“Rooted and grounded in Love”.

Further Maths

Intent – 'Rooted and grounded in Love'

At the heart of our curriculum is the belief that every young person can become confident Mathematicians. The development of Mathematical literacy is an issue of Social Justice; no child should leave school Mathematically illiterate. Our aim is to nurture and inspire, support and challenge, so that all students reach their full potential.

At De Lisle College, we teach for Mastery. Our curriculum is sequenced to enable students to master a topic before moving on to the next one. It is only by having a firm understanding of what has been taught, will you be confident in attempting what follows.

All students at De Lisle College follow the same curriculum. Year 7 acts as a bridge to what has been taught at primary school; mastering the core concepts of Mathematics, to act as building blocks for future years. Number and Algebra feature heavily as these are crucial components of future topics. The remainder of the Key Stage 3 curriculum interleaves and builds on these concepts, whilst introducing other areas of Mathematics, namely Statistics and Probability.

Students are placed into tiers at the beginning of Key Stage 4, to ensure the curriculum fully meets their needs and enables them to flourish. Concepts and topics from Key Stage 3 are revisited and built upon, to deepen students understanding and prepare them for their exams. Time is dedicated in year 11 to reteach prior content, ensuring all students feel confident and secure in their understanding of what has been taught.

Maths is very popular at KS5. Our knowledge rich curriculum exposes students to a range of new content, including mechanics and calculus; developing their analytical and logical thinking skills to inspire, challenge and ultimately prepare students for higher education and a career in STEM.

Ultimately our intent rests on three core principles. Every child should experience the joy of Mathematical thinking and understanding; that feeling of solving a really challenging problem. Every child should leave school Mathematically literate, confident and unintimidated by the subject. Every child deserves an outstanding Mathematics education.

A Level Further Maths
Year 12

De Lisle College
A Catholic Voluntary Academy

Curriculum Outline

Link to Catholic Social Teaching:

The OCR MEI Further Mathematics curriculum develops students' ability to model, analyse and solve complex real-world problems through advanced pure mathematics, statistics and mechanics. Topics such as algorithms, differential equations, optimisation and statistical analysis demonstrate how mathematics can support the common good, responsible stewardship of creation and informed decision-making. Students develop independence, critical thinking and problem-solving skills that enable them to participate positively in society and contribute to the wellbeing of others.

The use of matrices, vectors and proof develops logical reasoning and problem-solving skills which underpin advances in science, engineering and technology. Students appreciate how mathematical structures are used to model and understand the world, supporting responsible stewardship of creation and encouraging active participation in solving real-world challenges.

Advent 1	Core Pure (410)	**Advent 2**	Core Pure and Modelling with algorithms
Description	• Complex numbers and their basic arithmetic are introduced, including in modulus-argument form. They are used to solve polynomial equations with real coefficients and to define loci on the Argand diagram. • Relationships between roots of and coefficients of polynomials are explored • Matrix arithmetic is introduced and applied to linear transformations in 2-D, and some in 3-D. Inverses of matrices are used to solve matrix equations and related to inverse transformations • Proof by induction is introduced for formulae for simple sequences, sums of simple series and powers of matrices • Standard formulae and the method of differences are used to calculate the sum of the given series	Description	• Scalar products are introduced and used to form the equation of a plane. How planes intersect in 3-D space is considered, and matrices are used to find the point(s) of intersection. • In covering this section of the specification learners should understand: what an algorithm is; iterative processes; what kind of problems are susceptible to an algorithmic approach; how to compare algorithms, including complexity; the importance of proving that an algorithm works and of the use of heuristic algorithms when this is not possible; the need for an algorithmic approach and computing power to solve problems of the size often met in the real world.

