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Let's Explore!

Maths

sample pages **catalogue**

Let's Explore!

Maths

Levels 1 - 5

Let's Explore! Maths is a complete five-level series for secondary students, specifically designed to help students deepen their understanding of Maths concepts and prepare them for higher education. The course meets the requirements of the Singapore Maths Curriculum and other international standards and provides a comprehensive learning experience to students, using the Singapore Maths method as a core didactic methodology.

The five-level curriculum of the **Let's Explore! Maths** series is structured into thematic units and covers the mathematical domains of numbers, algebra, geometry, measurement, statistics and probability and focuses on the progression of advanced mathematical skills. The series challenges students to think critically as they work through a wide variety of mathematical problems and enables them to achieve better problem-solving skills in real-world contexts. This assists in building students' confidence in their ability to tackle challenging problems and prepares them for their future studies and careers.

Level 1 Level 2 Level 3 Level 4 Level 5

Key features

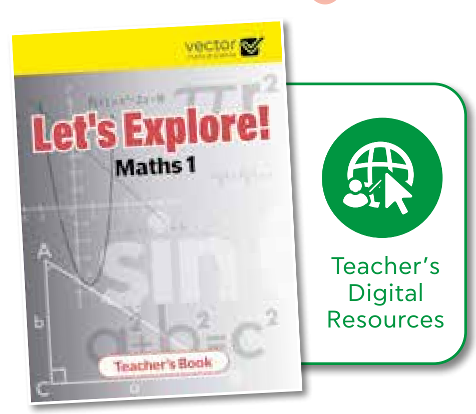
For students

- A progressive development of mathematical knowledge and terminology
- Extension of mathematical concepts in real-life contexts
- Theory sections and worked examples to enable students to deeply understand the main mathematical concepts
- 'Apply your knowledge' sections to give students the opportunity to practise solving simple activities related to each unit
- 'Exercises' sections to facilitate expanding students' knowledge and testing their ability to solve more complicated activities
- 'More Exercises' sections to solve challenging activities which combine mathematical knowledge from previous units

- 'Note' sections allow students to add information or specify the corresponding theory sections
- 'All about maths' sections to learn historical information related to the maths topics taught
- 'Using tech in maths...' sections to utilise technology to apply known mathematical methods
- 'Think deeper' sections allow students to challenge themselves to further explore main mathematical cores
- '!' sections to assist students in avoiding common mistakes
- 'Maths as language' sections to understand the meaning of the main mathematical symbols
- Assessment closed questions at the end of each unit
- Review pages in the middle and at the end of each level
- Glossary with age-appropriate definitions of critical mathematical terms at each level
- Workbook activities for individual practice

For teachers

- Detailed maps of the Student's Book, Workbook and Teacher's Book that help the teacher understand the structure of each component
- A 'Map of the units' section that contains the theory sections, the learning objectives and the keywords to be covered in each unit organised in a table
- Step-by-step guidelines for each theory section and the supplementary sections ('Note', 'All about maths', 'Using tech in maths...', 'Think deeper' and '!') in the Student's Book
- The keys to all the activities of the 'Apply your knowledge', 'Exercises' and 'More Exercises' sections of the Student's Book
- The keys to all Assessment and Review pages



Theory sections	Learning objectives
1.1 The Number system 1.2 Number line 1.3 Single operations with integers 1.4 Absolute value 1.5 Combined operations of integers 1.6 Laws of the four operations 1.7 Calculations with a calculator	• Recognise natural or whole numbers and integers. • Recognise the place value of each digit in integers. • Determine the position and order of integers on a number line. • Perform addition, subtraction, multiplication and division with integers. • Understand the properties and the order of the four operations. • Solve word problems involving integers in different contexts. • Apply logical reasoning and critical thinking to mathematical concepts. • Estimate the result of combined operations before calculating with a calculator.
2.1 Factors 2.2 Prime numbers 2.3 Prime factors 2.4 Prime factorisation 2.5 Common factors and highest common factor 2.6 Multiples 2.7 Common multiples and lowest common multiple 2.8 Square numbers and square roots 2.9 Cube numbers and cube roots	• Recognise prime numbers. • Understand the meaning of prime factors and prime factorisation. • Express the prime factorisation of a number in the form of index notation. • Find the Highest Common Factor (HCF) and the Lowest Common Multiple (LCM) of two or more numbers applying different methods. • Find square numbers, cube numbers as well as square and cube roots using prime factorisation.
3.1 Fractions 3.2 Comparing fractions 3.3 Mixed numbers and improper fractions 3.4 Addition and subtraction of fractions and mixed numbers 3.5 Multiplication and division of fractions and mixed numbers 3.6 Fraction of a quantity 3.7 Division of fractions and mixed numbers 3.8 Expressing one quantity as a fraction of another 3.9 Operations with positive and negative fractions 3.10 Percentages 3.11 Word problems with percentages	• Recall what a fraction is and recognise the numerator and denominator. • Recall proper fractions, improper fractions and mixed numbers and conversions between them. • Do calculations with fractions and mixed numbers. • Realise the link between fractions, decimals and percentages. • Write fractions and decimals as percentages and vice versa. • Recognise percentages greater than 100%.
4.1 Decimals 4.2 Decimals and fractions 4.3 Recurring decimals 4.4 Ascending and descending order 4.5 Addition and subtraction of decimals 4.6 Multiplication of decimals 4.7 Division of decimals 4.8 Operations with positive and negative decimals 4.9 Problem solving with decimals	• Recognise decimal numbers. • Recognise the place value of each digit in decimals. • Compare and put decimals in ascending or descending order. • Perform addition, subtraction, multiplication and division with decimals. • Write fractions as decimals and vice versa. • Solve word problems involving decimals in different contexts.

