Mathletics

Victorian Program of Studies
Understanding, Practice and Fluency (UPF)
October 2021

Year 9

1 Number and Algebra

1.1 Real numbers

Outcome	Quests	Content
1. Solve problems involving direct proportion. Explore the relationship between graphs and equations corresponding to simple rate problems	Proportion, rates, graphs & equations	Unit rates
		Converting rates
		Direct proportion
		Indirect/inverse proportion
		Direct & inversely proportionate graphs
		Interpreting & using conversion graphs
		The constant of proportionality
		Graphing equations of direct proportion
		Solving distance, speed & time problems
		Travel graphs
2. Apply index laws to numerical expressions with integer indices	Index laws with numerical expressions	Mixed index laws numerical expressions
		Index laws: positive & negative integer index
3. Express numbers in scientific notation	Express numbers in scientific notation	Introducing scientific notation
		Converting scientific notation & basic numbers
		Calculating & rounding with scientific notation

1.2 Money and financial mathematics

Outcome	Quests	Content
4. Solve problems involving simple interest	Solve problems involving simple interest	Simple interest
		Understanding hire purchase agreements

1.3 Patterns and algebra

Outcome	Quests	Content
5. Extend and apply the index laws to variables, using positive integer indices and the zero index	Index laws with variables	Mixed index laws algebraic expressions

Outcome	Quests	Content
6. Apply the distributive law to the expansion of algebraic expressions, including binomials, and collect like terms where appropriate	Applying the distributive law	Applying the distributive law

1.4 Linear and non-linear relationships

Outcome	Quests	Content
8. Find the distance between two points located on the Cartesian plane using a range of strategies, including graphing software	Find the distance between two points	Distance between two points without the formula
		Distance between two points using the formula
9. Find the midpoint and gradient of a line segment (interval) on the Cartesian plane using a range of strategies, including graphing software	Midpoint & gradient of line segments	Finding the midpoint without the formula
		Finding the midpoint using the formula
		Finding the gradient without the formula
		Finding the gradient using the formula
10. Sketch linear graphs using the coordinates of two points and solve linear equations	Linear graphs & solving linear equations	Vertical & horizontal lines
		Finding & using x and y-intercepts
		Graphing using a table of values
		Graphing using the gradient-intercept method
		Comparing linear relationships
		Further linear equations
11. Graph simple non-linear relations with and without the use of digital technologies and solve simple related equations	Graph & solve non-linear relationships	Graphing simple non-linear relations
		Solving simple non-linear relationships
		Parabolas
		Exponential graphs
		Sketching circles

2 Measurement and Geometry

2.1 Using units of measurement

Outcome	Quests	Content
2. Calculate areas of composite shapes	Areas of composite shapes	Areas of composite shapes
3. Calculate the surface area and volume of cylinders and solve related problems	Surface area & volume of cylinders	Volumes of cylinders
		Surface area of cylinders
4. Solve problems involving the surface area and volume of right prisms	Surface area & volume of right prisms	Surface area of right prisms with nets
		Finding surface area problems
		Volumes of composite right prisms
5. Investigate very small and very large time scales and intervals	Lge/sml amounts of time, data & limits	Significant figures
		Amounts of data
		Large & small time intervals
		Representing large & small numbers
		Limits of accuracy

2.2 Geometric reasoning

Outcome	Quests	Content
6. Use the enlargement transformation to explain similarity and develop the conditions for triangles to be similar	Similar triangles	Introducing similarity
		Similar triangles
7. Solve problems using ratio and scale factors in similar figures	Scale factors with similar figures	Scale factors
		Area & volume scale factors

2.3 Pythagoras and trigonometry

Outcome	Quests	Content
8. Investigate Pythagoras' theorem and its application to solving simple problems involving right angled triangles	Pythagoras' theorem	Identifying sides on right-angled triangles
		Finding a shorter side using Pythagoras' theorem

		Finding the hypotenuse using Pythagoras' theorem
	7	Solving problems involving Pythagoras' theorem
		Exploring Pythagorean triads
		Using the converse of Pythagoras' theorem
		Solving Pythagoras' theorem problems: exact values
9. Use similarity to investigate the constancy of the sine, cosine and tangent ratios for a given angle in right-angled triangles	Introduction to trigonometry	Introducing trigonometry
		Calculating trigonometric ratios & angles
10. Apply trigonometry to solve right-angled triangle problems	Apply trigonometry	Finding the missing side using trig ratios
		Finding the missing angle using trig ratios
		Solving 2D & 3D problems using trig ratios

3 Statistics and Probability

3.1 Chance

Outcome	Quests	Content
1. List all outcomes for two-step chance experiments, both with and without replacement using tree diagrams or arrays. Assign probabilities to outcomes and determine probabilities for events	List outcomes & find probabilities	The fundamental counting principle
		Two-step chance experiments with replacement
		Two-step chance experiments without replacement
2. Calculate relative frequencies from given or collected data to estimate probabilities of events involving 'and' or 'or'	Calculate & use relative frequency	Calculating & using relative frequency
3. Investigate reports of surveys in digital media and elsewhere for information on how data were obtained to estimate population means and medians	Make population predictions from data	Using data to make predictions about populations

