Preparing for an Engineering Degree

Engineering degree courses all require good mathematical skills.

You will be taught the mathematics required for the course during your first year. The topics covered will be mostly content from A level Mathematics and Further Mathematics. These techniques and methods will be applied in engineering contexts and require you to pick up the skills and concepts quickly.

Consequently you are encouraged to do as much mathematics in the sixth-form as possible so that you have some familiarity with topics like:

- Differentiation
- Integration
- Differential equations
- Functions, such as trigonometric, logarithmic, exponential
- Vectors
- Matrices
- Complex numbers
- Mechanics
- and Probability

Overview of Mathematics covered in first year Engineering Degrees

The table below shows typical areas of mathematics that might be studied in the first year of an undergraduate engineering degree course.

The applications of A level Mathematics and Further Mathematics in red text have been included in this folder in Integral to illustrate how these mathematical ideas are used in engineering contexts:

Differential Calculus	Integral Calculus	Differential Equations
Differentiation – implicit and parametric Finding stationary points Numerical methods for finding roots Taylor Series Series expansions and limits Introduction to partial differentiation	Integration methods, by parts, substitution, separation of variables Volume of revolution, centroids Numerical integration Integration of rational functions Improper integrals **Work done pumping water from a bore hole**	Linear First Order ODEs Linear Second Order ODEs Particular solutions **Calculating Energy of an Oscillating Body**
Functions	**Complex Numbers**	**Matrices**

Inverse Functions Trigonometric Exponential Logarithmic Hyperbolic Curve Sketching	Cartesian, Polar & Exponential Forms Euler's formula De Moivre's theorem Complex roots **Analysing AC current** **Impedance can be complex**	Inverse of a matrix Product Solution of sets of linear equations Eigenvalues and eigenvectors Matrices as transformations **Calculating the current in a mesh** **Motion of a coupled spring system**
Vectors	**Mechanics**	**Probability**
Vector Algebra Scalar and vector products Triple product Differentiation and integration of vectors Vector equations of lines and planes	Newton's laws of motion Conservation laws Collisions Circular motion Rigid body mechanics Moments of inertia, rotation Simple harmonic motion, damping, resonance	Random variables Binomial distribution Poisson distribution

Example Careers

The **Tomorrow's Engineers website** has information about routes into engineering and a large selection of career profiles.

Rebecca - a civil engineer describes her work and the pathway to her career as a civil engineer. This is one of many profiles on the **Women's Engineering Society, WES** website.

Useful links

The following websites have useful information about the mathematical topics you will study during your first year of an engineering degree together with other resources to support your preparation for engineering at university.

MEI's Engineering Resources were developed for the Royal Academy of Engineering to support the teaching and learning of mathematics within engineering courses. These are free but schools need to register with MEI to access them. Here is a sample activity for Simple Gears and Transmission for **students** and for **teachers**.

EngNRICH - a section of the Nrich website with problems and articles specific to applications of mathematics in Engineering. It is for students aged 14 - 19 and is designed to complement and enhance the study of engineering. Some of the examples in the table above are from this website.

I want to study Engineering is a website with hundreds of problems based on A level questions to help students prepare for engineering at university.

Isaac Physics - a bank of challenging questions for improving your mathematical problem solving skills for physics and engineering problems. The site includes notes and explanations of techniques and is designed and maintained by the University of Cambridge.

Tomorrow's Engineers Guide to Engineering at University gives an overview of different types of engineering courses.

The Maths Centre - this site was developed by a group from the Universities of Loughborough, Leeds and Coventry and has been set up to deliver mathematics support to students looking for post-16 mathematics help.