Theory sections	Learning objectives
5.1 Rounding 5.2 Significant figures	• Distinguish between estimation and approximation. • Round off whole and decimal numbers to the nearest given place value. • Identify significant figures. • Round off a number to the required number of significant figures.
6.1 Algebraic expressions 6.2 Properties 6.3 Factorisation using the distributive property	• Realise that we can use letters to represent numbers or variables. • Understand the use of variables in mathematics. • Use given values for variables to evaluate algebraic expressions. • Recognise equivalent forms of algebraic expressions such as $a \times b = ab$, $a \div b = \frac{a}{b} = a \times \frac{1}{b}$, $c \times (a + b) = c(a + b)$, etc. • Differentiate between various types of terms and realise what kind of calculations we can perform between them. • Use commutative, associative, distributive and identity properties to simplify linear or more complex algebraic expressions. • Realise that properties show us the correct way to do calculations and can be applied in both directions. • Realise that the distributive property is useful for factorising and expanding linear expressions such as $c(a + b)$, $ka + kb$, $ax + bx + kya + kyb$, etc. • Use algebraic expressions to represent real-life problems, phrases or situations.
7.1 Definition of linear equations 7.2 How to solve a linear equation 7.3 Equations with fractional coefficients 7.4 Evaluation of formulas 7.5 Problem solving with algebra	• Identify an equation as a mathematical statement that has two mathematical expressions separated by the equals sign. • Distinguish between linear and non-linear expressions and equations. • Solve simple linear equations with integral or fractional coefficients. • Evaluate formulas and other mathematical expressions. • Change the subject of a given formula and calculate its value. • Form linear equations to express mathematical or real-life word problems. • Solve word problems involving linear equations in different contexts.
8.1 Fundamental terms 8.2 Angles 8.3 More types and properties of angles 8.4 Angle bisector 8.5 Parallel and perpendicular lines 8.6 Parallel and transversal lines	• Sort angles into right, acute, obtuse, reflex, straight or complete angles. • Revise complementary, supplementary and vertically opposite angles, angles on a straight line and angles at a point. • Identify and use the properties of angles formed by parallel lines and transversals (corresponding, alternate and interior angles). • Recognise the bisector of an angle. • Calculate unknown angles using various properties.
9.1 Units of measurement and SI units 9.2 Units of length measurement 9.3 Units of area measurement 9.4 Units of volume measurement 9.5 Units of mass measurement 9.6 Units of time measurement 9.7 British imperial units of measurement	• Comprehend the metric system of measurement for length, area, mass, capacity, volume and time. • Recognise the imperial units of measurement for length, depth and distance. • Record measurements using standard metric or imperial units. • Convert measurements of the same system from one unit to another. • Familiarise ourselves with the conversion of units from the metric to the imperial system of units and vice versa.

Let's Explore! Maths 1

Theory sections	Learning objectives
10.1 Triangles 10.2 Quadrilaterals 10.3 Polygons 10.4 Circles 10.5 Circumference and area of circles 10.6 Perimeter and area of polygons 10.7 Perimeter and area problems	• Classify triangles according to side length or angle size. • Identify properties of triangles and relations between the interior and exterior angles, interior angles and sides as well as the triangle inequality. • Identify properties of quadrilaterals (e.g. parallel sides, equal sides, diagonals, different types of symmetry, etc.). • Use formulas to calculate the area of known quadrilaterals (e.g. parallelograms, trapeziums, etc.). • Classify different shapes, such as squares, pentagons, hexagons, octagons according to their properties (e.g. parallel sides, equal sides, different types of symmetry, etc.). • Identify properties of polygons and relationships between the interior and exterior angles and between the number of sides and the interior angles. • Use knowledge of 2D shapes to solve problems that require the perimeter and area of composite shapes. • Use a formula to calculate the sum of the interior angles of any polygon. • Realise that the sum of the exterior angles of any polygon is 360°.
11.1 Nets 11.2 Volume and total surface area of common solids 11.3 Total surface area 11.4 Volume	• Calculate the total surface area of cubes, cuboids, cylinders, and other prisms. • Calculate the volume of cubes, cuboids, cylinders, and other prisms. • Recognise the solids for a given net and imagine the nets of various solids.
12.1 Basics of statistics 12.2 Tallies and frequency tables 12.3 Pictograms 12.4 Bar charts 12.5 Pie charts 12.6 Line graphs	• Realise the influence of statistics in our daily life. • Collect, classify and organise data in tables. • Construct, read and interpret pictograms, pie charts, bar charts and line graphs. • Realise the advantages and disadvantages of the different ways of representing data when using statistics. • Comprehend how using the wrong graphs and tables or using them in the wrong way can lead us to interpret the data incorrectly.