3.2 Data representation and interpretation

Outcome	Quests	Content
4. Identify everyday questions and issues involving at least one numerical and at least one categorical variable, and collect data directly and from secondary sources	Collect everyday data	Collecting everyday data
5. Construct back-to-back stem-and-leaf plots and histograms and describe data, using terms including 'skewed', 'symmetric' and 'bi modal'	Construct & interpret data displays	Constructing & interpreting data displays
6. Compare data displays using mean, median and range to describe and interpret numerical data sets in terms of location (centre) and spread	Compare data displays	Comparing data displays

Year 10

1 Number and Algebra

1.1 Money and financial mathematics

Outcome	Quests	Content
8. Connect the compound interest formula to repeated applications of simple interest using appropriate digital technologies	Compound & simple interest	Compound interest
		Comparing simple & compound interest

1.2 Patterns and algebra

Outcome	Quests	Content
9. Factorise algebraic expressions by taking out a common algebraic factor	Factorise algebraic expressions	Factorising algebraic expressions
10. Simplify algebraic products and quotients using index laws	Index laws	Indices: Multiplication
		Indices: Division
		Indices: Power of a power
		Indices: Zero index
		Indices: Mixed basic operations with coefficient = 1
		Indices: Mixed basic operations with coefficient >1
		Indices: Negative index with numerical base
		Indices: Negative index, algebraic & numerical base
		Indices: Mixed with negative indices
11. Apply the four operations to simple algebraic fractions with numerical denominators	Algebraic fractions	Algebraic fractions: 4 ops numerical denominators
		Algebraic fractions: Simplifying
12. Expand binomial products and factorise monic quadratic expressions using a variety of strategies	Binomial expansions & basic quadratics	Expanding binomial products
		Binomial product special results
		Factorising monic quadratic trinomials
		Further binomial expansions
13. Substitute values into formulas to determine an unknown and re-arrange formulas to solve for a particular term	Substitute into formulas	Using authentic formula

1.3 Linear and non-linear relationships

Outcome	Quests	Content
15. Solve problems involving linear equations, including those derived from formulas	Problems involving linear equations	Word problems
16. Solve linear inequalities and graph their solutions on a number line	Linear inequalities & their graphs	Understanding inequalities
		Solving linear inequalities
17. Solve linear simultaneous equations, using algebraic and graphical techniques, including using digital technology	Linear simultaneous equations	Simultaneous equations
18. Solve problems involving parallel and perpendicular lines	Parallel & perpendicular lines	Parallel lines
		Perpendicular lines
		Equations of lines: Parallel & perpendicular lines
		Problems involving parallel & perpendicular lines
19. Explore the connection between algebraic and graphical representations of relations such as simple quadratics, circles and exponentials using digital technology as appropriate	Representations of non-linear relations	Graphing representations of non-linear relations
20. Solve linear equations involving simple algebraic fractions	Equations involving algebraic fractions	Solving equations involving algebraic fractions
21. Solve simple quadratic equations using a range of strategies	Solve simple quadratic equations	Solving simple quadratic equations

2 Measurement and Geometry

2.1 Using units of measurement

Outcome	Quests	Content
3. Solve problems involving surface area and volume for a range of prisms, cylinders and composite solids	Area of volume of composite solids	Surface area of composite solids
		Volume of composite solids

2.2 Geometric reasoning

Outcome	Quests	Content
5. Apply logical reasoning, including the use of congruence and similarity, to proofs and numerical exercises involving plane shapes	Solve problems using geometric reasoning	Solving problems using geometric reasoning

2.3 Pythagoras and trigonometry

Outcome	Quests	Content
6. Solve right-angled triangle problems including those involving direction and angles of elevation and depression	Angles of elevation & depression	Angles of elevation & depression
	Bearings	Compass bearings
		True bearings

3 Statistics and Probability

3.1 Chance

Outcome	Quests	Content
7. Describe the results of two- and three-step chance experiments, both with and without replacements, assign probabilities to outcomes and determine probabilities of events. Investigate the concept of independence	Two/three step experiments, independence	Three-step chance experiments with replacement
		Three-step chance experiments without replacement
		Independent events
8. Use the language of 'if….then, 'given', 'of', 'knowing that' to investigate conditional statements and identify common mistakes in interpreting such language	Conditional probability	Conditional probability introduction
		Conditional probability & two-way tables
		Conditional probability & tree diagrams
		Conditional probability & arrays
		Conditional probability & Venn diagrams
		Set theory & Venn diagrams