Lent 1	Modelling with algorithms	**Lent 2**	Statistics Minor
Description	• Network algorithms are used for modelling a range of real-world problems. Formulating the problems as linear programming (LP) problems allows them to be addressed using technology. • This topic introduces constrained optimisation. In some cases, LP problems can be interpreted and solved graphically. The simplex method gives an algebraic approach, but using this by hand is limited. The use of a simplex method optimisation routine in a spreadsheet package or other software is introduced, which enables problems of a more realistic size to be tackled. The crucial skills are then setting up the problem in a way suitable for the software and interpreting the output. These are precisely the modelling skills most useful in the real world.	Description	• A short section about the importance of sampling methods • The binomial distribution is introduced for modelling discrete univariate data in AS Level Mathematics. This content extends the range of models available to include the (discrete) uniform, geometric and Poisson distributions. • Different types of bivariate data are considered. Where appropriate, Pearson's product moment correlation coefficient and Spearman's rank correlation coefficient are used to test for correlation and association, respectively, for bivariate numerical data. The different underlying assumptions are explored. Linear regression as a model for bivariate numerical data is introduced.
Pentecost 1	Statistics Minor	**Pentecost 2**	Core Pure (420)
Description	The hypothesis testing work in AS Level Mathematics - based on the binomial distribution and, informally, on correlation coefficients - is extended to include chi-squared tests and a more formal approach to tests based on correlation coefficients. This gives learners an understanding of a range of tests, including the concept of degrees of freedom, which should allow them to pick up quickly any hypothesis tests they encounter in other subjects. The product moment correlation coefficient is also considered, informally, as an effect size; this serves as an example of a widely-used approach which is complementary to hypothesis testing.	Description	• Vector equations of lines are studied; methods for finding angles and distances between points, lines and planes are developed • The determinant and inverse of a 3 × 3 matrix are found without a calculator • Partial fractions are used to sum series. Maclaurin series are used to approximate functions.

A Level Further Maths
Year 13

De Lisle College
A Catholic Voluntary Academy

Curriculum Outline

Link to Catholic Social Teaching:

The study of first and second order differential equations allows students to model changing systems such as population growth, environmental processes and physical phenomena. Students recognise how mathematics supports scientific understanding and informed decision-making that benefits both society and the environment.

Through the study of algorithms, network optimisation and linear programming, students learn how mathematics can be used to solve complex real-world problems involving the allocation of resources and decision-making. These topics demonstrate how evidence-based solutions can support communities and ensure resources are used fairly and effectively for the common good.

Topics including energy, momentum, collisions and equilibrium within the mechanics module demonstrate how mathematics contributes to the design of safer structures, transport systems and technologies. Students gain an appreciation of how mathematical modelling can improve safety, wellbeing and quality of life for individuals and communities as we grow into the idea of becoming stewards of the Earth.

Advent 1	Core Pure (420)	**Advent 2**	Core Pure (420)
Description	• Proof by induction is used more generally, including to prove divisibility results • Integration techniques are extended to include improper integrals, volumes of revolution, mean values of functions and partial fractions. Inverse trigonometric functions are defined and used for integration. • Curves defined in polar coordinates are explored, including finding the area enclosed by a curve	Description	• De Moivre's theorem is used to develop trigonometrical relationships. Roots of complex numbers are used to help to solve geometrical problems using an Argand diagram. • Hyperbolic functions and their inverses are used in integration • The work in A level Mathematics is extended to include the integrating factor method for first order differential equations. The general 2nd order linear differential equation is solved; applications include SHM, damped oscillations and paired linear 1st order differential equations.

Lent 1	Mechanics Minor	**Lent 2**	Mechanics Minor
Description	• The dimensions of quantities are analysed in terms of mass, length and time; this allows checking of results and prediction of suitable models in some cases. • Work on the vector treatment of forces and friction is extended to consider the equilibrium of a particle and of a rigid body. • Consideration of kinetic energy, gravitational potential energy and the work done by a force leading to situations which can be modelled using the work-energy principle or conservation of energy. Power is introduced.	Description	• Conservation of linear momentum and Newton's experimental law are used to model situations involving direct impact collisions. Mechanical energy lost in a collision is calculated. • The centre of mass of systems of particles and some given shapes are used in situations involving equilibrium of a rigid body.
Pentecost 1	Revision & Exams	**Pentecost 2**	Revision & Exams
Description	/	Description	/