GCS year 12 Maths/FM Guide 2021-2022

Congratulations on choosing to study Maths A-level at GCS. We believe that you are in the very best place for high quality teaching and support in your 6th form studies. To make the most of this you must come well prepared and highly motivated to learn.

The most important keys to success in A-level maths are (1) regular practice for skills mastery and (2) developing an ability to recognise and close understanding gaps. With purposeful practice new maths concepts move from short term working memories to long term embedded skills.

It cannot be overstated how important regular recall of previous concepts that you've learned is. A huge amount of top-quality research has shown that recalling concepts actively (doing questions) is of paramount importance to creating lasting change in your long-term memory. *If you're not remembering what you've learnt, then we're all wasting our time!* Your class teachers will implement previous concept recall throughout the year, but it is down to **you** to develop independence here, and form the habit of doing it every day in your own time.

Organisation and presentation are very important in A-level work. You must keep your work in folders that are systematic and tidy, and be prepared for your teacher to inspect them regularly. An ability to take good notes and present your workings in an easy-to-read and mathematically-logical way will make a big difference to your performance.

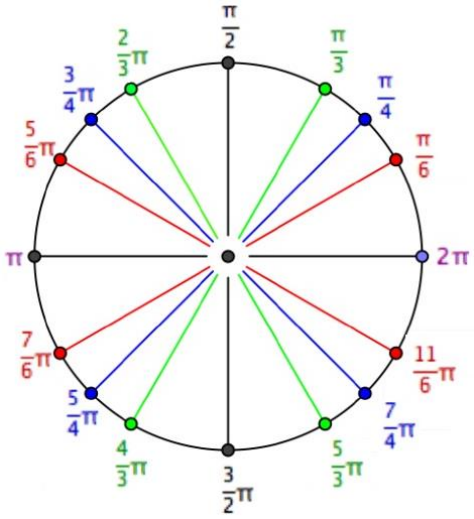
Expect to be given homework after nearly every lesson. Many of these will be short (<1hour) and aimed at practising new skills. Every couple of weeks you will be set a "review" task, which will take longer, but you will be given more time for those.

MYO – all homework should be **SELF-MARKED** and **ANNOTATED** prior to handing-in. You will normally be provided with answers, so you can check if you are correct, but not necessarily the full workings, so you are encouraged to take a further look when incorrect and explain to the teacher anything you do not understand or cannot follow.

In addition to regular homework, you will be expected to complete considerable additional study outside of lessons. The following pages describe in some detail how to do this.

2π a Week –

Independent Study in Maths and FM



So why 2π a week? You should be spending just over 6 hours (2π) a week **per subject** (so FM need to scale by $|1+i|^2$) on your study, in addition to lesson time.

Typically, about π hours a week will be regular HW set by your class teacher, leaving you to make up the other piece of the π with other modes of independent study…

In maths this should be made up of **consolidation**, **revision** and **extension**. You should decide the proportion of each, based on how well you are doing with the material.

If you are doing FM, then you should think of your maths independent study time as a whole and allocate it where most suitable; be careful here in that previous students have sometimes not given regular maths the necessary time for mastery – you will not be able to build a good mathematical house without strong bricks!

Read forward with the textbook and other recommended sources. Come to your lessons already with an idea and a bunch of questions, and you will get so much more out of them.

Read back with the textbooks and with your notes. Don't let any understanding gaps develop. To enable this, you must **keep your folders and notes in mint condition and use your error log sheets properly.**

Read around using the reading list, youtube channels and maths "wiki-surfing."

Must have app (install on your phone now!)

Desmos

Must have webpages (favourite on your browser now!)

Activelearn, TL Maths, Madasmaths, Examsolutions.net and Desmos

Always be thinking about the *WHY*?

Youtube Channels:

- 3blue1brown
- Mathologer
- Vihart
- Welch Labs
- Numberphile
- PatrickJMT
- MEI
- Khan Academy (also see their website)
- Veritasium
- Vsauce
- Fermilab

Additional Websites: "engaging with the unfamiliar is key to forming deeper insights and developing intellectual independence" – Professor Povey (see his book in the reading list!).

Mathshelper http://www.mathshelper.co.uk/index.htm

Nrich https://nrich.maths.org/

Plusmaths.org https://plus.maths.org/content/

Underground maths https://undergroundmathematics.org/

Mathematics Stack Exchange https://math.stackexchange.com/

Alex Bellos blog @theguardian https://www.theguardian.com/profile/alexbellos

UKMT https://www.ukmt.org.uk/

STEP Maths https://www.admissionstesting.org/for-test-takers/step/about-step/

Oxford MAT https://www.maths.ox.ac.uk/study-here/undergraduate-study/maths-admissions-test

TMUA https://www.admissionstesting.org/for-test-takers/test-of-mathematics-for-university-admission/about-the-test-of-mathematics-for-university-admission/

AEA Maths https://qualifications.pearson.com/en/qualifications/edexcel-a-levels/advanced-extension-award-mathematics-2008.html and http://www.mathshelper.co.uk/oxb.htm

FAQ

Where can I find past papers?

Mathsandphysicstutor.com Bear in mind these are the old style papers and you are now on the new A level course! However, many of the old questions map perfectly to "new spec" and no maths practice is bad ☺.

Madasmaths.com – An excellent selection of new spec (and old spec if you want) questions and worked solutions. The difficulty level starts around the same as standard A-level material, but then ramps up to considerably more challenging on the later papers

Examsolutions.net – A massive library of past questions, all with video work-through solutions

naikermaths.com/a-level-practice-papers-2019-specs/ - A fourth option for papers based on the our exam board, Edexcel's, spec

Where can I find video tutorials?

