



Applied Mathematics Year 12	Working towards expected outcomes	Working at expected outcomes	Working beyond expected outcomes
Autumn Term	<p>Students working <b>towards</b> expected outcomes in Y12 can:</p> <ul style="list-style-type: none"><li>• Apply basic probability rules and calculate simple probabilities</li><li>• Complete structured Venn and tree diagrams for simple cases</li><li>• Use basic set notation in probability contexts</li><li>• Understand the concept of a discrete probability distribution</li><li>• Identify when the binomial distribution might apply</li><li>• Use a calculator to find basic binomial probabilities</li><li>• Identify the null and alternative hypotheses in structured examples</li><li>• Interpret the result of a simple hypothesis test with scaffolding</li></ul>	<p>Students working <b>at</b> expected in Y12 can:</p> <ul style="list-style-type: none"><li>• Solve probability problems using Venn diagrams, set notation, and tree diagrams</li><li>• Apply conditional probability in structured contexts</li><li>• Recognise and apply the binomial distribution to model real-world problems</li><li>• Use formulae or calculator to calculate exact and cumulative binomial probabilities</li><li>• Carry out a one-tailed hypothesis test for population proportion using binomial distribution</li><li>• Identify and interpret critical regions and significance levels</li></ul>	<p>Students working <b>beyond</b> expected in Y12 can: <b>In addition to the skills listed under ‘Working At’ for this topic, students working beyond expected outcomes can:</b></p> <ul style="list-style-type: none"><li>• Solve more complex probability problems</li><li>• Critically assess the assumptions behind conditional probability and independence</li><li>• Evaluate whether the binomial distribution is appropriate in a given context</li><li>• Justify conclusions from hypothesis tests using contextual reasoning and significance levels</li><li>• Explain the implications of mechanics modelling assumptions and when they might break down</li><li>• Solve unfamiliar kinematics problems using multiple suvat equations</li><li>• Link motion graphs and algebra to justify conclusions (e.g. areas under curves, gradient interpretations)</li></ul>



- Recognise scalar and vector quantities
- Identify common forces in mechanics (e.g. weight, tension, normal contact)
- Understand and state basic modelling assumptions
- Use suvat equations where all quantities are given
- Interpret and draw basic velocity–time graphs for constant acceleration
- Identify different data types (qualitative, quantitative, discrete, continuous)
- Describe basic sampling methods (e.g. random, opportunity) and their use in simple contexts

- State test conclusions clearly in the context of a given problem
- Model motion using particles in 1D with constant acceleration
- Draw and interpret force diagrams
- Apply  $F = ma$  in structured mechanics problems
- Use and rearrange suvat equations to solve a range of motion problems
- Use and interpret velocity–time and displacement–time graphs to calculate key quantities
- Compare and evaluate sampling methods (e.g. random, stratified, systematic)
- Understand the importance of bias and how it can be reduced through sampling design

- Identify potential limitations in real-world data collection and propose improvements





**Spring Term**

Students working **towards** expected outcomes in Y12 can:

- Calculate mean, median, mode, range, and interquartile range from small datasets
- Understand the meaning of "spread" and interpret simple comparisons between data sets
- Construct or interpret bar charts, stem-and-leaf diagrams, and histograms with equal class widths
- Identify outliers using a provided rule
- Interpret box plots with support
- Describe correlation in a scatter diagram using everyday language (e.g. positive/negative)
- Understand the concept of a line of best fit visually
- Identify and label basic forces acting on particles in one dimension

Students working **at** expected in Y12 can:

- Calculate and interpret mean, median, mode, range, interquartile range, and standard deviation
- Use appropriate measures to compare data sets and justify which are most suitable
- Construct and interpret histograms with unequal class widths
- Identify and interpret outliers using interquartile range
- Compare distributions using box plots and calculate skew from data
- Use the product moment correlation coefficient (PMCC) to quantify correlation
- Interpret and use linear regression lines to model bivariate data
- Distinguish between interpolation and extrapolation when making predictions

Students working **beyond** expected in Y12 can:

- Justify the choice of measure of central tendency or spread for different types of data sets
- Select the most suitable diagram for representing data and explain the rationale
- Critically interpret the PMCC value and comment on reliability of correlation in context
- Use regression models with understanding of model limitations and prediction accuracy
- Interpret regression lines algebraically and graphically in applied settings
- Apply Newton's second law to more complex systems
- Use vector components to resolve forces and solve multi-stage force problems



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|  | <ul style="list-style-type: none"><li>• Apply Newton's second law (<math>F = ma</math>) in structured questions where motion is linear and forces are aligned</li></ul> | <ul style="list-style-type: none"><li>• Apply Newton's laws in systems involving multiple forces and connected particles</li><li>• Resolve forces acting at angles and solve 1D force problems with acceleration</li><li>• Draw and analyse force diagrams for particles on horizontal and inclined planes</li></ul> |  |
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<b>Summer Term</b>	Students working <b>towards</b> expected outcomes in Y12 can:	Students working <b>at</b> expected in Y12 can:	Students working <b>beyond</b> expected in Y12 can:
	<ul style="list-style-type: none"><li>• Differentiate displacement–time equations to find velocity and acceleration</li><li>• Interpret motion described algebraically or graphically using simple calculus</li><li>• Draw force diagrams for objects in equilibrium or under simple acceleration</li><li>• Understand that equilibrium implies net force is zero</li><li>• Identify and label friction as a force opposing motion in simple contexts</li><li>• Recognise that limiting friction occurs when an object is on the point of moving</li></ul>	<ul style="list-style-type: none"><li>• Use calculus to model motion: differentiate to find velocity/acceleration, integrate to find displacement</li><li>• Interpret and solve kinematics problems involving variable acceleration using given equations</li><li>• Apply Newton’s laws to problems involving particles in equilibrium (statics) and in motion (dynamics)</li><li>• Resolve forces into components and solve problems involving inclined planes and connected particles</li><li>• Apply the friction model <math>F \leq \mu R</math> and solve problems involving limiting friction</li><li>• Distinguish between static and kinetic friction and apply correct conditions in problem solving</li><li>• Analyse problems involving particles on rough horizontal or inclined surface</li></ul>	<ul style="list-style-type: none"><li>• Interpret and solve unfamiliar kinematics problems with variable acceleration</li><li>• Solve statics/dynamics problems requiring multiple steps or involving non-perpendicular force directions</li><li>• Evaluate the impact of changing forces, angles or masses in systems involving equilibrium or motion</li><li>• Solve complex problems involving friction on inclined planes or with connected particles</li><li>• Justify whether motion will occur using comparison of limiting friction and applied force</li><li>• Critically assess and explain the assumptions behind the friction model in applied scenarios</li></ul>