3.2 Data representation and interpretation

Outcome	Quests	Content
9. Determine quartiles and interquartile range and investigate the effect of individual data values, including outliers on the interquartile range	Interquartile range	Interquartile range
10. Construct and interpret box plots and use them to compare data sets	Construct & interpret box plots	Constructing & interpreting box plots
11. Compare shapes of box plots to corresponding histograms and dot plots and discuss the distribution of data	Compare box plots	Comparing box plots
12. Use scatter plots to investigate and comment on relationships between two numerical variables	Scatter plots	Scatter plots
13. Investigate and describe bivariate numerical data where the independent variable is time	Bivariate data	Bivariate data
14. Evaluate statistical reports in the media and other places by linking claims to displays, statistics and representative data	Evaluating statistical reports	Evaluating statistical reports

Year 10A

1 Number and Algebra

1.1 Real numbers

Outcome	Quests	Content
5. Define rational and irrational numbers and perform operations with surds and fractional indices	Rational & irrational numbers & surds	Understanding rational & irrational numbers
		Introducing surds
		Surd general rules
		Simplification & addition/subtraction of surds
		Multiplying & dividing surds
		Expanding brackets with surds
		Rationalising the denominator
		Convert recurring decimals into rational numbers
		Solving problems involving surds
6. Use the definition of a logarithm to establish and apply the laws of logarithms and investigate logarithmic scales in measurement	Logarithms & their laws	Introducing logarithms
		Multiplication Log law
		Division Log law 1
		Division Log law 2
		Log results
		Log graphs & relationship with exponentials
		Solving equations with logarithms

1.2 Patterns and algebra

Outcome	Quests	Content
7. Investigate the concept of a polynomial and apply the factor and remainder theorems to solve problems	Polynomials	Introducing polynomials
		Remainder & factor theorems

1.3 Linear and non-linear relationships

Outcome	Quests	Content
9. Describe, interpret and sketch parabolas, hyperbolas, circles and	Functions & their transformations	Exploring parabolas
		Parabolas: Vertex & axis of symmetry

		Graphing parabolas
exponential functions and their transformations	14	Parabolas & their transformations
		Graphing hyperbolas
		Hyperbolas & their transformations
		Graphing circles
		Circles & their transformations
		Exponential functions & their transformations
		General non-linear relationships
10. Solve simple exponential equations	Solve exponential equations	Solving exponential equations
11. Apply understanding of polynomials to sketch a range of curves and describe the features of these curves from their equation	Sketch polynomials	Sketching polynomials
12. Factorise monic and non-monic quadratic expressions and solve a wide range of quadratic equations derived from a variety of contexts	Factorise & solve quadratics	Factorising using difference of 2 squares
		Factorising using grouping
		Factorising using perfect squares
		Factorising quadratic trinomials
		Factorising complex fractions
		Solving quadratic equations by factorisation
		Solving quadratic equations: Completing the square
		Solving quadratic equations with quadratic formula
		Solving a variety of quadratic equations
		The discriminant
		Quadratic equations in context

2 Measurement and Geometry

2.1 Using units of measurement

Outcome	Quests	Content
5. Solve problems involving surface area and volume of right pyramids, right cones, spheres and related composite solids	Surface area & volume: composite solids	Finding surface area of pyramids & cones
		Finding surface area of spheres
		Find dimensions of objects given the surface area
		Surface area of composite solids
		Volume of cones
		Volume of spheres
		Volume of composite solids

2.2 Geometric reasoning

Outcome	Quests	Content
6. Prove and apply angle and chord properties of circles	Properties of circles	Circle terminology
		Circle properties: Tangents
		Circle properties: Equal radii
		Circle properties: Chord properties
		Circle properties: Angle in a semicircle property
		Circle properties: Angle properties
		Circle properties: Solve problems using properties

2.3 Pythagoras and trigonometry

Outcome	Quests	Content
7. Establish the sine, cosine and area rules for any triangle and solve related problems	Trigonometry: non right-angled triangles	Sine rule
		Cosine rule
		Area rule
		Solving problems in non-right-angled triangles
8. Use the unit circle to define trigonometric functions as functions of a real variable, and graph them	Trigonometry: identities, ratios, angles	Using trigonometric identities
		Investigating trigonometric ratios
		Angles of any magnitude

with and without the use of digital technologies		Angle of inclination of a line and its gradient
9. Solve simple trigonometric equations	Solve simple trigonometric equations	Solving simple trigonometric equations
10. Apply Pythagoras' theorem and trigonometry to solving three-dimensional problems in right-angled triangles	Solve problems in three dimensions	Solving problems in three dimensions

3 Statistics and Probability

3.1 Chance

Outcome	Quests	Content
1. Investigate reports of studies in digital media and elsewhere for information on their planning and implementation	Critical analysis of data in the media	Critical analysis of data in the media

3.2 Data representation and interpretation

Outcome	Quests	Content
2. Calculate and interpret the mean and standard deviation of data and use these to compare data sets. Investigate the effect of individual data values including outliers, on the standard deviation	Mean & standard deviation	Using the mean & standard deviation of data sets
		Comparing data using mean & standard deviation
3. Use digital technology to investigate bivariate numerical data sets. Where appropriate use a straight line to describe the relationship allowing for variation, make predictions based on this straight line and discuss limitations	Bivariate data & lines of best fit	Bivariate data & lines of best fit

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