THE ABBEY SCHOOL
A BUSINESS & ENTERPRISE ACADEMY

Mathematics

Year 12

AS Pure mathematics Scheme of Learning 2023 - 2024

Subject leader: K Ellender

Topics by term	Topic overview for 12 – AS Level maths					
	Term 1	**Term 2**	**Term 3**	**Term 4**	**Term 5**	**Term 6**
	Algebraic Expressions 1.1 Index laws 1.2 Expanding brackets 1.3 Factorising 1.4 Negative and fractional indices 1.5 Surds 1.6 Rationalising denominators **Quadratics** 2.1 Solving equations 2.2 Completing the square 2.3 Functions 2.4 Quadratic graphs 2.5 The discriminant 2.6 Modelling with quadratics **Equations and inequalities** 3.1 Linear simultaneous equations 3.2 Quadratic simultaneous equations	**Graphs and Transformations** 4.1 Cubic graphs 4.2 Quartic graphs 4.3 Reciprocal graphs 4.4 Points of intersection 4.5 Translating graphs 4.6 Stretching graphs 4.7 Transforming functions **Straight Line Graphs** 5.1 $y = mx + c$ 5.2 Equations of straight lines 5.3 Parallel and perpendicular lines 5.4 Length and area 5.5 Modelling with straight lines **Circles** 6.1 Midpoints and perpendicular bisectors 6.2 Equation of a circle 6.3 Intersection of straight lines and circles	**Algebraic Methods** 7.1 Algebraic fractions 7.2 Dividing polynomials 7.3 The factor theorem 7.4 Mathematical proof 7.5 Methods of Proof **The Binomial Expansion** 8.1 Pascal's triangle 8.2 Factorial notation 8.3 The binomial expansion 8.4 Solving binomial problems 8.5 Binomial estimation	**Trigonometric Ratios** 9.1 The cosine rule 9.2 The sine rule 9.3 Areas of triangles 9.4 Solving triangle problems 9.5 Graphs of sine, cosine and tangent 9.6 Transforming trigonometric graphs **Trigonometric Identities and Equations** 10.1 Angles in all four quadrants 10.2 Exact values of trigonometric ratios 10.3 Trigonometric identities 10.4 Simple trigonometric equations 10.5 Harder trigonometric equations 10.6 Equations and identities **Vectors**	**Differentiation** 12.1 Gradients of curves 12.2 Finding the derivative 12.3 Differentiating x^n 12.4 Differentiating quadratics 12.5 Differentiating functions with two or more terms 12.6 Gradients, tangents, and normals 12.7 Increasing and decreasing functions 12.8 Second order derivatives 12.9 Stationary points 12.10 Sketching gradient functions 12.11 Modelling with differentiation **Integration 1** 13.1 Integrating x^n 13.2 Indefinite integrals 13.3 Finding functions	**Integration 2** 13.5 Areas under curves 13.6 Areas under the x-axis 13.7 Areas between curves and lines **Exponentials and Logarithms** 14.1 Exponential functions 14.2 $y = e^x$ 14.3 Exponential modelling 14.4 Logarithms 14.5 Laws of logarithms 14.6 Solving equations using logarithms 14.7 Working with natural logarithms 14.8 Logarithms and non-linear data

	3.3 Simultaneous equations on graphs 3.4 Linear Inequalities 3.5 Quadratic Inequalities 3.6 Inequalities on graphs 3.7 Regions	6.4 Use tangent and chord properties 6.5 Circles and triangles		11.1 Introducing vectors 11.2 Representing vectors 11.3 Magnitude and direction 11.4 Position vectors 11.5 Solving geometric problems 11.6 Modelling with vectors	13.4 Definite integrals	

