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Teddington Sixth Form

A Level Further Mathematics

Course Details & Transition Reading 2020-2022

Introduction

The Mathematics Department is Teddington School are delighted that you would like to continue your studies in mathematics by applying to Teddington to study Further Mathematics at A-Level.

This booklet is to help support you from the start of the course. It contains a description of each of the modules you will be studying as well as the reading we suggest that you do before you start the course.

A-level Further Mathematics is designed to broaden and deepen the mathematical knowledge and skills developed when studying A-level Mathematics. It is studied alongside A-level Mathematics.

The course provides the opportunity to explore new and often more sophisticated mathematical concepts. It is a challenging qualification which will extend and deepen your knowledge. It will provide a solid foundation for further studies in any Science or Mathematics-based course at university.

Content and Exams

We study the **Edexcel syllabus** for Further Mathematics.

A levels are now linear so all your exams will be at the end of Year 13.

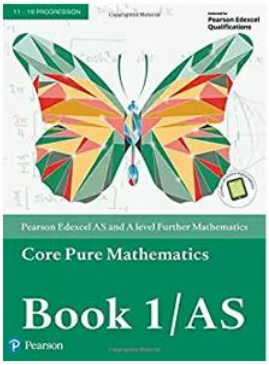
There is a compulsory Core Pure Mathematics element of Further Mathematics which makes up 50% of the marks. There are then 2 optional modules making up the remaining 50%. We have decided that these will be Further Mechanics and Decision Mathematics. The assessment at the end of Year 13 is in four exam papers:

<table>
<tr><td>Paper 1: Core Pure Mathematics
25% , 90 minutes, 75 marks</td><td rowspan="2">Any pure content can be assessed on either paper.</td></tr>
<tr><td>Paper 2: Core Pure Mathematics
25%, 90 minutes, 75 marks</td></tr>
<tr><td>Paper 3: Further Mechanics
25%, 90 minutes, 75 marks</td><td rowspan="2">The Mechanics and Decision modules are assessed in separate exams.</td></tr>
<tr><td>Paper 4: Decision Mathematics
25%, 90 minutes, 75 marks</td></tr>
</table>

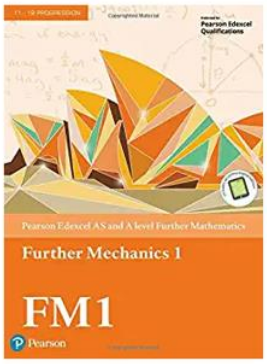
Course Materials

You do not need a different calculator for Further Mathematics – you will be using the same calculator as you need for your A level Mathematics course.

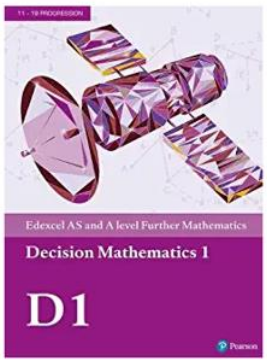
For September you will need to buy three Pearson A level Further Mathematics textbooks details of which are below:



ISBN-10: 1292183330
ISBN-13: 978-1292183336



ISBN-10: 1292183314
ISBN-13: 978-1292183312



ISBN-10: 1292183292
ISBN-13: 978-1292183299

The FM1 and D1 textbooks will also be used in year 13.

Please let us know if you have any problems in buying these.

A level Further Mathematics Transition Reading

You should start reading around the subject over the summer before you start your course in September to get a flavour of the wider world of maths. Below are some suggestions of books (in no particular order) which you may find interesting. These are not textbooks! We do not suggest that you read all of the books on the list, nor should you feel limited to the books suggested.

1. The Foundations of Mathematics, Ian Stewart
2. Mathematics and the Imagination, Edward Kasner
3. Symmetry: a Journey into the Patterns of Nature, Marcus du Sautoy
4. Mathematician's Delight, WW Sawyer
5. A Mathematician's Apology, GH Hardy

In addition to books, there are many websites which you can use to broaden your understanding of maths. One you could get started with is Numberphile.com but there are plenty more out there!

There is also a list of suggested books (which may be slightly lighter reading) in the A level Mathematics Booklet.

We look forward to welcoming you in September.

The Mathematics Department.

Core Pure Mathematics Year 12

Title
Complex numbers
Introduction of complex numbers, basic manipulation
Complex conjugate, division and solving polynomial equations
Argand diagrams
Modulus and argument
Loci
Series
Sums of series
Algebra and Functions
Roots of polynomial equations
Formation of polynomial equations
Calculus
Volumes of revolution
Matrices
Matrix addition, subtraction and multiplication
Inverse of 2×2 and 3×3 matrices
Simultaneous equations
Linear transformations
Proof
Proof by mathematical induction
Vectors
Vector and Cartesian equations of a line and a plane
Scalar product
Problems involving points, lines and planes

Core Pure Mathematics Year 13

Title
Complex Numbers
Know and use $z = re^{i\vartheta} = r(\cos\vartheta + i\sin\vartheta)$
De Moivre's theorem
The nth roots of $z = re^{i\vartheta}$ and complex roots of unity
Further Algebra and Functions (series)
Method of differences
Maclaurin series
Further Calculus
Improper integrals
Mean value of a function
Integrate using partial fractions
Differentiate inverse trigonometric functions and integrate using trigonometric substitutions
Further volumes of revolutions
Polar Coordinates
Convert between Cartesian and polar and sketch $r(\vartheta)$
Area enclosed by a polar curve
Hyperbolic Functions
sinh x, cosh x, tanh x and their inverses
Logarithmic forms of the inverse hyperbolic functions and integrate functions of the form $(x^2 + a^2)^{-\frac{1}{2}}$ and $(x^2 - a^2)^{-\frac{1}{2}}$
Differential Equations
Integrating factors to solve first order differential equations
Second order differential equations of the form $y'' + ay' + by = f(x)$
Modelling

Applied Modules

Note: Items in **bold** are studied in Year 12

Further Mechanics 1
Momentum and Impulse
Momentum and impulse; derivation of units and formulae **Impulse-momentum principle. Conservation of momentum applied to collisions and 'jerking' string problems**
Momentum as a vector (**i**, **j** problems) Impulse-momentum principle in vector form
Work, Energy and Power
Work, kinetic energy; derivation of units and formulae
Potential energy, work-energy principle, conservation of mechanical energy, problem solving
Power; derivation of units and formula
Elastic Strings and Springs and Elastic Energy
Hooke's law and definition of modulus of elasticity. Derivation of elastic potential energy formula.
Elastic Collisions in One Dimension
Direct impact of elastic spheres. Newton's law of restitution. Loss of kinetic energy due to impact
Problem solving (including 'successive' impacts)
Elastic collisions in Two Dimensions
Oblique impact of a smooth sphere with a fixed surface Successive oblique impacts of a sphere with smooth plane surfaces
Oblique impact of two smooth spheres of equal radius
Decision Mathematics 1
Algorithms and Graph Theory
Introduction to algorithms
Sorting algorithms
Introduction to graph theory
Planarity algorithm
Algorithms on graphs
Minimum connectors (spanning trees)
Dijkstra's algorithm
Floyd's algorithm

Route inspection
Travelling salesman problem
Linear programming
Formulation of problems
Graphical solutions
Simplex algorithm
Big-M and two-stage Simplex
Critical path analysis
Activity networks; precedence tables
Critical path algorithm; earliest and latest event times
Total float; Gantt charts
Resource histograms
Scheduling diagrams