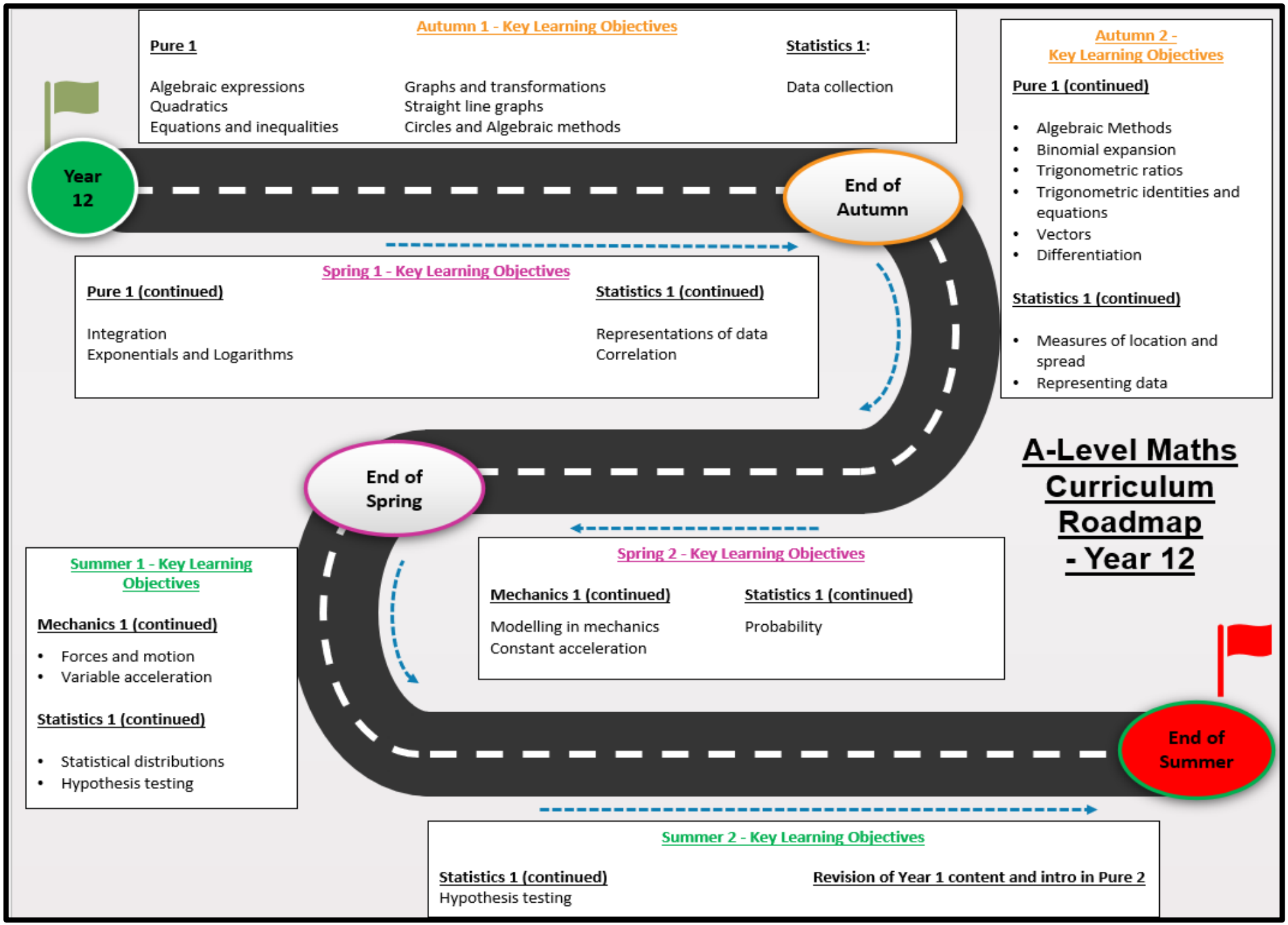
Eastbrook Sixth Form

Independent Study Guide

Mathematics

Year 12 Mathematics Roadmap



Year 12 - Autumn Term

Summary:

In the Autumn Term, students build foundational knowledge in Pure Mathematics by studying Algebraic Expressions, Quadratics, Equations and Inequalities, Graphs, Straight Line Graphs, and Circles. Alongside this, students begin work in Applied Mathematics (Statistics and Mechanics), covering topics like Data Collection, Measures of Location, and Modelling in Mechanics.