Exam Board - Edexcel							
Spec References	**Big Questions**	**Topic area: Main Items**	**Outcomes**	**Key Terms and Concepts Literacy Numeracy**	**Assessment and homework tasks**	**Resources**	**Personal Development Curriculum links (SMSC, British Values, WPD)**
Term 1							
Algebraic Expressions – Week 2-3							
2.1 **2.2**	What is meant by the phrase 'algebraic manipulation'?	**1.1 Index Laws** **1.2 Expanding Brackets** **1.3 Factorising** **1.4 Negative and Fractional Indices** **1.5 Surds** **1.6 Rationalising denominators**	By the end of this topic, students should be able to… • understand and use the laws of indices for all rational exponents. • confidently manipulate expressions involving different numbers of brackets. • use and manipulation expressions involving surd notation.	○ **Indices** ○ **Power** ○ **Surd** ○ **Root** ○ **Rational**	**Unit 1** - Exercises from the Year 1 Pure Mathematics Textbook and Practice Book by Pearson	**Mathsbox, Pearson Textbook and Practice Book, Mathsgenie.**	The course content encourages students to apply logic, reason, construct arguments, critically analyse and communicate effectively. These skills are applied to both number based practice and to wider areas of mathematical application in context as students consider where these ideas could be used in the wider world.
Quadratics – Week 4-5							
2.3	How can quadratic equations be used to interpret real world problems?	**2.1 Solving Equations** **2.2 Completing the Square** **2.3 Functions** **2.4 Quadratic Graphs** **2.5 The Discriminant** **2.6 Modelling with Quadratics**	By the end of this topic, students should be able to… • solve quadratic equations through a mixture of factorisation, completing the square, and the quadratic formulae. • understand and use function notation and the associated terminology.	○ **Quadratic** ○ **Root** ○ **Discriminant** ○ **Function** ○ **Domain** ○ **Range**	**Unit 2** - Exercises from the Year 1 Pure Mathematics Textbook and Practice Book by Pearson	**Mathsbox, Pearson Textbook and Practice Book, Mathsgenie.**	Modelling relevance. Critical thinking in contextual problems. Mathematical reasoning. Construction of arguments.

			• plot and interpret quadratic graphs. • apply and understand the discriminant. • apply all understanding of quadratic equations to the modelling of real-life situations.				
Equations and Inequalities – Week 6-7 (Room to roll 3.6-3.7 into week 1 of term 3)							
2.4 **2.5**	How can we represent a solution graphically when the solution is a range of values?	**3.1 Linear Simultaneous Equations** **3.2 Quadratic Simultaneous Equations** **3.3 Simultaneous Equations on Graphs** **3.4 Linear Inequalities** **3.5 Quadratic Inequalities** **3.6 Inequalities on Graphs** **3.7 Regions**	By the end of this topic, students should be able to… • solve simultaneous equations involving two linear equations, or one linear and one quadratic equation. • interpret algebraic solutions of equations graphically. • solve linear and quadratic inequalities. • represent both linear and quadratic inequalities graphically.	○ **Intersection** ○ **Equation** ○ **Inequality** ○ **Solution** ○ **Region**	**Unit 3** - Exercises from the Year 1 Pure Mathematics Textbook and Practice Book by Pearson	**Mathsbox, Pearson Textbook and Practice Book, Mathsgenie.**	Mathematical reasoning. Construction of arguments.
Term 2							
Graphs and Transformations – Week 1-3 (8-10)							
2.7 **2.8** **2.9**	How do we sketch and transform graphs of equations?	**4.1 Cubic Graphs** **4.2 Quartic Graphs** **4.3 Reciprocal Graphs** **4.4 Points of Intersection** **4.5 Translating Graphs** **4.6 Stretching Graphs** **4.7 Transforming Functions**	By the end of this topic, students should be able to… • sketch cubic and quartic graphs. • sketch reciprocal graphs in the form $y = \frac{a}{x}$ and $y = \frac{a}{x^2}$. • use intersections to solve equations.	○ **Cubic** ○ **Quartic** ○ **Reciprocal** ○ **Translation** ○ **Transformation** ○ **Function**	**Unit 4** - Exercises from the Year 1 Pure Mathematics Textbook and Practice Book by Pearson	**Mathsbox, Pearson Textbook and Practice Book, Mathsgenie.**	Mathematical reasoning. Construction of arguments