Let's Explore! Maths 2

Theory sections	Learning objectives
1.1 Rational numbers 1.2 Decimals, fractions and rational numbers 1.3 Irrational numbers 1.4 Square roots and cube roots	• Identify rational and irrational numbers. • Realise that real numbers consist of rational and irrational numbers. • Recongise terminating decimals and distinguish them from decimals with an infinite number of non-repeating decimal places. • Realise that recurring decimals are rational numbers. • Find square roots and cube roots using prime factorisation. • Use basic properties of multiplication and division to perform calculations with square and cube roots. • Use a calculator to find square and cube roots of large numbers.
2.1 Introduction to indices 2.2 Laws of exponents 2.3 Exponential notation 2.4 Addition with the same exponents 2.5 Subtraction in exponential notation 2.6 Multiplication and division in exponential notation 2.7 Combined operation using exponential notation	• Familiarise ourselves with positive, negative and zero indices. • Realise that to operate with numbers in the form of index notation, we follow the laws for indices. • Recognise exponential notation as an easy way to represent extremely big or small numbers. • Use the standard form $A \times 10^n$, where n is an integer and $1 \leq A < 10$ to make calculations easier.

Theory sections	Learning objectives
3.1 Linear equations 3.2 Equations with decimals 3.3 Fractional equations 3.4 Problem solving involving linear equations 3.5 Linear inequalities 3.6 Solving linear inequalities with one unknown 3.7 Solving simultaneous linear inequalities 3.8 Problem solving involving inequalities	• Solve simple linear equations with integral or fractional coefficients. • Solve simple fractional equations and reject the roots when needed. • Familiarise ourselves with useful properties of linear inequalities. • Solve simple linear inequalities and systems of two simple linear inequalities. • Form linear equations and inequalities to express mathematical or real-life word problems. • Solve word problems involving linear equations and inequalities in different contexts.
4.1 Ratio 4.2 Ratios in measurement 4.3 Ratios involving rational numbers 4.4 Dividing a quantity in a given ratio 4.5 Proportion 4.6 Distance and map scales 4.7 Area and map scales 4.8 Rate and average rate 4.9 Speed, average speed and uniform speed 4.10 Percentages	• Recall the relationship between ratios and fractions. • Use integers, decimals and fractions as terms of ratios and simplify or write them in other equivalent forms. • Compare quantities by ratio, find the ratio between two or more quantities and share a quantity according to a ratio. • Realise how ratios are used for map scales. • Recongise the formula that links distance, time and speed and use it to calculate them. • Recongise rate, average rate as well as constant and average speed. • Calculate speed in different units and convert between them (e.g. km/h, m/s, etc.). • Identify direct and inverse proportion. • Use percentages to compare quantities. • Realise what the increase, decrease and reverse percentages are. • Use different percentages and the percentage point to calculate the value of an increase, a decrease, etc. • Solve word problems involving ratios, rates, speed, and percentages. • Apply logical reasoning and critical thinking to mathematical concepts.
5.1 Cartesian coordinate system 5.2 Graphs 5.3 Linear graphs 5.4 Gradient 5.5 Applications of graphs of linear equations	• Familiarise ourselves and construct the cartesian coordinate system in two dimensions. • Draw a graph given several ordered pairs or a mathematical equation that links two variables. • Perceive graphs as the representation of the relation between two variables. • Distinguish between linear and non-linear graphs. • Recognise the general form of the equations for linear graphs ($y = ax + b$). • Understand the gradient of a slope as the ratio of vertical change of the y-coordinates to horizontal change of the x-coordinates. • Apply real-life or mathematical problems to linear graphs equations.
6.1 Use of compass 6.2 Bisecting a line segment 6.3 Bisecting an angle 6.4 Constructing triangles 6.5 Constructing a 60 degree angle 6.6 Constructing a 90 degree angle 6.7 Quadrilateral constructions	• Comprehend the different uses that a pair of compasses can have. • Practise making geometrical constructions with the use of compasses, a ruler and a protractor (draw an arc, a circle, bisect a line segment or an angle, draw a line perpendicular to a straight line, etc.). • Make more complex geometrical constructions (e.g. triangles, quadrilaterals) with the use of geometrical tools, given the appropriate measurements or features.
7.1 Pythagoras' theorem 7.2 Determine if a triangle is right-angled 7.3 Applications of Pythagoras' theorem	• Realise that the sentence of a theorem states a truth that is a mathematical statement. • Familiarise ourselves with the geometrical interpretation of Pythagoras' theorem. • Use the algebraic expression of Pythagoras' theorem to calculate the unknown length of a side of a right-angled triangle. • Perceive the converse of Pythagoras' theorem as the mathematical foundation to determine whether a triangle is right-angled or not. • Distinguish between Pythagoras' theorem and its converse sentence. • Use the converse of Pythagoras' theorem to determine the right angle of a triangle, if there is any. • Solve mathematical and real-life problems using Pythagoras' theorem.

Let's Explore! Maths 2

Theory sections	Learning objectives
8.1 Congruent figures 8.2 Congruent triangles 8.3 Matching diagram 8.4 Tests for congruent triangles	• Recognise congruent figures. • Realise that congruent figures may have different orientations but be identical in shape. • Use tests of congruency to verify that two triangles are congruent. • Solve problems involving congruent triangles.
9.1 Dot diagrams 9.2 Histograms 9.3 Stem-and-leaf diagrams 9.4 Pie charts	• Construct, read and interpret dot diagrams, histograms, stem-and-leaf diagrams as well as pie charts. • Realise the advantages and disadvantages of the different ways of representing data when using statistics. • Comprehend how using the wrong graphs, charts and tables or using them in the wrong way can lead us to interpret the data incorrectly.
10.1 Data analysis 10.2 Mean of ungrouped data 10.3 Median 10.4 Mode 10.5 Mean of grouped data	• Identify the mean, the mode and the median of a set of data. • Realise the purposes and uses of the mean, the mode and the median of a set of data. • Calculate the mean of a set of data.

