Year 11 Maths: Personalised Learning Checklist (PLC) – Crossover Higher

Learning Journey

1	Probability
2	Numbers & the Number System
3	Statistics
4	Quadratics
5	Simultaneous Equations
6	Fractions
7	Units & Real-life Graphs
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Unit 1 – Probability	**MathsWatch**
Language of probability, 0-1 probability scale, random, fair, equally likely, bias, unequally likely	14
Calculate probability and write as fractions, decimals or percentages	59
Sample space diagrams for combined events	126
Mutually exclusive events & their probabilities	60
Experimental probability	125
Expected results from repeated experiments	125
Use a frequency tree to record outcomes of an event	57
Use listing strategies to identify all permutations or combinations & use the product rule for counting	58
Represent outcomes using a Venn diagram Find the union and intersection of sets	127a, 186
Recognise the symbols { } for sets, ∩ for intersection and ∪ for union	127b, 186
Know the addition law for mutually exclusive events: P(A or B) = P(A) + P(B)	204
Know the multiplication law for independent events: P(A & B) = P(A) x P(B)	204
Use a tree diagram to solve problems involving combined events that are independent and dependent	151, 175
Conditional probability using Venn diagrams, tables and tree diagrams	175

Key Vocabulary		**Careers**
Probability	Expected	• Scientists
Chance	Expectation	• Market Research
Likelihood	Experiment	• Finance
Impossible	Trial	• Statisticians
Unlikely	Theoretical probability	• And many more!
Likely	Experimental probability	
Even chance	Relative frequency	
Certain	Frequency tree	
Random	Combination	
Fair	Permutation	
Biased	Probability tree diagram	
Event	Independent events	
Outcome	Dependent events	**Career Transferable Skill**
Frequency	Conditional probability	**Analytical Skills.**
Equally likely	Venn diagram	Construct logical arguments and expose illogical ones
Mutually exclusive	Set	
Sample space	Union	
Two-way table	Intersection	
Combined	Complement	

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Unit 2 – Numbers & the Number System	**MathsWatch**
Calculate with fractional indices	188
Change recurring decimals into their corresponding fractions and vice versa	177
Convert a recurring decimal to a fraction using algebra	189b
Find error intervals	155a, 155b
Truncate decimals	155b
Express truncation errors using inequality notation $a < x \leq b$	155a, 155b
Apply and interpret limits of accuracy (eg max/min number of people from a rounded value)	132
Calculate with upper or lower bounds	206

Key Vocabulary		**Careers**
Index (Power)	Rounding error	• Cyber Security
Base	Error interval	• Computer Programming
Exponent (Power)	Inclusive	• Construction
Indices (Powers)	Truncate, truncation	• Distribution and Resource Management
Square Root	Upper/Lower bound	• Scientists
Cube Root	Maximum/minimum	
Root		
Convert		
Decimal		
Terminating decimal		**Career Transferable Skill**
Recurring decimal		**Problem Solving Skills.**
		Be flexible and approach the same problem from different points of view.

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Unit 3 – Statistics	**MathsWatch**
Understand sampling and know its limitations	176a, 176b
Find upper and lower quartile from a list of data using the positions ¼ (n+1) and ¾ (n + 1)	152a, 152b
Plot a cumulative frequency curve and use it to estimate the median, quartiles and interquartile range	187a
Draw and interpret boxplots	187b
Compare sets of data using median and interquartile range	187c
Construct histograms	205
The following skills are extension work	
Use and interpret a histogram to solve problems such as estimating the median	205

Key Vocabulary		**Careers**
Data Sample Population Random Quartile Interquartile range Median Cumulative frequency Interval Box plot Histogram Frequency density		• Marketing • Business and Finance • Social Science • Sports • Media including journalism • And many more….



Career Transferable Skill

Analytical Skills

Construct logical arguments and expose illogical ones.