			• transform graphs by stretching or translating. • transform graphs of unfamiliar functions.				
Straight Line Graphs – Week 4-5 (11-12)							
2.11 **3.1**	How can straight lines equations be used to interpret real world problems?	**5.1 $y = mx + c$** **5.2 Equations of Straight Lines** **5.3 Parallel and Perpendicular Lines** **5.4 Length and Area** **5.5 Modelling with Straight Lines**	By the end of this topic, students should be able to… • understand and apply the link between the equation of a line and its gradient and intercepts. • know and use the gradient rules for parallel and perpendicular lines. • solve area and length problems on a coordinate grid. • use and apply all knowledge of straight lines in a real-world context.	○ **Gradient** ○ **Line Equation** ○ **Intercept** ○ **Parallel** ○ **Perpendicular** ○ **Reciprocal**	**Unit 5** - Exercises from the Year 1 Pure Mathematics Textbook and Practice Book by Pearson	**Mathsbox, Pearson Textbook and Practice Book, Mathsgenie.**	Critical thinking in contextual problems. Mathematical reasoning. Construction of arguments
Circles – Week 6-7 (13-14) (Room to roll 6.5 into week 1 of term 3)							
3.2	How do we solve problems involving circles and triangles on a coordinate grid?	**6.1 Midpoints and Perpendicular Bisectors** **6.2 Equation of a Circle** **6.3 Intersection of Straight Lines and Circles** **6.4 Use Tangent and Chord Properties** **6.5 Circles and Triangles**	By the end of this topic, students should be able to… • find the equation of a circle and relevant straight lines. • use circle properties to solve problems on a coordinate grid. • apply circle theorems to solve problems involving triangles.	○ **Bisector** ○ **Circle Equation** ○ **Chord** ○ **Tangent** ○ **Subtend** ○ **Radius** ○ **Diameter** ○ **Circumference** ○ **Arc**	**Unit 6** - Exercises from the Year 1 Pure Mathematics Textbook and Practice Book by Pearson	**Mathsbox, Pearson Textbook and Practice Book, Mathsgenie.**	Critical thinking in contextual problems. Mathematical reasoning. Construction of arguments
Term 3							

Algebraic Methods – Week 1-3 (15-17)							
1.1 **2.6** **2.10**	How can our knowledge of algebraic manipulation help use to prove or disprove a mathematical statement?	**7.1 Algebraic Fractions** **7.2 Dividing Polynomials** **7.3 The Factor Theorem** **7.4 Mathematical Proof** **7.5 Methods of Proof**	By the end of this topic, students should be able to… • cancel factors in algebraic fractions. • divide a polynomial by a linear expression. • use the factor theorem to factorise a cubic expression. • construct mathematical proofs using algebra. • use proof by exhaustion and disproof by counterexample.	○ **Numerator** ○ **Denominator** ○ **Polynomial** ○ **Factorisation** ○ **Direct Proof** ○ **Counter Example** ○ **Exhaustion Proof** ○ **Cubic** ○ **Quadratic**	**Unit 7** - Exercises from the Year 1 Pure Mathematics Textbook and Practice Book by Pearson	**Mathsbox, Pearson Textbook and Practice Book, Mathsgenie.**	Critical thinking in contextual problems. Mathematical reasoning. Construction of argument.s
Binomial Expansion – Week 4-5 (18-19)							
4.1	What is binomial expansion and how is it useful?	**8.1 Pascal's Triangle** **8.2 Factorial Notation** **8.3 The Binomial Expansion** **8.4 Solving Binomial Problems** **8.5 Binomial Estimation**	By the end of this topic, students should be able to… • use Pascal's triangle to identify binomial coefficients and use them to expand simple binomial expressions. • use combinations and factorial notation. • use the binomial expansion to expand brackets. • find individual coefficients in a binomial expansion. • make approximations using the binomial expansion.	○ **Factorial** ○ **Binomial Expand** ○ **Coefficient** ○ **Estimation** ○ **Approximation**	**Unit 8** - Exercises from the Year 1 Pure Mathematics Textbook and Practice Book by Pearson	**Mathsbox, Pearson Textbook and Practice Book, Mathsgenie.**	Cultural references to Mathematical discoveries. Critical thinking in contextual problems. Mathematical reasoning. Construction of arguments.

