration by parts  Use of partial fractions  Areas under graphs or between two curves  The trapezium rule  Differential equations | **Regression and correlation**  Change of variable  Product Moment Correlation Coefficients  Statistical hypothesis testing for zero correlation |
| **Proof:** including proof by deduction and proof by contradiction | **Mechanics** |
| **Functions and modelling**  Modulus function  Composite and inverse functions  Transformations  Modelling with functions | **Further kinematics (part 1)**  Constant acceleration (equations of motion in 2D; the **i**, **j** system)  **Applications of kinematics**  Projectiles |
| **Series and sequences**  Arithmetic and geometric progressions  Sigma notation  Recurrence and iterations | **Forces at any angle:**  Resolving forces  Friction forces (including coefficient of friction *µ*) |
| **The binomial theorem**  Expanding (*a* + *bx*)*n* for rational *n*;  Expansion of functions by first using partial fractions | **Moments**  Forces’ turning effect |
| **Trigonometry (part 2)**  Arcs and sectors  Compound and double (and half) angle formulae  Harmonic form*: R* cos (*x* ± *α*) or *R* sin (*x* ± *α*)  Proving trigonometric identities  Solving problems in context (e.g. mechanics) | **Applications of forces**  Equilibrium and statics of a particle  Dynamics of a particle  Equilibrium and statics of a particle (including ladder problems) |
| **Parametric equations**  Definition and converting between parametric and Cartesian forms  Curve sketching and modelling  Differentiating parametric functions  Integrating functions/ Areas under curves defined parametrically | **Further kinematics (part 2)**  Variable acceleration (use of calculus and finding vectors and at a given time) |
| **Numerical methods**  Location of roots  Solving by iterative methods ( ‘staircase and cobweb’ diagrams)  Newton-Raphson method |  |
| **Vectors** (**3D):**  Use of vectors in three dimensions; knowledge of column vectors and **i**, **j** and **k** unit vectors |  |

**Examinations – at the end of the two year course**

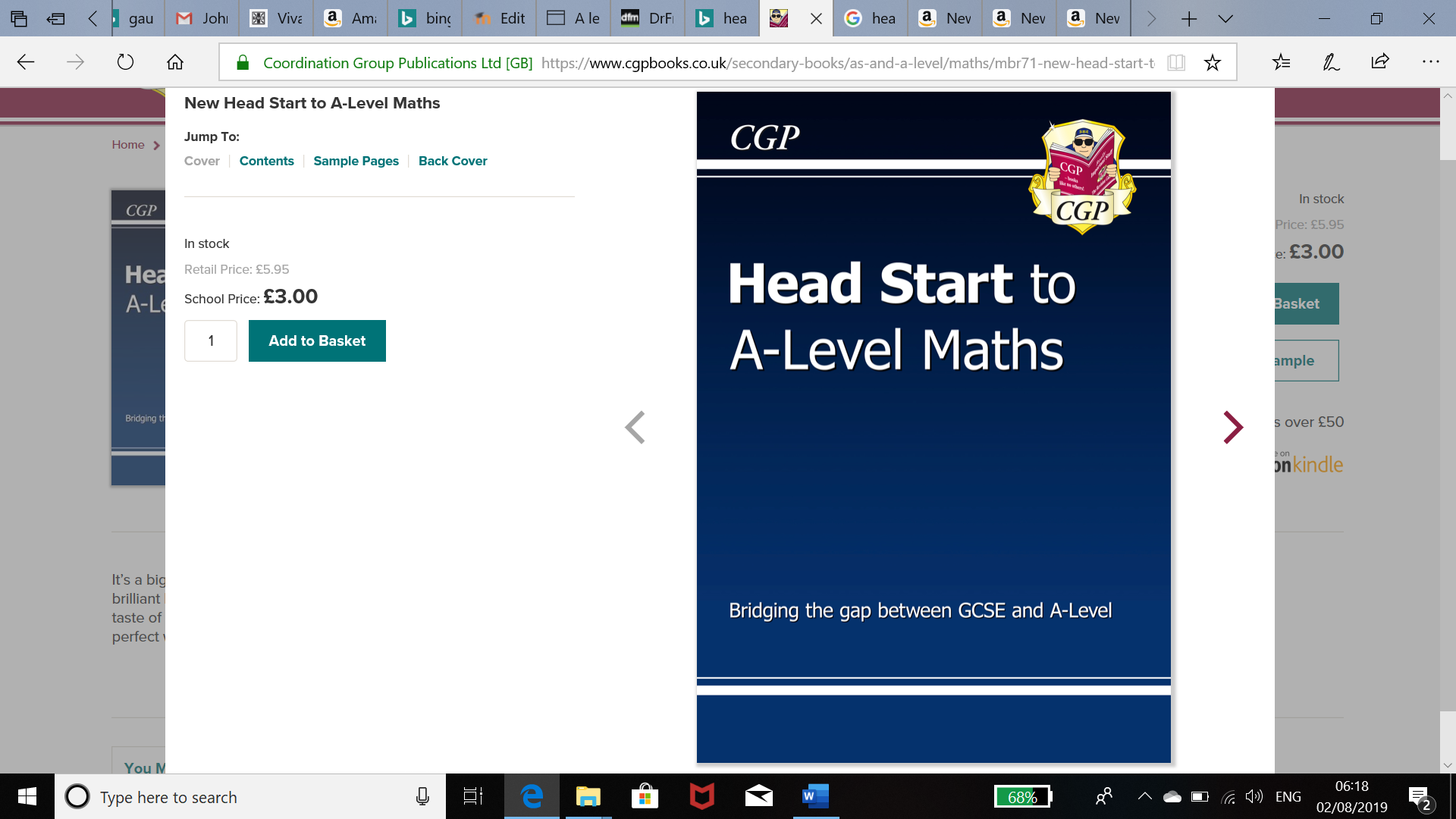
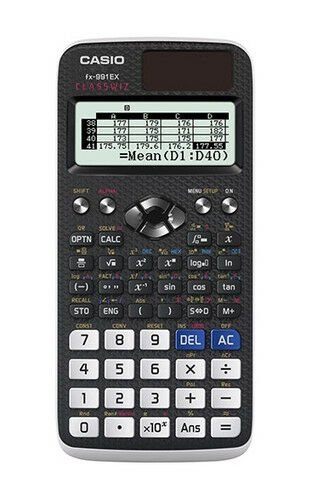
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| **A level Mathematics** | |
| **Paper 1:**  Pure Mathematics  33%, 2 hours, 100 marks | Any pure content can be assessed on either paper |
| **Paper 2:**  Pure Mathematics  33%, 2 hours, 100 marks |
| **Paper 3:**  Statistics and Mechanics  33%, 2 hours, 100 marks | Section A: Statistics (50 marks)  Section B: Mechanics (50 marks) |