Assessment Objectives:

- Understand and manipulate algebraic expressions (Pure)
- Solve quadratic equations and inequalities (Pure)
- Sketch and interpret graphs including linear, quadratic, and reciprocal. Model real-world scenarios using equations and graphs. (Pure)
- Collect and represent statistical data accurately (Stats)

Required Reading and Action List:

1) Pearson Edexcel AS and A level Mathematics Pure Mathematics Year 1/AS Textbook
2) Student Overview – provided to all students, electronic copy here
3) Access "A-level Maths Video Vault" link here

Following each chapter, you are expected to complete the 'Core' and 'C+' questions from the student overview. You are strongly encouraged to attempt the 'Challenge' questions which will support your exposure and practice to exam-style questions.

Additional Guidance and Reference List:

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Self-Study Questions:

1. Solve the quadratic equation $2x^2 - 7x + 3 = 0$
2. Sketch $y = x^2 - 4x + 3$ and identify its roots
3. Solve the inequality $(x+1)/(x-2) > 0$
4. Find the equation of a circle with centre (3, –2) and radius 5
5. Transform $y = f(x)$ into $y = f(x-2) + 3$

What the mark scheme says?

1. Quadratic solutions: credit for correct method and accurate roots
2. Sketches: correct shape, intercepts, labels required
3. Inequalities: full marks for correct intervals and reasoning
4. Circles: must be in form $(x-a)^2 + (y-b)^2 = r^2$
5. Transformations: clear description with correct terminology

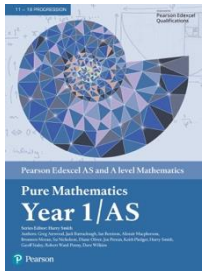
Top Tip from the Department:

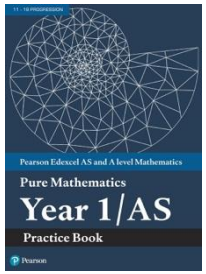
Don't just memorise methods, practise applying them in varied contexts. Draw diagrams, label graphs properly, and always compare data using context.

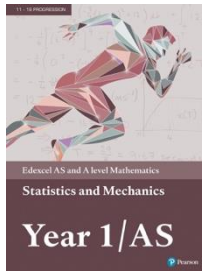
Revise little but often, set weekly goals and revisit problem areas using all the resources that have been outlined. "The only way to learn mathematics is to do mathematics" – Paul Halmos

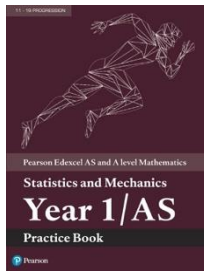
Where this term links with Career Prospects

- Engineering & Physics – algebra models motion
- Data Science – statistical measures underpin forecasting
- Computer Science – algorithms require algebra and statistics









Year 12 - Spring Term

Summary:

In the Spring Term, students build upon their Pure Mathematics foundation by studying topics such as Integration, Exponentials and Logarithms. They also deepen their understanding of Statistics by exploring Representations of Data, Statistical Distributions, and Probability. Mechanics is introduced through topics like Modelling Assumptions and Constant Acceleration.

Assessment Objectives:

- Integrate algebraic functions and interpret area under curves (Pure)
- Apply and manipulate exponential and logarithmic functions to solve equations (Pure)
- Accurately represent and analyse data using statistical diagrams (Stats)
- Calculate probabilities using binomial distributions and Venn diagrams (Stats)
- Apply constant acceleration equations to model motion in one and two dimensions (Mechanics)

Required Reading and Action List:

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Self-Study Questions:

1. Expand $(1 + 2x)^5$ using the binomial theorem
2. Prove that $\sin^2\theta + \cos^2\theta = 1$
   Solve $\cos 2x = 0.5$ for $0 \leq x \leq 360$
3. Find the derivative of $y = 3x^3 - 5x^2 + 7x - 4$
4. Express $3i + 4j$ as a unit vector

What the mark scheme says?

1. Binomial: coefficients must be correct and simplified
2. Trig: credit for exact values and clear working
3. Differentiation: correct use of power rule, simplify final answer
4. Vectors: unit vector requires magnitude calculation

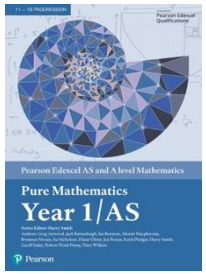
Top Tip from the Department:

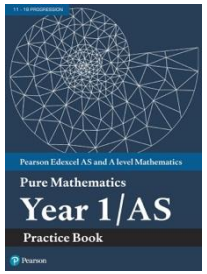
Practise proofs of identities step by step. Examiners value clarity and justification, not just the final answer.