Let's Explore! Maths 3

Theory sections	Learning objectives
1.1 Real numbers 1.2 Absolute value 1.3 Addition and subtraction of real numbers 1.4 Multiplication and division of real numbers	• Identify rational and irrational numbers. • Realise that real numbers consist of rational and irrational numbers. • Realise that recurring decimals are rational numbers. • Understand the correct way to do one or more calculations. • Solve word problems involving real numbers in different situations of real life. • Think deeper to produce further general and mathematical ideas. • Perform addition, subtraction, multiplication and division in arithmetic expressions. • Recognise the calculator as a useful tool to do calculations.
2.1 Algebraic expressions 2.2 Expansion of algebraic expressions 2.3 Special products 2.4 Factorisation of quadratic expressions 2.5 Algebraic fractions	• Recognise equivalent forms of algebraic expressions such as $a \times b = ab$, $a \div b = \frac{a}{b} = a \times \frac{1}{b}$, $c \times (a + b) = c(a + b)$, etc. • Familiarise ourselves with the basic properties of calculations and how we apply them in arithmetic and algebra. • Differentiate between various types of terms and realise what kind of calculations we can perform between them. • Use the distributive property to simplify quadratic expressions or more complex algebraic expressions. • Realise that properties show us the correct way to do calculations and can be applied in both directions. • Realise that the distributive property is useful for factorising and expanding linear expressions such as $c(a + b)$, $ka + kb$, $ax + bx + kya + kyb$, etc. • Use algebraic expressions to represent real-life problems, phrases or situations. • Familiarise ourselves with quadratic expressions in the form $ax^2 + bx + c$. • Realise that special products are useful for factorising and expanding algebraic expressions. • Familiarise ourselves with algebraic fractions and do calculations. • Use the multiplication grid to factorise algebraic expressions.
3.1 Linear and quadratic equations 3.2 Solving quadratic equations using the factorisation method 3.3 Completing the square method 3.4 Solving quadratic equations using the quadratic formula method 3.5 Change of subject of algebraic formulas	• Solve simple quadratic equations in one variable with integral coefficients. • Solve quadratic equations in one variable using the methods of factorisation, completing the square and the quadratic formula. • Familiarise ourselves with the number of roots a quadratic equation in one variable has. • Change the subject of a given formula and calculate its value. • Form quadratic equations in one variable to express mathematical or real-life word problems. • Solve word problems involving quadratic equations in one variable in different contexts.

Theory sections	Learning objectives
4.1 Indices and roots 4.2 Fractional indices 4.3 Surds 4.4 Addition and subtraction of surds 4.5 Multiplication and division of surds 4.6 Rationalising the denominator 4.7 Equations involving indices 4.8 Equations involving square roots 4.9 Compound interest	• Familiarise ourselves with positive, negative, zero and fractional indices. • Familiarise ourselves with the nth root of x. • Use properties of exponents to simplify expressions involving indices. • Use properties of roots to simplify expressions involving surds. • Convert a fraction whose denominator involves surds into an equivalent one with a rational denominator. • Solve simple equations involving indices. • Solve simple equations involving square roots and identify the accepted solutions. • Familiarise ourselves with simple and compound interest. • Solve word problems involving equations that include surds in different contexts. • Solve word problems involving interest.
5.1 Algebraic solution to simultaneous linear equations 5.2 Graphical solution to simultaneous linear equations 5.3 Solving word problems involving simultaneous equations 5.4 Solving inequalities 5.5 Equations and inequalities with absolute values 5.6 Solving word problems involving inequalities	• Solve simultaneous linear equations with two variables, using the elimination, substitution or graphical method. • Familiarise ourselves with useful properties of linear inequalities. • Solve simple linear inequalities and systems of two simple linear inequalities. • Solve equations and inequalities involving absolute values. • Form simultaneous linear equations and inequalities to express mathematical or real-life word problems. • Solve word problems involving simultaneous linear equations and inequalities in different contexts.
6.1 Translation 6.2 Reflection 6.3 Rotation	• Use the cartesian coordinate system in two dimensions to draw shapes and perform transformations. • Familiarise ourselves with translation, reflection and rotation and their properties. • Apply real-life or mathematical problems to shape transformations.
7.1 Similar figures 7.2 Similar triangles 7.3 Similar polygons 7.4 Finding the ratio of areas of similar plane figures 7.5 Solving problems with similar triangles	• Recognise congruent figures. • Identify and use reduction and enlargement on figures. • Realise that similar figures have the same shape but they have different sizes. • Use the properties of similar triangles or polygons. • Use the conditions of similarity to verify that two triangles or polygons are similar. • Use the ratio of areas to solve problems involving similar figures. • Solve problems involving similar and congruent triangles.
8.1 Angles at the centre and angles at the circumference 8.2 Angles in a semicircle 8.3 Angles in the same segment 8.4 Angles in opposite segments	• Identify that an angle in a semicircle is equal to a right angle. • Identify that angles in the same segment are equal. • Identify that angles in opposite segments are supplementary. • Identify that any angle at the centre is twice the angle at the circumference subtended by the same arc. • Calculate unknown angles using various properties. • Solve problems using the properties of angles and circles.
9.1 Prisms and cylinders 9.2 Pyramids 9.3 Cones 9.4 Spheres 9.5 Composite solids 9.6 Problem solving involving total surface area and volume of solids	• Calculate the total surface area of prisms, cylinders, pyramids, cones, spheres and hemispheres. • Calculate the volume of prisms, cylinders, pyramids, cones, spheres and hemispheres. • Use knowledge of known 3D shapes to solve problems that require the total surface area and volume of composite solids.
10.1 Introduction to probability 10.2 Definitions in probability 10.3 Properties of probability	• Familiarise ourselves with the concept of probability as a measure of chance. • Familiarise ourselves with the random experiment, outcome, sample space and event. • Use a formula to find the probability of an event. • Use the properties of probability to solve problems. • Calculate the probability of a single event.