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Unit 4 – Quadratics	**MathsWatch**
Expand products of more than two binomials	178
Factorise quadratics of the form $ax^2 + bx + c$	191b
Solve quadratic equations of the form $x^2 + bx + c = 0$ by factorising	157a
Solve quadratic equations of the form $ax^2 + bx + c = 0$ by factorising	191b
Solve quadratic equations by completing the square	209a, 209b
Solve quadratic equations using the quadratic formula	191a
Draw the graph of quadratic functions of the form $y = ax^2 + bx + c$	133a
Use quadratic graphs to estimate values of y for given values of x and vice versa	133a
Identify and interpret roots, intercepts and turning points of quadratic functions graphically	160
Find approximate solutions to a quadratic equation using a graph	160
Deduce an expression for the nth term of a quadratic sequence	213
The following skills are extension work	
Deduce turning points of quadratic functions by completing the square	209c

Key Vocabulary		**Careers**
Quadratic Square Solution Solve Factorising Complete the square Quadratic formula Discriminant Root Real root	Parabola Intersection Intercept Turning point Vertex Minimum Maximum Approximate	• Engineering (all types) • Finance and Accounting • Computer Programming • Operational Research • Business including investment • Scientist



Career Transferable Skill

Problem Solving Skills

Present a solution clearly, making your assumptions explicit.

Useful Personality Traits

Intellectual rigour

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Unit 5 – Simultaneous Equations	**MathsWatch**
Translate situations into expressions or formulae	137
Derive an equation and interpret the solution	137
Recognise the point of intersection of two linear graphs represents the solution to these equations	140
Approximate solutions to simultaneous equations graphically	140
Solve simultaneous equations using substitution	
Find approximate solutions to simultaneous equations involving quadratics graphically	211b
Derive two simultaneous equations, solve them and interpret the solution	162
The following skills are extension work	
Solve two simultaneous equations in two variables, where one is linear, and one is quadratic	211a

Key Vocabulary		**Careers**
Expression Formula, formulae Equation Graph Linear Intersection Solution Solve Simultaneous Equations Elimination Substitution Quadratic Approximate		• Engineering (all types) • Finance and Accounting • Computer Programming • Operational Research • Business including investment • Scientist  **Career Transferable Skill** **Problem Solving Skills** Present a solution clearly, making your assumptions explicit. Be meticulous and have a structured approach

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Unit 6 – Fractions	**MathsWatch**
Work with fractions involving surds and rationalise denominators	207c
Simplify and manipulate algebraic expressions involving algebraic fractions or surds	207a, 207b 210a
Add, subtract, multiply and divide fractions with algebraic numerators and/or denominators	210a
Solve equations involving algebraic fractions	210b

Key Vocabulary		**Careers**
Surd Denominators Rational Irrational Rationalise the denominator Algebraic fraction		• Cyber Security • Computer Programming • Construction • Distribution and Resource Management • Finance and Management  **Career Transferable Skill** **Problem Solving Skills** Think clearly.

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Unit 7 – Units & Real-life Graphs	**MathsWatch**
Read, convert and calculate with time Convert units of length, mass and capacity	111
Understand and calculate compound units involving speed, distance and time	142a
Understand and calculate compound units involving density, mass and volume	142b
Understand and calculate pressure	142c
Understand and calculate population density	
Solve problems involving compound units	142a, b, c
Solve problems involving time, timetables, speed and distance tables	6b
Plot and interpret graphs in real contexts	
Plot and interpret distance-time graphs	143
Interpret the gradient of a straight line graph as a rate of change	97
Review plotting linear graphs, y = mx + x, gradient and intercept	96, 97 159a, 159b
Recognise, sketch and interpret graphs of quadratic, cubic and reciprocal functions	133b 161a, 161b
Estimate gradients at a point on a curve using a tangent	216b
Estimate the area under a non-linear graph	216a
Plot a velocity-time graph Calculate acceleration from a velocity-time graph Calculate a distance from a velocity-time graph	216a

Key Vocabulary		**Careers**
Compound unit Rate Measure Unit Conversion Speed Distance Time Miles per hour Metres per second Kilometres per hour Average speed Density Mass Volume Grams per cubic centimetre Kilograms per cubic metre	Pressure Force Area Newtons per square metre Pascal Population density Cost per item Pay rate Flow rate Quadratic Cubic Reciprocal Gradient Tangent Velocity Acceleration Rate of change	• Business including advertising, real estate and purchasing • Finance and Economics • Research including science, engineering and computing • Healthcare • Sports Analysis • Engineering (all types) • Scientist  **Career Transferable Skill** **Deductive Reasoning** Ability to apply general rules to specific problems to produce answers that make sense. **Inductive Reasoning** Ability to combine pieces of information to form general rules or conclusions

