CURRICULUM AND ASSESSMENT PLAN

YEAR 12 | A LEVEL FURTHER MATHS

The curriculum and assessment of students at this stage of education has been carefully designed to promote deep learning of mathematics and develop students into mathematicians:

Scheme of work follows the 2017 specification from Edexcel, which builds on prior knowledge from GCSE. There are opportunities throughout to apply techniques and methods to real life modelling.

HALF TERM 1

All students will know:

CORE

1) Complex numbers:

- Understand and use definitions of imaginary and complex numbers.
- Add, subtract, multiply with complex numbers.
- Understand complex conjugates and use in division of complex numbers.
- Solve quadratic, cubic and quartic equations with complex roots.

2) Argand diagrams:

- Show complex numbers on an Argand diagram.
- Find the modulus and argument of a complex number, and write in modulus-argument form.
- Represent loci and regions on an Argand diagram.

DISCRETE

1) Algorithms:

- Understand and use an algorithm given in words, or using a flow chart.
- Carry out a bubble sort and a quick sort.
- Carry out the three bin-packing algorithms and understand their strengths and weaknesses.
- Determine the order of an algorithm.

2) Graphs and networks:

- Know how mathematical models use graphs and networks, and be familiar with basic graph theory terminology.
- Know how matrices can be used to represent graphs and networks.
- Determine whether a given graph is planar.

3) Algorithms on graphs:

- Use Kruskal's algorithm and Prim's algorithm to find a minimum spanning tree.
- Apply Prim's algorithm to a distance matrix.
- Use Dijkstra's algorithm to find the shortest path between two vertices in a network.
- Use Floyd's algorithm.

All students will be assessed:

Class assessments on all the topics covered during this half term.

Past paper questions on topics covered.

Reading skills needed for this unit:

Pearson eBook.

Key vocabulary:

Complex, imaginary, conjugate, real, Argand diagram, argument, modulus, loci, region.

CURRICULUM AND ASSESSMENT PLAN

YEAR 12 | FURTHER MATHS

ENRICHMENT OPPORTUNITIES

UKMT challenge, university lecture visits.

HALF TERM 2

All students will know:

CORE

1) Series:

- Use the standard results for the sum of natural numbers, square numbers and cube numbers.
- Simplify a series that is of a linear, quadratic or cubic form.

2) Roots of polynomials

- Derive and use the relationship between coefficients and roots of quadratic, cubic and quartic equations.
- Evaluate expressions relating to the roots of a polynomial.
- Find the equation of a polynomial whose roots are a linear transformation of another polynomial.

DISCRETE

1) Route inspection:

- Use orders of nodes to determine whether a graph is Eulerian, semi-Eulerian or neither.
- Use the Chinese postman algorithm to find the shortest route in a network.
- Use route inspection algorithms in networks with more than four odd nodes.

2) The travelling salesman problem:

- Explain the differences between the classical and practical problems.
- Use a minimum spanning tree method to find upper and lower bounds.
- Use the nearest neighbour algorithm to find an upper bound.

All students will be assessed:

Class assessments on all the topics covered during this half term.

Past paper questions on topics covered.

Reading skills needed for this unit:

Pearson eBook.

Key vocabulary:

Series, sigma, summation, convergence, divergence, roots, coefficient, integer, rational.

HALF TERM 3

All students will know:

CORE

1) Volume of revolutions:

- Find the volume of revolution when a curve is rotated about the x-axis or the y-axis.
- Find more complex volumes through addition and subtraction of volume of revolutions.
- Model real-life situations using volumes of revolutions.

DISCRETE

1) Linear programming:

- Model a problem using linear programming.
- Illustrate a two-variable linear programming problem graphically.
- Locate the optimal point in a feasibility region using the objective line (ruler) method, and the vertex testing method.
- Determine solutions that need integer values.

2) The Simplex Algorithm:

- Understand and use slack and surplus variables.
- Solve maximising and minimising linear programming problems using simplex tableau.
- Understand and use the two-stage simplex method and the Big-M method for maximising and minimising problems which may include inequality constraints.