TL Maths is your "go to" when first learning. Examsolutions.net is also fantastic, particularly when you are recalling previous concepts later down the line – it hosts a fantastic set of walkthroughs specific for Edexcel exams. Additionally, Khan Academy has some great videos. Also see Youtube Channel section.

What do I do if I am really stuck on a question?

When you have exhausted all your resources (class notes, books, peers, TL Maths, examsolutions, youtube etc) remember that your most valuable resource is ***your class teacher and we are always here to help you***. Come and see us! ***We love helping you understand your A level maths***; that's why we're here!

What tools can I access online that will really help me understand maths?

We are so lucky to live in a time where there are excellent, free resources.

- ActiveLearn online books: you have a login for each of these. They are jam packed full of examples, links to Geogebra (see below) and step by step solutions for exercises.
- Desmos: a graphing calculator that you can use for almost anything algebraic. *Don't pay the no sketch tax! Get better at sketches with Desmos!*
- Geogebra: thousands of animated tools to help you understand, visually, the principles we are exploring together.

Maths Reading List. Aim to read a book a month. 2 for FM!

Maths

Why Do Buses Come In Threes? – R Eastway

1089 And All That – D Acheson

50 Mathematical Ideas You need to know – Tony Crilly

Alex's Adventures In Numberland – Alex Bellos

Alex Through The Looking Glass – Alex Bellos

E The Story Of A Number – Eli Maor

How to Lie With Statistics – Darrell Huff

The Works of Archimedes – Thomas L. Heath

The Mathematical Principles of Natural Philosophy – Isaac Newton

Numericon – Freiburg & Thomas

Penguin Dictionary Of Curious And Interesting Numbers – D Wells

Maths Of The Simpsons – Simon Singh

Codebook – Simon Singh

Very Short Introduction To Mathematics – Tim Gowers

17 Equations That Changed The World – I Stewart

How To Solve It - Polya

Letter To A Young Mathematician – I Stewart

Further Maths

Music Of The Primes – Marcus Du Sautoy

Fermat's Last Theorem – Simon Singh

The Calculus Story – A Mathematical Adventure – D Acheson

Will You Still Be Alive In 10 Years Time?- P Nahin

An Imaginary Tale: The Story Of $\sqrt{-1}$ – P Nahin

God Created The Integers – Steven Hawking

History Of Mathematics – Carl Boyer

The Unfinished Game – Keith Devlin

Journey Through Genius – William Dunham

The Emperor's New Mind – Roger Penrose

The Pleasures Of Counting – TW Koerner

Calculus For The Ambitious – TW Koerner

The Art Of The Infinite – Kaplan

Millennium Problems – Devlin

What Is Mathematics? – Courant, Robbins & Stewart

Archimedes' Revenge – P Hoffman

Zero – Biography Of A Dangerous Idea – C Seife

Proofs And Refutations – Latkos

Introduction To Mathematical Reasoning – Eccles

Finding Moonshine – Marcus Du Sautoy

Solving Maths Problems – Terrence Tao

Brief History Of Mathematical Thought – Luke Heaton

<u>Maths Puzzles (Note The Prolific Authors: Martin Gardner, Ian Stewart)</u>

Can you Solve my Problems – Alex Bellos

Professor Povey's Perplexing Problems – Povey

Maths Hysteria – A Stewart

My Best Mathematical & Logical Puzzles – M Gardner

Challenging Math problems – Terry Stickles

536 Puzzles – Dudenoy

Mathematical Puzzles Of Sam Lloyd – S Lloyd/M Gardner

Colossal Book Of Maths – M Gardner

What To Solve? – Judita Cofman

Moscow Maths Problems: 359 Mathematical Recreations

Professor Stewart's Casebook Of Mathematical Mysteries

The Great Mathematical Problems – Ian Stewart

50 Challenging Problem In Probability – F Mosteller

Duelling Idiots And Other Classic Problems In Probability – P Nahin

A Problem Solver's Handbook - Jobbings

Advanced Problems In Core Mathematics – Steven Siklos

Advanced Problems In Mathematics – Steven Siklos

A Century Of Pythagoras Magazine

Maths/Science/Maths

Measuring The Universe – Kitty Ferguson

The Quantum Universe: Anything That Can Happen, Happens – Cox & Greene

Bad Science – Ben Goldacre

Mathematics And The Physical World – M Kline

Galileo's Finger – PW Atkins

A Brief History Of Time – S Hawking

Mathematical Methods For Science Students – G Stephenson

Six Easy Pieces – Richard Feynman

Six Not-So-Easy Pieces – Richard Feynman

Biographies

Logicomix (Bertrand Russel) – Apostolos Doxiadis

The Man Who Knew Infinity (Ramanujan) – Robert Kanigel

Carl Friedrich Gauss: Titan of Science – G.Waldo Dunnington

The Strangest Man (Paul Dirac) – Graham Farmelo

The Man Who Loved Only Numbers (Paul Erdos) – Paul Hoffman

The Quantum Astrologer's Handbook (Gerolamo Cardano) – Michael Brooks

A Bit Mathsy But Also Something Else

Bringing Down The House – B Mezrich

Thinking Fast And Slow – Daniel Kahneman

Curious Incident Of The Dog In The Nighttime – Mark Haddon

Thinking In Numbers – Daniel Hamnet

Black Swan – Nassim Nicholas Taleb

Film

A Beautiful Mind

The Imitation Game

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Fermat's Room

Good Will Hunting

The Theory of Everything

Travelling Salesman

Ramanujan – The Man Who Knew Infinity

Hidden Figures

Pi

Proof