Theory sections	Learning objectives
1.1 Introduction to sets 1.2 Set representations 1.3 Relations between sets 1.4 Different types of sets	• Familiarise ourselves with the concept of sets as a collection of distinct objects that share specific properties. • Recognise different ways of set representation. • Convert one set representation form to another. • Familiarise ourselves with set language and the corresponding notation such as: an element belongs ($\in$) or does not belong ($\notin$) to a set, the number of elements in set A ($n(A)$), etc. • Realise the possible relations between sets such as equal sets, subsets and proper subsets and use the appropriate set notation. • Identify the existence of the empty set. • Identify finite and infinite sets. • Identify the existence of universal sets.
2.1 Venn diagrams 2.2 Complement of a set 2.3 Union and intersection of sets 2.4 Venn diagram with 3 sets	• Familiarise ourselves with set language and the corresponding notation, such as union ($\cup$), intersection ($\cap$), complement of set A (A'), etc. • Draw Venn diagrams and find the relationships between the sets of the diagrams. • Identify the union and the intersection of two or more sets as a different set and make further calculations.
3.1 Relations between two sets 3.2 Ordered pairs and Cartesian graphs 3.3 Tree diagrams	• Familiarise ourselves with different types of relations between sets. • Recognise the arrow diagram as a way to represent the link between the elements of two sets. • Realise that a tree diagram is a way to reach and represent all the possible ways something can happen.
4.1 Introduction to functions 4.2 Linear function and graph 4.3 Quadratic function and graph 4.4 Absolute value function and graph 4.5 Exponential function and graph	• Distinguish relations from functions and study their key features. • Recognise the general form of linear and quadratic functions. • Draw a graph of a given linear or quadratic function. • Familiarise ourselves with the absolute value function. • Draw a graph of the absolute function of a given linear function. • Recognise the effect of the absolute value on a graph of a function. • Familiarise ourselves with exponential functions. • Draw a graph of a given exponential function. • Use our experience of functions to solve mathematical problems.
5.1 Quadratic equations 5.2 Solving quadratic inequalities by using a graph 5.3 Fractional equations that can be reduced to quadratic equations 5.4 Solving linear inequalities by using a graph 5.5 Exponential inequalities 5.6 Graphs and real-life problems	• Solve quadratic equations in one variable with coefficients and constants being any real number. • Solve quadratic equations in one variable using the methods of factorisation, completing the square, the quadratic formula and the graphical method. • Solve linear, simultaneous linear, quadratic and exponential inequalities using the graphical method. • Solve fractional equations in one variable reducing them to equivalent quadratic equations. • Solve exponential inequalities using laws of exponents and properties of linear inequalities. • Form linear, quadratic, fractional and other types of equations or functions to express mathematical or real-life word problems. • Solve word problems involving linear, quadratic, fractional and other types of equations or functions in different contexts.
6.1 Linear equations in the form $ax + by = k$ 6.2 Equation of a straight line 6.3 Length of a line segment 6.4 Problem solving with coordinate geometry	• Recognise the linear equation in the form $ax + by = k$. • Recognise $y = ax + b$ and $ax + by = k$ as equivalent general forms for linear equations. • Use a formula to calculate the length of a line segment on the coordinate plane. • Find the equation of a straight line given various pieces of information such as its gradient and one point on the line, etc. • Solve simple or complex geometrical problems located on the coordinate plane.

Theory sections	Learning objectives
7.1 Pythagoras' theorem 7.2 Trigonometric ratios of acute angles 7.3 Special angles	• Use Pythagoras' theorem and its converse statement to solve simple and complex geometrical problems. • Use the trigonometric ratios of acute angles to calculate the unknown length of a side of a right-angled triangle. • Realise which trigonometric ratio to use for calculating the length of a side or the size of an angle of a simple or more complex 2D shape. • Practise using a scientific calculator to find the value of an angle given the value of a trigonometric ratio. • Familiarise ourselves with the trigonometric value of special angles and use them for simple calculation or problem solving.
8.1 Angles of elevation and depression 8.2 Bearing 8.3 Trigonometric formula for the area of a triangle 8.4 Sine and cosine rules	• Familiarise ourselves with the concept of elevation and depression angles as well as bearing. • Practise using trigonometric ratios of elevation and depression angles in simple geometrical diagrams. • Find bearings in simple or complex geometrical diagrams. • Realise that we can use trigonometric ratios to express the area of a triangle. • Practise using the trigonometric formula for the area of a triangle to calculate any element of a triangle. • Familiarise ourselves with the sine and the cosine rule. • Realise that the sine rule in a triangle is a useful ratio between the sides of a triangle and the sines of its angles.
9.1 Chords of a circle and their properties 9.2 Tangents and angles 9.3 Tangents from an external point 9.4 Arc length and sector area 9.5 Area of a segment of a circle 9.6 Radian measure of angles 9.7 Solving problems with measurements in circles	• Identify the tangent line of a circle at a point. • Realise that the angle between the tangent line and the corresponding radius that end at the point of contact is a right angle. • Realise that chords equidistant from the centre of the circle have equal length. • Realise that the perpendicular bisector of any chord in a circle passes through the centre of the circle. • Familiarise ourselves with symmetry and angle properties of circles. • Realise that the tangent segments of a circle from the same external point have the same length. • Realise that the line that joins an external point and the centre of a circle is the bisector of the angle included between the corresponding tangent segments. • Familiarise ourselves with radians as another unit to measure angles. • Convert the measures of angles from degrees to radians and vice versa. • Solve geometric problems involving symmetry and measurements in circles.
10.1 Cumulative frequency 10.2 Cumulative frequency curve 10.3 Measures of position 10.4 Box-and-whisker plot	• Recognise the cumulative frequency as a statistical measure. • Recognise the cumulative frequency table and curve as tools to visualise sets of data. • Analyse and interpret the cumulative frequency curve to get results about sets of data. • Identify the quartiles and percentiles as measures of position. • Use the cumulative frequency curve to approximate quartiles and percentiles. • Represent sets of data using box-and-whisker plots and use their information as an easy way to compare the spread of a data set between the maximum and minimum values. • Identify the advantages and disadvantages of different statistical representations of a data set.