3) Critical path analysis:

- Model a project by an activity network using a precedence table.
- Use dummy activities.
- Identify and calculate early and late event times in activity networks, and critical activities.
- Calculate total float of an activity.
- Calculate and use Gantt (cascade) charts, resource histograms and scheduling diagrams.

All students will be assessed:

Class assessments on all the topics covered during this half term.

Past paper questions on topics covered.

Reading skills needed for this unit:

Pearson eBook.

Key vocabulary:

Calculus, volume, revolution, solid, radian, integration, integral, definite and indefinite.

CURRICULUM AND ASSESSMENT PLAN

YEAR 12 | FURTHER MATHS

HALF TERM 4

All students will know:

CORE

1) Matrices:

- Understand the concept of a matrix, including zero and identity matrices.
- Add, subtract and multiply matrices.
- Find the determinant of a matrix, and the inverse of a matrix.
- Use matrices to form simultaneous equations, and interpret them geometrically.

2) Linear transformations:

- Understand the properties of linear transformations and represent them using matrices, including in 3D.
- Reflect, rotate and stretch using matrices.
- Find invariant points and lines.
- Carry out successive transformations, and use inverse matrices to reverse a transformation.

MECHANICS

1) Momentum and impulse:

- Calculate the momentum of a particle and the impulse of a force.
- Solve problems involving collisions using conservation of momentum.
- Use the impulse-momentum principle and conservation of momentum in vector form.

2) Work, energy and power:

- Calculate the work done by a force.
- Calculate the kinetic energy and potential energy of a particle.
- Use conservation of energy and the work-energy principle.
- Calculate the power developed by an engine.

All students will be assessed:

Class assessments on all the topics covered during this half term.

Past paper questions on topics covered

Reading skills needed for this unit:

Pearson eBook.

Key vocabulary:

Matrix, vector, determinant, minor, cofactors, transpose, inverse, identity, zero matrix, lead diagonal, plane, coplanar, singular / non-singular, consistent, translation, reflection, rotation, stretch, invariant, momentum, impulse, conservation, work done, power, kinetic energy, potential energy.

HALF TERM 5

All students will know:

CORE

1) Proof by induction

- Understand the principle of proof by induction and use to prove the sum of a series.
- Prove results about divisibility using induction.
- Prove results about matrices using matrices.

MECHANICS

1) Elastic strings and springs:

- Use Hooke's law to solve static and dynamic problems involving elastic springs and strings.
- Find the energy stored in an elastic spring or string.
- Solve problems involving elastic energy using the work-energy principle and conservation of energy.

All students will be assessed:

Class assessments on all the topics covered during this half term.

Past paper questions on topics covered

Reading skills needed for this unit:

Pearson eBook.

Key vocabulary:

Proof by induction, argument, statement, example, contradiction, elasticity, plastic, tension, work done, static, dynamic, potential energy, kinetic energy.

HALF TERM 6

All students will know:

CORE

1) Vectors:

- Understand and use vector and Cartesian forms of theequation of a straight line in 3D and of a plane.
- Calculate the scalar product for two 3D vectors, and useto find the angle between lines and planes.
- Determine whether two lines meet and the point ofintersection.
- Calculate the perpendicular distance between two lines,a point to a line, or a point to a plane.

MECHANICS

1) Elastic collisions in 1D:

- Solve problems involving collisions of two particles using conservation of momentum and Newton's law of restitution.
- Find the change in energy due to an impact or applicationof an impulse.
- Solve problems involving successive impacts.

2) Elastic collisions in 2D:

- Solve problems involving the oblique impactof a smooth sphere with a fixed surface, and between two smooth spheres.
- Solve problems involving successive impacts.

All students willbe assessed:

- Class assessments onall the topics covered during this half term.
  Past paper questions on topics covered
- Mock exam using AS level past exam paper.

Reading skills neededfor this unit:

Pearson eBook.

Key vocabulary:

Vector, cartesian, plane,coplanar, intersection, collision, elastic, plastic, momentum, impulse, oblique, conservation, kinetic energy, potential energy

HOW STUDENTS CAN BE SUPPORTED AT HOME

Pearson Active Learn eBooks, videos of class assessment model answers, independent study guide with suggested websites.