UNIT 1 - ALGEBRA, LOGS & TRIG

ADV. MATHEMATICS 2.1

Content

- Polynomials
- The Factor and Remainder Theorems
- The Modulus Function
- Logarithms
- Exponential Functions
- Reciprocal Trigonometrical Functions
- Compound Angle Formulae
- Double Angle Formulae
- The Forms Rcos (Theta+Alpha) and Rsin (Theta+Alpha)

Resources & ICT

- Textbook
- Worksheets
- Calculators
- Autograph
- Online resources from the BM website
- www.myimaths.com
- www.mathsnetalevel.com
- www.wolframalpha.com

Types of assessment

- Exercises from textbooks and worksheets
- Relevant questions from past papers
- Formative assessment of homework and test results
- Structured questioning during lessons
- Judgments based on class participation and effort

Students to Know

- Solving problems using a number of methods
- How to use logarithms effectively
- Solving problems involving trig identities

Students to Understand

- Connections between algebra and graphical representations
- How to approach problems using a variety of techniques
- The necessary standard to attain marks in an A Level standard exam question

Students to be able to Do

- Solve algebraic problems
- Understand new vocabulary
- Answer exam standard questions

Cross curricular links

- Chemistry; radioactive decay and logarithms
- Geography; exponential growth of populations
- History; The development of mathematics and key figures in history
- Economics; problem solving skills using a logical approach

Differentiation incl. EAL

- Extension tasks for gifted students
- Emphasis on vocabulary (especially for non native speakers of English)
- Group work and Academic Champions to encourage peer learning

Learning styles activities

- Students encouraged to approach tasks using different methods
- Individual guidance to improve understanding
- Lessons taught using a range of techniques

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Global citizenship, internationalism, local environment

- Links to countries where the mathematics at hand was first developed
- Sharing of ideas from students with different mathematical backgrounds
- Comparing the advantages and disadvantages of French, German and British algebraic notation and the development of symbols used in problem solving
- Using the Greek alphabet for variables and constants in advanced mathematics

UNIT 2 - CALCULUS & ITERATION

ADV. MATHEMATICS 2.1

Content

- The Product & Quotient Rule
- Differentiating logarithmic, exponential and trigonometrical functions
- Parametric curves
- Integrating logarithmic, exponential and trigonometrical functions
- Numerical solutions to equations
- Integration techniques
- Differential Equations

Resources & ICT

- Textbook
- Worksheets
- Calculators
- Autograph
- Online resources from the BM website
- www.myimaths.com
- www.mathsnetalevel.com
- www.wolframalpha.com

Types of assessment

- Exercises from textbooks and worksheets
- Relevant questions from past papers
- Formative assessment of homework and test results
- Structured questioning during lessons
- Judgments based on class participation and effort

Students to Know

- Solving calculus problems using a number of methods
- Using accurate algebraic techniques to solve calculus problems
- Common sense approaches to answering integration questions involving area

Students to Understand

- Connections between differentiation and integration
- How to approach problems using a variety of techniques
- The necessary standard to attain marks in an A Level standard exam question

Students to be able to Do

- Solve calculus problems
- Understand new vocabulary
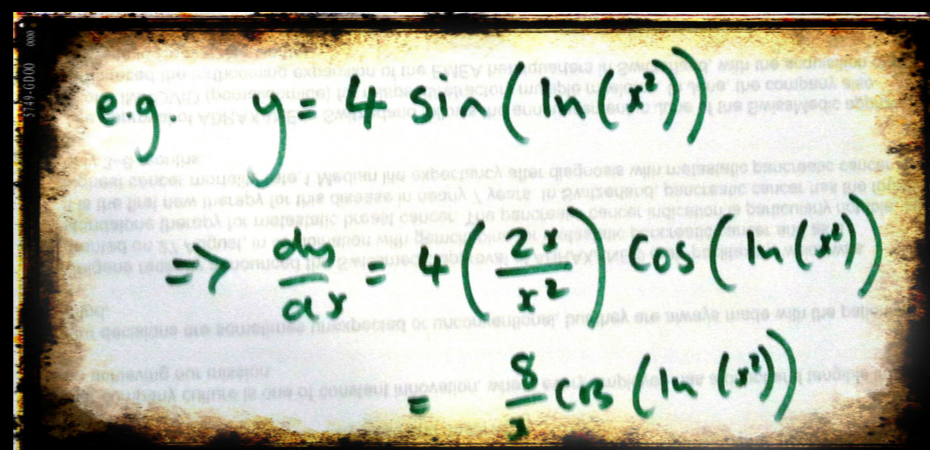- Answer exam standard questions involving calculus