10 2D shape basics

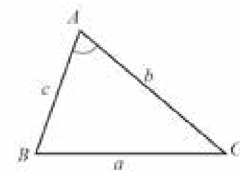
Note
Instead of using the end points to name the sides of a triangle, we can use small letters to name them following the rule:

Opposite $\angle A$ we name the side a.
Opposite $\angle B$ we name the side b.
Opposite $\angle C$ we name the side c.

We use the symbol $\triangle$ instead of the word triangle.

10.1 Triangles

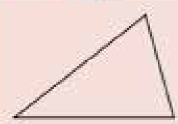
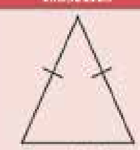
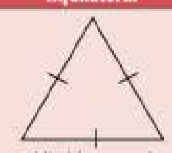
A triangle is a closed 2D shape with three straight sides and three vertices.



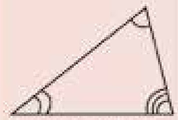
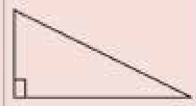
The vertices of this triangle are A, B and C so its name is $\triangle ABC$. The angles of the triangle $\angle A$, $\angle B$ and $\angle C$ are its interior angles. The sides of $\triangle ABC$ are AC, AB and BC.

Classification of triangles

By Sides
We can classify triangles by the length of their sides.

Scalene	Isosceles	Equilateral
		
No equal sides	2 equal sides	All sides equal

By Angles
We can classify triangles by the sizes of their angles.

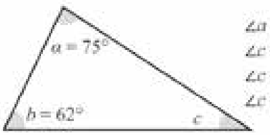
Acute-angled	Obtuse-angled	Right-angled
		
All angles are acute	1 obtuse angle	1 right angle

‘Using tech in maths...’ sections with websites for further exploration.

Using tech in maths...
For further exploration you can visit Geogebra.org where you can make a triangle with vertices A, B and C and find the sum of the angles. Then you can move the vertices and find the sum of the angles after every change. What do you notice?

Properties of triangles

Sum of angles in a triangle
The sum of the interior angles in a triangle is 180°.



$\angle a + \angle b + \angle c = 180°$
$\angle c = 180° - (75° + 62°)$
$\angle c = 180° - 137°$
$\angle c = 43°$

Note
We use the abbreviation $\angle$sum of $\triangle$ to express the sum of the interior angles in a triangle is 180°.

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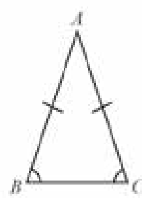
Detailed theory sections including various methods and worked examples for representation of the main mathematical concepts and further understanding of the mathematical methodologies.

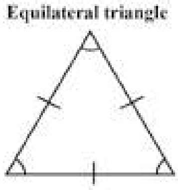
10

Isosceles triangle

An isosceles triangle is a triangle with 2 equal sides, AB and AC. The third side, BC, is called the base. The angles on the base of an isosceles triangle, $\angle ABC$ and $\angle ACB$ are called base angles and are equal in size.

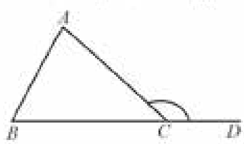


Equilateral triangle



All angles and sides of an equilateral triangle are the same size. Each angle is 60°.

Exterior angles of triangle



We expand the side BC to the right and form ray BCD. Ray BCD and side CA of the triangle form an exterior angle of the $\triangle ABC$, the angle $\angle ACD$.

The exterior angle $\angle ACD$ and the interior angle $\angle ACB$ of the triangle meet at a point on a straight line, so they add up to 180°.

$$\angle ACD + \angle ACB = 180°$$

The sum of the interior angles of the triangle is 180°.

$$\angle BAC + \angle ABC + \angle ACB = 180°$$

So, the exterior angle $\angle ACD$ is equal to the sum of the two interior opposite angles of the $\triangle ABC$.

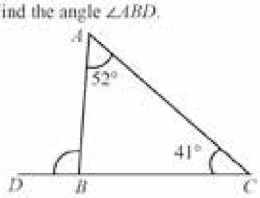
$$\angle ACD = \angle BAC + \angle ABC$$

Think deeper
Are equilateral triangles also isosceles?