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Unit 8 – Proportion	**MathsWatch**
Understand direct proportion and solve problems involving direct proportion	42
Understand inverse proportion and solve inverse proportion problems Understand that X is inversely proportional to Y is equivalent to X is proportional to $\frac{1}{Y}$	107 199
Graphs of direct and inverse proportion	199
Interpret direct proportion equations	199
Interpret inverse proportion equations	199
Construct equations for directly proportional relationships	199
Construct equations for inversely proportional relationships	199
Use equations of proportionality to find missing values	199

Key Vocabulary		**Careers**
Proportion Proportional Direct proportion Inverse proportion Scale Scale factor Multiplier Constant		• Finance including bank, stocks and shares • Design including graphic, art and interior • Cookery • Construction  **Career Transferable Skill** **Information Ordering** The ability to arrange things or actions in a certain order or pattern according to a specific rule or set of rules

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Unit 9 – Inequalities	**MathsWatch**
Solve linear inequalities in one or two variables	139
Solve linear inequalities with the variable on both sides	139
Represent a solution set on a number line	138
Solve quadratic inequalities in one variable	212
Represent the solution using set notation	
Represent the solution on a graph	198
Solve double inequalities	
Graphs of linear inequalities	198
In graphical solutions, know and use the convention of a dashed line for strict inequalities and a solid line for an included inequality	198
Construct and solve inequalities	

Key Vocabulary		**Careers**
Variable Inequality Solution Number line Quadratic Set Boundary Inclusive		• Engineering (all types) • Finance and Accounting • Computer Programming • Scientist • Operational Research • Business including investment



Career Transferable Skill

Problem Solving Skills
Present a solution clearly, making your assumptions explicit.

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Unit 10 – Shape & Construction	**MathsWatch**
Solve geometrical problems involving coordinates	113
Calculate midpoint of a line	98
Properties of 3D shapes (including faces, edges and vertices)	43
Construct and interpret plans and elevations of 3D shapes	51
Understand and use isometric drawings	
Recognise, draw and interpret nets of 3D shapes	44
Congruence and congruence criteria for triangles (SSS, SAS, ASA, RHS)	166
Understand similarity and find missing values in similar shapes	144
Find areas and volumes in similar shapes	201
Use compasses	
Use ruler and protractor or compasses to construct triangles	147
Construct an angle bisector	145c
Construct perpendicular bisectors and lines	145a, 145b
Construct loci	146
Use scale diagrams	38

Key Vocabulary		**Careers**
Face Edge Vertex Plan Elevation View Net Congruent Congruence Similar Similarity Scale factor Multiplier Construct Construction lines Arc Bisect Perpendicular	Angle bisector Perpendicular bisector Locus Loci Scale Bearing	• Architects • Visual Design • Interior Design • Construction and Installation • Production • Pilot/Air Traffic Controller • Cartographers (map makers)



Career Transferable Skill

Analytical Skills
Follow complex reasoning. Accuracy

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Unit 11 – Circle Theorems	**MathsWatch**
Angle subtended by an arc at the centre is equal to twice the angle subtended at any point on the circumference	185a
Angle subtended at the circumference by a semicircle is 90°	185a
Angles in the same segment are equal	185a
Opposite angles in a cyclic quadrilateral sum to 180°	185a
Tangent at any point on a circle is perpendicular to the radius at that point	185a
Tangents from an external point are equal in length	185a
The perpendicular from the centre to a chord bisects the chord	185a
Alternate segment theorem	185a

Key Vocabulary		**Careers**
Arc Radius Diameter Chord Segment Sector Circumference Semicircle Subtended Cyclic Centre Perpendicular Equal Bisect Alternate		• Architects including landscape • Construction work • Mechanical Engineering • Aerospace Engineering • Games programmer • Sports • Fashion  **Career Transferable Skill** **Analytical Skills.** Follow complex reasoning.