Cross curricular links

- Physics; rates of change in mechanics problems
- Chemistry; rates of change in chemical reactions
- Economics; calculus in insurance calculations and analysis of economic growth

Differentiation incl. EAL

- Extension tasks for gifted students
- Emphasis on vocabulary (especially for non native speakers of English)
- Group work and Academic Champions to encourage peer learning

Learning styles activities

- Students encouraged to approach tasks using different methods
- Individual guidance to improve understanding
- Lessons taught using a range of techniques

$$e.g. \quad y = 4\sin(\ln(x^2))$$

$$\Rightarrow \frac{dy}{dx} = 4\left(\frac{2x}{x^2}\right)\cos(\ln(x^2))$$

$$= \frac{8}{x}\cos(\ln(x^2))$$

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Global citizenship, internationalism, local environment

- Practical applications of Newtonian mechanics and calculus made by the Bernoulli brothers in Switzerland
- Links to countries where the mathematics at hand was first developed
- Sharing of ideas from students with different mathematical backgrounds
- Using the Greek alphabet for variables and constants in advanced mathematics

UNIT 3 - VECTORS & COMPLEX NUMBERS

Content

- Vector Lines
- Vector Planes
- Angles between lines and planes
- Complex arithmetic
- Argand diagrams
- Complex loci
- Complex number forms
- Complex Equations

Resources & ICT

- Textbook
- Worksheets
- Calculators
- Autograph
- Online resources from the BM website
- www.myimaths.com
- www.mathsnetalevel.com
- www.wolframalpha.com

Types of assessment

- Exercises from textbooks and worksheets
- Relevant questions from past papers
- Formative assessment of homework and test results
- Structured questioning during lessons
- Judgments based on class participation and effort

Students to Know

- Solving vector problems using appropriate techniques
- Using calculators and graphical methods to find correct solutions
- Complex number rules of arithmetic and methods of problem solving

Students to Understand

- Vector notation and equations of lines / planes
- How to approach problems using a variety of techniques
- The necessary standard to attain marks in an A Level standard exam question

Students to be able to Do

- Solve vector and complex number problems
- Understand new vocabulary
- Answer exam standard questions involving trigonometry and vectors

Cross curricular links

- Physics; tracking motion using mathematical models (especially vehicles and planets)
- Engineering: complex numbers in the solution to practical design problems
- Art; computer graphics using vectors and fractal technology

Differentiation incl. EAL

- Extension tasks for gifted students
- Emphasis on vocabulary (especially for non native speakers of English)
- Group work and Academic Champions to encourage peer learning

Learning styles activities

- Students encouraged to approach tasks using different methods
- Individual guidance to improve understanding
- Lessons taught using a range of techniques
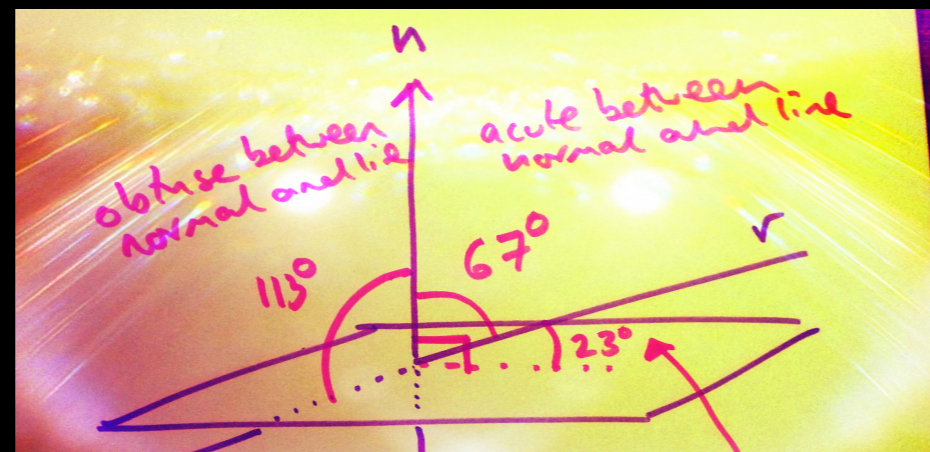
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Global citizenship, internationalism, local environment

- Leonhard Euler's contribution to trigonometry and mathematics during his time in Basel, Berlin and St Petersburg
- Vectors in air traffic control technology and global cooperation in organizing air travel
- Sharing of ideas from students with different mathematical backgrounds

January-February - 6 weeks

UNIT 4 - NEWTONIAN MECHANICS

ADV. MATHEMATICS 2.1

Content

- Motion in a straight line
- Newtons laws of motion
- Vectors

Resources & ICT

- Textbook
- Worksheets
- Calculators
- Autograph
- Online resources from the BM website
- www.myimaths.com
- www.mathsnetalevel.com
- www.wolframalpha.com