'Think deeper' sections with questions and problems to trigger students' interest.

Example

1 Find the angle $\angle ABD$.



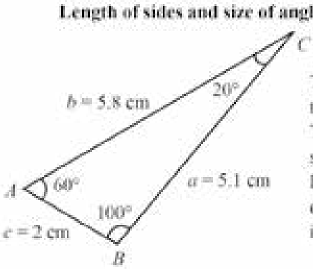
Solution

$\angle ABD = \angle BAC + \angle ACB$ (ext.∠ of △)

$\angle ABD = 52° + 41°$

$\angle ABD = 93°$

Length of sides and size of angles



The smallest angle of $\triangle ABC$ is $\angle C = 20°$ and the shortest side is $c = 2$ cm.

The biggest angle is $\angle B = 100°$ and the longest side is $b = 5.8$ cm.

For any triangle, the shortest side of a triangle is opposite the smallest angle and the longest side is opposite the biggest angle.

Note

We use the following abbreviations:

base ∠s of isos. △ to express angles at the base of an isosceles triangle are equal.

∠ of equilat. △ to express that an angle of an equilateral triangle is 60°.

ext.∠ of △ to express that an exterior angle of a triangle is equal to the sum of the two interior opposite angles of the same triangle.

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Helpful notes adding information or clarifying details about the theory sections.

'Exercises' section with numerous graded activities where students apply their knowledge in different contexts in order to enable them to develop their problem solving skills.

6 Algebraic expressions

13 **Use grouping to factorise the algebraic expressions.**

(a) $ax - by + ay - bx =$ ______

(b) $ax + ay - x - y =$ ______

(c) $ax - ay + x - y =$ ______

(d) $2ax - 2ay - wy + wx =$ ______

(e) $2ax + 4ay + 3bx + 6by =$ ______

(f) $ab - 3a - 3b + 9 =$ ______

Exercises

1 **Use factorisation and calculate.**

(a) $57 \times 2 + 57 \times 998$

(b) $197 \times 15 + 197 \times 85$

2 **Nick has 10 notes of different values. x of them are of \$5 and the rest are of \$10.**

(a) Write the algebraic expression that expresses the value of Nick's \$5 notes.

(b) Write the algebraic expression that expresses the value of Nick's \$10 notes.

(c) Write the algebraic expression that expresses the total value of Nick's money.

(d) Find the total value of Nick's money if $x = 4$.

3 **Describe a real-life problem that could have as algebraic expression $\frac{120}{x} - 7y$.**

4 **Simplify the algebraic expressions and then calculate their value.**

(a) $1 - (-2x + y - 2) - 2(3x - 2y - 6)$ when $x = -1$ and $y = -2$

(b) $2x + (3x - 4y) \times (-2) - (4x - 2y - 5) \times (-2)$ when $x = -3$ and $y = 0$

5 **If $x + y = -2$ calculate the value of the algebraic expressions.**

(a) $3x - (2x - y) + 3$

(b) $7 - 3(x - 2y) + 5(x - y) + y$

(c) $3x + (3x - 2y) \times 3 - 3(2x - 4y) - 7$

6 **Alex and Kate played a game and they won coloured pencils. Alex won $(3x + 5y)$ coloured pencils and Kate won two fifths of that.**

(a) Make an algebraic expression for Kate's coloured pencils. Then write it in expanded form.

(b) Alex gave $\frac{2}{3}y$ of his coloured pencils to his friend. Make an algebraic expression in its simplest form that expresses the coloured pencils Alex has left over.

(c) Make an algebraic expression for Kate's and Alex's coloured pencils that they have in total in expanded form.

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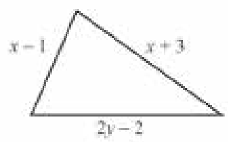
'More exercises' section with activities specifically designed to challenge students and extend their knowledge and problem-solving skills.

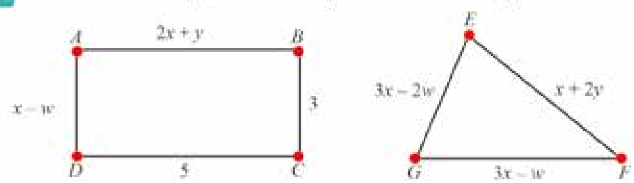
6

More Exercises

1 Calculate the perimeter of the triangle, when $x + y = 10$.



2 If $ABCD$ is a rectangle, calculate the perimeter of the triangle EFG.



Maths as language

$x + 10$	add 10 to x
$x - 3$	subtract 3 from x
$x + y$	the sum of x and y
$8x$	8 times x
xy	the product of x and y
$3 \div x$	divide 3 by x

'Maths as language' section summing up the wording of core mathematical symbols.

Unit at a glance

1 Algebraic expression → $3xy - y + 16xy + 4y^2 + 18w + 2w^5 - 3$

2 $18w$ → Coefficient (18); → Variable (w)

3 $3xy$, $-y$, $16xy$, $4y^2$, $18w$, $2w^5$, -3 are terms → Like terms; → Constant term

4

Property	Symbolic form
Commutative property	$a + b = b + a$ $a \times b = b \times a$
Associative property	$(a + b) + c = a + (b + c)$ $(a \times b) \times c = a \times (b \times c)$
Identity property	$a + 0 = a$ $a \times 1 = a$
Distributive property	$a(b + c) = ab + ac$ $a(b - c) = ab - ac$

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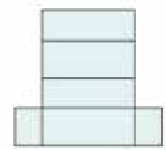
'Unit at a glance' section summarising the core mathematical terms and concepts taught in each unit.