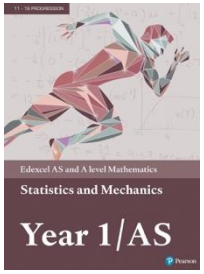
Revise little but often, set weekly goals and revisit problem areas using all the resources that have been outlined. "The only way to learn mathematics is to do mathematics" – Paul Halmos

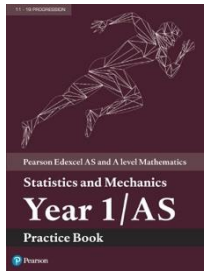
Where this term links with Career Prospects

- Architecture – vectors and trig model structures
- Engineering – differentiation models change and motion
- Economics – correlation and data analysis underpin forecasting









Year 12 - Summer Term

Summary:

In the Summer Term, students extend their knowledge of Statistics through Hypothesis Testing, and complete their Applied Mathematics learning by exploring Forces, Pulleys, and Variable Acceleration in Mechanics. The term consolidates key A-Level skills in problem solving, modelling, and data interpretation.

Assessment Objectives:

- Conduct and interpret results from hypothesis tests (Stats)
- Apply Newton's Laws to problems involving connected particles and pulleys (Mechanics)
- Use differentiation and integration to model motion and solve maxima/minima problems (Mechanics)
- Apply and evaluate statistical techniques for analysing real-world data (Stats)

Required Reading and Action List:

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Self-Study Questions:

1. Solve $\log 2(x+3) = 4$
2. Differentiate e^{2x}
3. Integrate $\int(3x^2 - 2)\,dx$
4. A sample mean of 52 (n=30, σ=10) is tested against μ=50
   Perform a hypothesis test at 5%.

What the mark scheme says?

1. Logs: require correct use of log laws
2. Exponentials: differentiate with chain rule
3. Integration: include +c for indefinite integrals
4. Hypothesis tests: must include H0, H1, significance level, test statistic, conclusion in context.

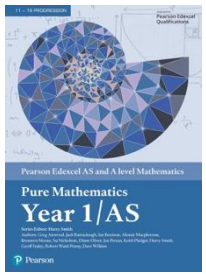
Top Tip from the Department:

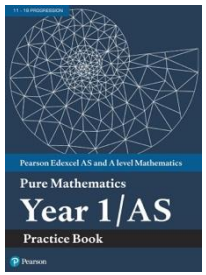
Always write hypotheses clearly in tests. Integration requires practice, show all steps.

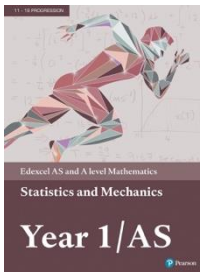
Revise little but often, set weekly goals and revisit problem areas using all the resources that have been outlined. "The only way to learn mathematics is to do mathematics" – Paul Halmos

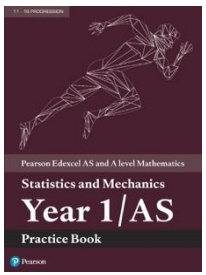
Where this term links with Career Prospects

- Finance – hypothesis testing supports decision making
- Physics – exponentials model growth and decay
- Data Analytics – probability underpins predictive models