Types of assessment

- Exercises from textbooks and worksheets
- Relevant questions from past papers
- Formative assessment of homework and test results
- Structured questioning during lessons
- Judgments based on class participation and effort

Students to Know

- SUVAT equations
- Newton's second law
- Standard units and variables used in problems

Students to Understand

- How to draw useful diagrams
- How to approach problems using a variety of techniques
- The necessary standard to attain marks in an A Level standard exam question

Students to be able to Do

- Calculate the acceleration, distance, velocity and time using appropriate method
- Understand new vocabulary
- Answer exam standard questions involving mechanics

Cross curricular links

- Pure mathematics; connections to quadratics and straight line graphs.
- Physics; links with the Physics A Level syllabus and similar questions
- Sports; physical movement and effects in high jump, football, basketball etc

Differentiation incl. EAL

- Extension tasks for gifted students
- Emphasis on vocabulary (especially for non native speakers of English)
- Group work and Academic Champions to encourage peer learning

Learning styles activities

- Students encouraged to approach tasks using different methods
- Individual guidance to improve understanding
- Lessons taught using a range of techniques

$$v = u + at$$

$$s = \left(\frac{u+v}{2}\right)t$$

$$s = ut + \frac{1}{2}at^2$$

$$v^2 = u^2 + 2as$$

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Global citizenship, internationalism, local environment

- The development of Newtonian systems and their use in science and engineering
- Engineering and architecture discussions
- Projectiles and their use in military situations

February-March - 4 weeks

UNIT 5 - FORCE DIAGRAMS AND FRICTION

ADV. MATHEMATICS 2.1

Content

- Forces in equilibrium
- Resultant Forces
- Calculus and motion
- Friction
- Energy, Work and Power

Resources & ICT

- Textbook
- Worksheets
- Calculators
- Autograph
- Online resources from the BM website
- www.myimaths.com
- www.mathsnetalevel.com
- www.wolframalpha.com

Types of assessment

- Exercises from textbooks and worksheets
- Relevant questions from past papers
- Formative assessment of homework and test results
- Structured questioning during lessons
- Judgments based on class participation and effort

Students to Know

- The mathematical connections between acceleration, velocity and displacement.
- Force diagrams
- Coefficient of friction formula

Students to Understand

- When to use appropriate methods
- The meaning of work, energy and power
- How to use trigonometry to resolve forces

Students to be able to Do

- Use diagrams to organise their work
- Use calculus and trigonometry to find out practical solutions
- Understand new vocabulary
- Answer exam standard questions involving data and probability
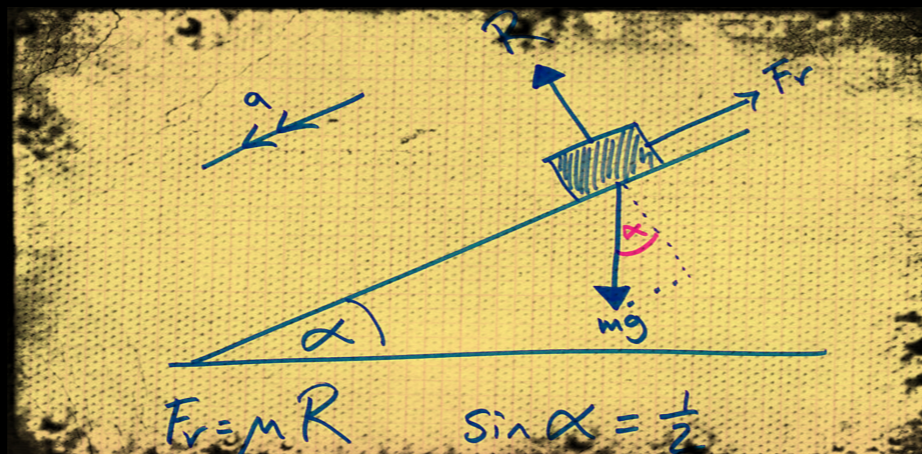
Cross curricular links

- Physics; strong links with the Physics A Level syllabus

Differentiation incl. EAL

- Extension tasks for gifted students
- Emphasis on vocabulary (especially for non native speakers of English)
- Group work and Academic Champions to encourage peer learning

Learning styles activities

- Students encouraged to approach tasks using different methods
- Individual guidance to improve understanding
- Lessons taught using a range of techniques

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Global citizenship, internationalism, local environment

- The development of Newtonian systems and their use in science and engineering
- Engineering and architecture discussions
- Projectiles and their use in military situations
-

March-April - 4 weeks