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Unit 12 – Proof	**MathsWatch**
Know the difference between an equation (true for a specific value) and an identity (true for all values)	158
Show algebraic expressions are equivalent, and construct algebraic proofs	193
Construct geometric proofs using angle facts	
Understand the proof of the angle sum of a triangle using alternate angles	
Construct geometric proofs using congruence & similarity	

Key Vocabulary		**Careers**
Equation Identity Equivalent Proof Prove Justify Explain Counter-example		• Engineering (all types) • Finance and Accounting • Computer Programming • Operational Research • Business including investment Scientist  **Career Transferable Skill** **Problem Solving Skills** Present a solution clearly, making your assumptions explicit. **Analytical Skills.** Follow complex reasoning.

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Unit 13 – Functions & Iteration	**MathsWatch**
Understand and use notation such as f(x), fg(x) and $f^{-1}(x)$	214a, 215
Interpret simple expressions as functions with inputs and outputs	214a, 215
Interpret the reverse process as the 'inverse function'	214a, 214b
Interpret the succession of two functions as a 'composite function'	215
Work with general iterative processes	179, 180
Find approximate solutions to equations numerically using iteration	179, 180
Use suffix notation in recursive formulae (Recurrence relations such as $u_{n+1} = 2u_n + 3$)	180

Key Vocabulary		**Careers**
Function Input Output Notation Inverse Composite Iteration Iterative Formula Subscript Numerical solution Starting value Converge Limit Degree of accuracy Recurrence		• Game Developers • Software Engineering • Financial Modellers • Climate Modellers • Data Scientist • Operational Research • Production • Agriculture  **Career Transferable Skill** **Information Ordering** The ability to arrange things or actions in a certain order or pattern according to a specific rule or set of rules

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Unit 14 – Pythagoras & Trigonometry	**MathsWatch**
Know the exact values of sin θ and cos θ for $\theta = 30, 45, 60 \; and \; 90$	173
Know the exact values of tan θ for $\theta = 30, 45, 60$	173
Know and use the formula for Pythagoras' Theorem $c^2 = a^2 + b^2$	150a, 150b
Know and use the trigonometric ratios sin, cos and tan	168
Use angles of elevation and depression and bearings with trigonometry	
Know and apply Area = $\frac{1}{2}ab \sin C$ to calculate the area, sides or angles in any triangle	203
The following skills are extension work	
Use Pythagoras' Theorem and trigonometry to find angles and lengths in 3D shapes	217, 218
Know and apply the sine rule to find unknown lengths and angles $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$	202a
Know and apply the cosine rule to find unknown lengths and angles $a^2 = b^2 + c^2 - 2bc \cos A$	202b

Key Vocabulary		**Careers**
Pythagoras' Theorem Hypotenuse Square Square root Surd Trigonometry Trigonometric ratio Opposite side Adjacent side Sine (sin) Cosine (cos) Tangent (tan) Angle Side length Degree	Angle of elevation Angle of depression Bearing Sine rule Cosine rule Ambiguous case	• Architect including Interior Design • Construction work • Games programmer and Visual Design • Sports • Fashion  **Career Transferable Skill** **Problem Solving Skills** Be flexible and approach the same problem from different points of view.

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Unit 15 – Graphs	**MathsWatch**
Use the form y = mx + x to recognise perpendicular lines	208
Recognise, sketch and interpret graphs of linear functions and quadratic functions	133b
Recognise, sketch and interpret graphs of simple cubic functions and the reciprocal function, $y = \frac{1}{x}$ with $x \neq 0$	161a, 161b
Recognise, sketch and interpret graphs of exponential functions $y = k^x$ for positive values of k	194
Recognise, sketch and interpret graphs of trigonometric functions (in degrees) $y = \sin x, y = \cos x$ and $y = \tan x$ for angles of any size	195a, 195b
Sketch translations and reflections of a given function	196a, 196b
Recognise and use the equation of a circle with centre at the origin	197
The following skills are extension work	
Find the equation of a tangent to a circle at a given point	197

Key Vocabulary		**Careers**
Linear Quadratic Cubic Reciprocal Exponential Trigonometric Periodic Translation Reflection Origin Tangent Perpendicular		• Engineering (all types) • Scientist • Business • Sports Analysis • Military and Law Enforcement  **Career Transferable Skill** **Inductive Reasoning** The ability to combine pieces of information to form general rules or conclusions