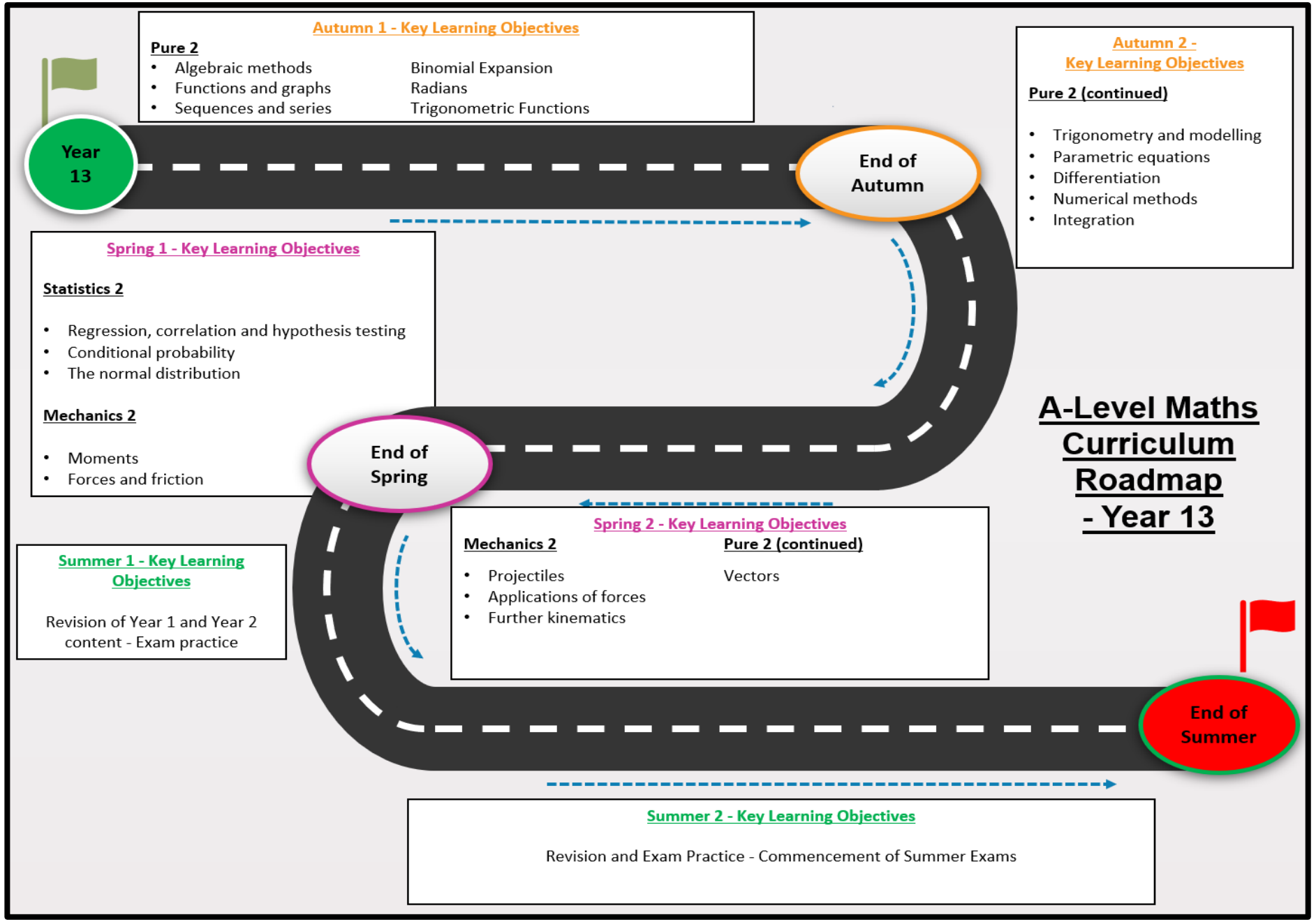








Year 13 Mathematics Roadmap



Year 13 - Autumn Term

Summary:

In the Autumn Term, students continue to build advanced knowledge in Pure Mathematics through topics such as Proof by Contradiction, Algebraic Fractions, Sequences and Series, Binomial Expansion, Trigonometric Identities, Parametric Equations, and Advanced Differentiation Techniques. These will help build foundational skill in year 2 applied topics.

Assessment Objectives:

- Use algebraic methods to simplify and solve equations, including proof techniques (Pure)
- Analyse and model real-life contexts using trigonometry, sequences, parametric equations and calculus (Pure)
- Interpret and evaluate mathematical models and assumptions (Pure)

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Self-Study Questions:

1. Find the sum of first 20 terms of 3n + 2
2. Convert 120° to radians
3. Differentiate y = tan x
   Integrate $\int \cos^{2x} dx$
4. Find dy/dx for parametric x=cos t, y=sin t

What the mark scheme says?

1. Series: apply correct formulae
2. Radians: credit for exact conversion
3. Trig differentiation: correct formulae, domain restrictions noted
4. Parametric: apply chain rule correctly

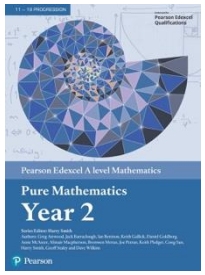
Top Tip from the Department:

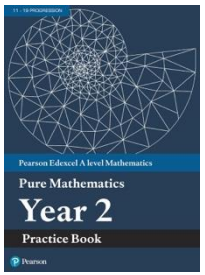
When integrating trig, use identities to simplify. Practice mixed exam questions regularly.