**Summer preparation**

The Step up to A level from Higher GCSE is very manageable if you had mastered all of the content before your GCSE but you need to be ready for a fast paced, challenging start.

The list below summarised the skills we expect you to be confident with:

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| **Number** | **Algebra Basics** | **Geometry** |
| Working with fractions | Expanding brackets | Pythagoras’ theorem |
| Laws of indices | Terms in expressions and equations | Trigonometry basics |
| Surds | Changing the subject of a formula | The Sine amd Cosine Rules |
|  | Solving Linear equations | Vectors |
| **Algebraic Graphs** | Solving inequalities |  |
| Equation of a straight line | Solving simultaneous equations | **Statistics & probability** |
| Parallel & perpendicular lines | Factorising | Histograms & cumulative frequency |
| Non-linear graphs | Solving quadratic equations | Sampling and averages |
| Transforming graphs | Completing the square | Probability & tree diagrams |
| Trigonometry graphs |  |  |
| Graphing inequalities |  |  |

You will need a ***Casio Classwiz calculator*** for A level fx991EX

These retail at between £25 and £35

Note that Casio do produce more advanced models that also include graphing software.

The CGP ***Head Start to A-Level Maths*** book offers a thorough review of the topics from GCSE that you will be using at A level

Summer preparation tasks

The purpose of giving you a summer bridging task is:

1. To provide a bridge from level 2 to level 3 study, and lead into the early stages of the course.
2. To engage you in independent learning which is required at level 3.
3. To encourage you to develop your work ethic and commitment to study.
4. To measure your suitability for the course and assess your initial levels of achievement.

**Task**: Review your GCSE skills from the list above, downloading the zip file ***Mathematics – Bridging task worksheets***

for appropriate refreshment and improvement of these skills

**Potentially useful websites:**

Studying Maths beyond GCSE course choices:

<https://amsp.org.uk/students/gcse/what-next>

The Jump - GCSE to A Level Bridging Course

<https://www.youtube.com/watch?v=mY7tn3NT9MQ>

### GCSE to A-Level Maths: Bridging the Gap NEW - [TLMaths](https://www.youtube.com/channel/UCCgGyPD6MYQcHuMIc-Kv-Uw)

<https://www.youtube.com/watch?v=QWaatt3t76k&list=PLg2tfDG3Ww4vuevQXAC13EyUvpVa0UrNa>

**Link to the Edexcel Mathematics Specification:**

<https://qualifications.pearson.com/en/qualifications/edexcel-a-levels/mathematics-2017.html>