MOCK EXAMS in this term, Week 6 left to allow for adjustment.							
Term 4							
Trigonometric Ratios – Week 1-2 (21-22)							
5.1 **5.5**	How can we further develop our knowledge of trigonometry from GCSE?	**9.1 The Sine Rule** **9.2 The Cosine Rule** **9.3 Areas of Triangles** **9.4 Solving Triangle Problems**	By the end of this topic, students should be able to… • use the cosine rule to find a missing side or angle. • use the sine rule to find a missing side or angle. • find the area of a triangle using an appropriate formula. • solve problems involving triangles.	○ **Sine** ○ **Cosine** ○ **Tangent** ○ **Adjacent** ○ **Opposite** ○ **Hypotenuse**	**Unit 9** - Exercises from the Year 1 Pure Mathematics Textbook and Practice Book by Pearson	**Mathsbox, Pearson Textbook and Practice Book, Mathsgenie.**	Critical thinking in contextual problems. Mathematical reasoning. Construction of arguments.
5.3		**9.5 Graphs of Sine, Cosine, and Tangent** **9.6 Transforming Trigonometric Graphs.**	• sketch the graphs of the sine, cosine, and tangent functions. • sketch simple transformations of these graphs.	○ **Transformation**			
Trigonometric Identities and Equations – Week 3-4 (23-24)							
2.11 **5.2** **5.6** **5.7** **5.8** **5.9**	What forms can trigonometric equations take, and how should we approach them?	**10.1 Angles in All Four Quadrants** **10.2 Exact Values of Trigonometric Ratios** **10.3 Trigonometric Identities** **10.4 Simple Trigonometric Equations** **10.5 Harder Trigonometric Equations** **10.6 Equations and Identities**	By the end of this topic, students should be able to… • calculate the sine, cosine, and tangent of any angle. • know the exact trigonometric ratios for 30°, 45° and 60°. • know and use the relationships $tan\,\theta = \frac{sin\theta}{cos\theta}$, and $\sin^2\theta + \cos^2\theta = 1$. • solve simple trigonometric	○ **Identity** ○ **Equation** ○ **Double Angle**	**Unit 10** - Exercises from the Year 1 Pure Mathematics Textbook and Practice Book by Pearson	**Mathsbox, Pearson Textbook and Practice Book, Mathsgenie.**	Critical thinking in contextual problems. Mathematical reasoning. Construction of arguments.

			equations of the forms $sin\,\theta = k, cos\,\theta = k$ and $tan\,\theta = k$. • solve more complicated trigonometric equations of the forms $sin\,n\theta = k$ and $sin\,(\theta \pm \alpha) = k$ and equivalent equations involving cos and tan. • solve trigonometric equations that produce quadratics.				
Vectors – Week 5-6 (25-26)							
10.1 **10.2** **10.3** **10.4** **10.5**	What kind of real-world problems can vectors help us solve?	**11.1 Introducing Vectors** **11.2 Representing Vectors** **11.3 Magnitude and Direction** **11.4 Position Vectors** **11.5 Solving Geometric Problems** **11.6 Modelling with Vectors**	By the end of this topic, students should be able to… • use vectors in two dimensions. • use column vectors and carry out arithmetic operations on vectors. • calculate the magnitude and direction of a vector. • understand and use position vectors. • use vectors to solve geometric problems understand vector magnitude and use vectors in speed and distance calculations. • use vectors to solve problems in context.	○ **Scalar** ○ **Column Vector** ○ **Resultant** ○ **Magnitude** ○ **Direction** ○ **Velocity**	**Unit 11** - Exercises from the Year 1 Pure Mathematics Textbook and Practice Book by Pearson	**Mathsbox, Pearson Textbook and Practice Book, Mathsgenie.**	Critical thinking in contextual problems. Mathematical reasoning. Construction of arguments.
Term 5							