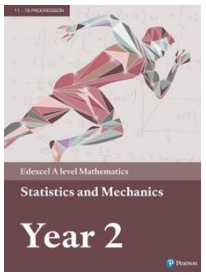
Revise little but often, set weekly goals and revisit problem areas using all the resources that have been outlined. "The only way to learn mathematics is to do mathematics" – Paul Halmos

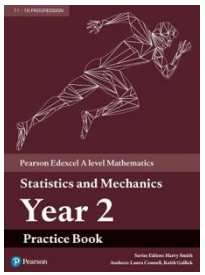
Where this term links with Career Prospects

- Engineering – calculus applied to optimisation
- Computer graphics – parametric equations model curves
- Actuarial science – sequences and series model cash flows









Year 13 - Spring Term

Summary:

In the Spring Term, students develop advanced statistical reasoning and deepen their understanding of mechanics principles. Key topics include Conditional Probability, Normal Distribution, Moments, Friction, Forces, and Projectiles. These applied topics develop the ability to model real-world scenarios and interpret data with precision and clarity, core skills for STEM fields.

Assessment Objectives:

- Interpret and calculate conditional probabilities.
- Interpret, sketch and apply normal distribution models (Stats)
- Perform and interpret statistical hypothesis tests (using the normal distribution) (Stats)
- Solve problems involving forces, moments, and friction (Mech)
- Analyse projectiles and motion using vectors and kinematics (Mech)
- Use mathematical reasoning to validate or refine models (Mech)

Required Reading and Action List:

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Self-Study Questions:

1. State the mean and variance of X~B(10,0.4)
2. Use Normal(100,15^2) to find P(X > 120)
3. A rod of length 2m is pivoted at one end. Calculate its moment about pivot.
4. Find probability of an event given conditional P(A|B)
5. A projectile is fired at 20m/s at 30°. Find horizontal range.

What the mark scheme says?

1. Binomial/Normal: correct use of parameters, continuity correction
2. Regression: interpret slope and intercept in context
3. Moments: apply force × distance
4. Conditional probability: use formula P(A∩B)/P(B)
5. Projectile: resolve forces, apply SUVAT equations

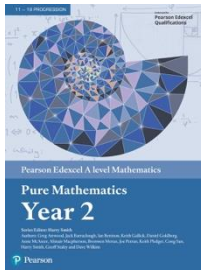
Top Tip from the Department:

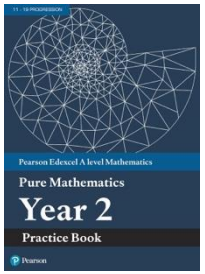
Interpret answers in context (e.g. probability cannot exceed 1) and always draw diagrams in mechanics.

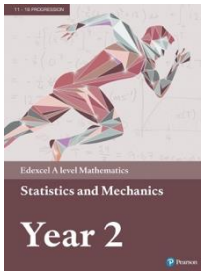
Revise little but often, set weekly goals and revisit problem areas using all the resources that have been outlined. "The only way to learn mathematics is to do mathematics" – Paul Halmos

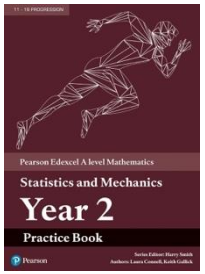
Where this term links with Career Prospects

- Civil Engineering – projectiles and forces in design
- Data Analytics – regression and conditional probability crucial in modelling
- Aerospace – kinematics for flight paths









ISG – Condensed Revision Checklist

	Year 12	Year 13
Term 1	• Quadratics: Solve using formula, factorisation, completing the square. • Inequalities: Solve and represent solutions on number lines. • Circles: Know $(x-a)^2+(y-b)^2=r^2$. • Graphs: Sketch quadratics, straight lines, and transformations. • Statistics: Mean, median, mode, range, IQR, standard deviation.	• Sequences & Series: Arithmetic and geometric sums. • Radians: Convert between degrees and radians. • Advanced trig: Graphs, identities, equations. • Parametric equations: Differentiate and eliminate parameter. • Advanced differentiation and integration.
Term 2	• Binomial expansion: Expand $(1+x)^n$. • Trig identities: $\sin^2\theta + \cos^2\theta = 1$, double angle, etc. • Solve trig equations in given ranges. • Differentiation basics: dy/dx of polynomials and trig functions. • Vectors: Add, subtract, magnitude, unit vectors.	• Regression and correlation: Interpret slope and intercept. • Normal distribution: Find probabilities using z-scores. • Conditional probability: $P(A\|B)=P(A\cap B)/P(B)$. • Moments: Force × distance calculations. • Projectiles and forces: Resolve into components, SUVAT applications.
Term 3	• Logs and exponentials: Laws of logs, solve equations. • Integration basics: $\int x^n\,dx$ and $\int e^x\,dx$. • Probability: Use addition, multiplication rules. • Hypothesis testing: State H0, H1, significance level, conclusion. • Mechanics: SUVAT equations, constant acceleration.	