Differentiation – Week 1-4 (27-30)							
7.1 **7.2** **7.3** **7.4** **7.6**	How can we formalise the notion of 'rate of change'?	**12.1 Gradients of Curves** **12.2 Finding the Derivative** **12.3 Differentiating x^n** **12.4 Differentiating Quadratics** **12.5 Differentiating Functions with Two or more Terms** **12.6 Gradients, Tangents, and Normals** **12.7 Increasing and Decreasing Functions** **12.8 Second Order Derivatives** **12.9 Stationary Points** **12.10 Sketching Gradient Functions** **12.11 Modelling with Differentiation**	By the end of this topic, students should be able to… • find the derivative, $f'(x)$ or $\frac{dy}{dx}$, of a simple function. • solve problems involving gradients, tangents, and normal. • identify increasing and decreasing functions. • find the second order derivative, $f''(x)$ or $\frac{d^2y}{dx^2}$, of a simple function. • identify stationary points and determine their nature. • sketch the gradient function of a given function. • model real-life situations with differentiation.	○ **Differentiate** ○ **Derive** ○ **Gradient** ○ **Maximum** ○ **Minimum** ○ **Stationary**	**Unit 12** - Exercises from the Year 1 Pure Mathematics Textbook and Practice Book by Pearson	**Mathsbox, Pearson Textbook and Practice Book, Mathsgenie.**	Critical thinking in contextual problems. Mathematical reasoning. Construction of arguments.
Integration 1 – Week 5-6 (31-32)							
8.1 **8.2** **8.3** **8.5**	What are the practical differences between definite and indefinite integration?	**13.1 Integrating x^n** **13.2 Indefinite Integrals** **13.3 Finding Functions** **13.4 Definite Integrals**	By the end of this topic, students should be able to… • find y given $\frac{dy}{dx}$ for x^n. • integrate polynomials. • find $f(x)$, given $f'(x)$ and a point on a curve. • evaluate a definite integral.	○ **Integrate** ○ **Integrand** ○ **Definite** ○ **Indefinite**	**Unit 13** - Exercises from the Year 1 Pure Mathematics Textbook and Practice Book by Pearson	**Mathsbox, Pearson Textbook and Practice Book, Mathsgenie.**	Critical thinking in contextual problems. Mathematical reasoning. Construction of arguments.
Term 6							
Integration 2 – Week 1-2 (33-34)							

	How can we apply integration to properties of graphs?	**13.5 Areas Under Curves** **13.6 Areas Under the x-axis** **13.7 Areas between Curves and Lines**	• find the area bounded by a curve and the x-axis. • find areas bounded by curves and straight lines.				
Exponentials and Logarithms – Week 3-5 (35-37)							
6.1 **6.2** **6.3** **6.4** **6.5** **6.6** **6.7**	How can we apply our knowledge of index laws to logarithms? What contexts lend themselves to the application of logarithms?	**14.1 Exponential Functions** **14.2 y = e^x** **14.3 Exponential Modelling** **14.4 Logarithms** **14.5 Laws of Logarithms** **14.6 Solving Equations Using Logarithms** **14.7 Working with Natural Logarithms** **14.8 Logarithms and Non-Linear Data**	By the end of this topic, students should be able to… • sketch graphs of the form $y = a^x$, $y = e^x$, and transformations of these graphs. • differentiate e^{kx} and understand why this result is important. • use and interpret models that use exponential functions. • recognise the relationship between exponents and logarithms. • recall and apply the laws of logarithms. • solve equations of the form $a^x = b$. • describe and use the natural logarithm function. • use logarithms to estimate the values of constants in non-linear models.	○ **Exponent** ○ **Logarithm** ○ **Base** ○ **Index** ○ **Natural Log** ○ **Non-Linear**	**Unit 14** - Exercises from the Year 1 Pure Mathematics Textbook and Practice Book by Pearson	**Mathsbox, Pearson Textbook and Practice Book, Mathsgenie.**	Critical thinking in contextual problems. Mathematical reasoning. Construction of arguments.
END OF YEAR EXAMS, Week 6 left to allow for adjustment.							