'!' sections helping students to avoid serious mathematical mistakes.

11 Solid Geometry

11.1 Nets

The net of a solid shows how the faces of the solid look when they are open.
The figure shows the net of a cuboid.



The surface area of a solid is the sum of the areas of all its faces.

Total surface area of a prism = sum of the areas of all the faces of the prism.
Total surface area of a closed cylinder =
area of curved surface + 2 × area of circular base

! Area and volume can have only positive values.

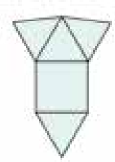
Volume is the amount of space occupied by a solid.

Volume of a cube = length × length × length
Volume of a cuboid = length × breadth × height
Volume of a prism = area of the base × height of prism
Volume of a cylinder = area of circular base × height of the cylinder

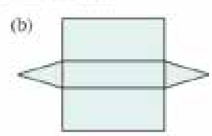
Apply your knowledge

1 **Name the solids that can be formed with the nets.**

(a)



(b)



______________ ______________

2 **Sketch a net of each of the solids.**

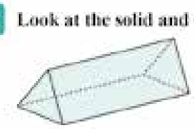
(a)

cube

(b)

square-based pyramid

3 **Look at the solid and complete the text.**



This solid is called a __________. It has __________ faces, __________ vertices and __________ edges.

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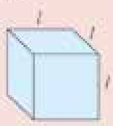
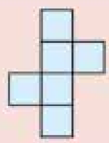
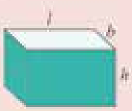
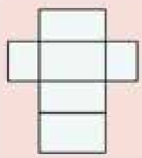
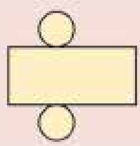
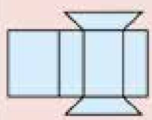
'Apply your knowledge' sections specifically targeted to cover the learning objectives of each unit assisting students in applying and consolidating their newly acquired knowledge of concepts and processes.

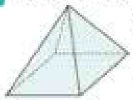
'All about maths' sections with historical information related to each topic.

11.2 Volume and total surface area of common solids

Solid	Volume (V)	Total Surface Area (A)	Net
Cube 	$l \times l \times l = l^3$	$6 \times l \times l = 6l^2$	
Cuboid 	$l \times b \times h$	$2(l \times b + l \times h + b \times h)$	
Cylinder 	$\pi r^2 h$	$2\pi r^2 + 2\pi rh$	
Prism 	area of the base × h	(2 × area of the base) + (h × perimeter of base)	

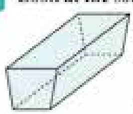
Apply your knowledge

4 **Look at the solid and complete the sentences.**



(a) The solid has __________ faces.
(b) Four faces are __________ and one face is a __________.
(c) The solid is called a __________.

5 **Look at the solid and complete the sentences.**



(a) The solid has __________ faces.
(b) __________ faces are rectangles and two faces are __________.
(c) The solid is called a __________.

6 **Look at the solid and complete the sentences.**

(a) The shapes of the faces of this solid are __________ and __________.
(b) The solid is called a __________.

11

All about maths

During the past centuries, mathematicians realised the need for formulas to measure areas of different shapes and worked on the problem and discovered the basic solutions. For example, nowadays we know that the calculation of a circular area is based on approximation because of Greek mathematicians like Hippocrates of Chios, Eudoxus of Cnidus and Archimedes who discovered the basic method for calculating circlular area as it is known nowadays. Another example is Heron of Alexandria who proved a formula for measuring the area of a triangle that depends on the triangle's sides. Later, Aryabhata from India found the formula we use today to calculate the area of a triangle. Mathematicians like Descartes, Gauss, Minkowski and many more continued working on these geometrical problems which lead to our ability to calculate the surface area of any solid or 2D shape within a really good approximation.

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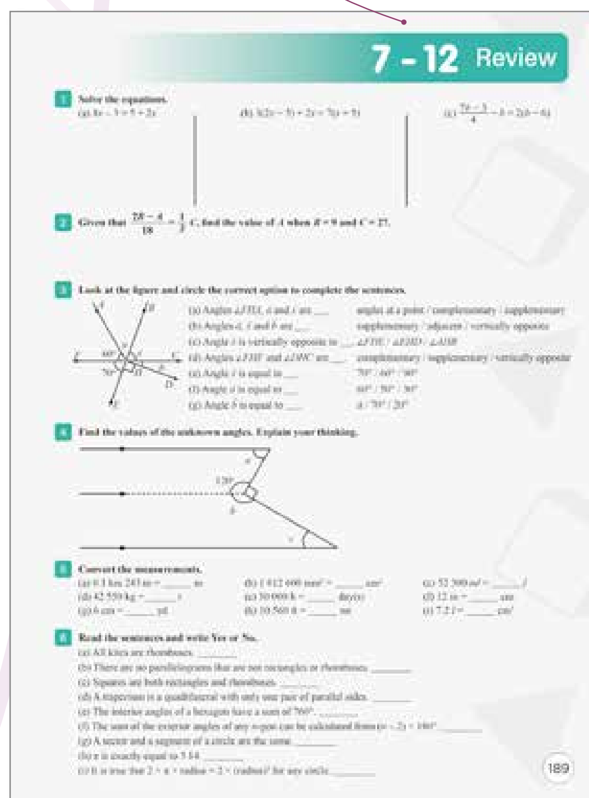
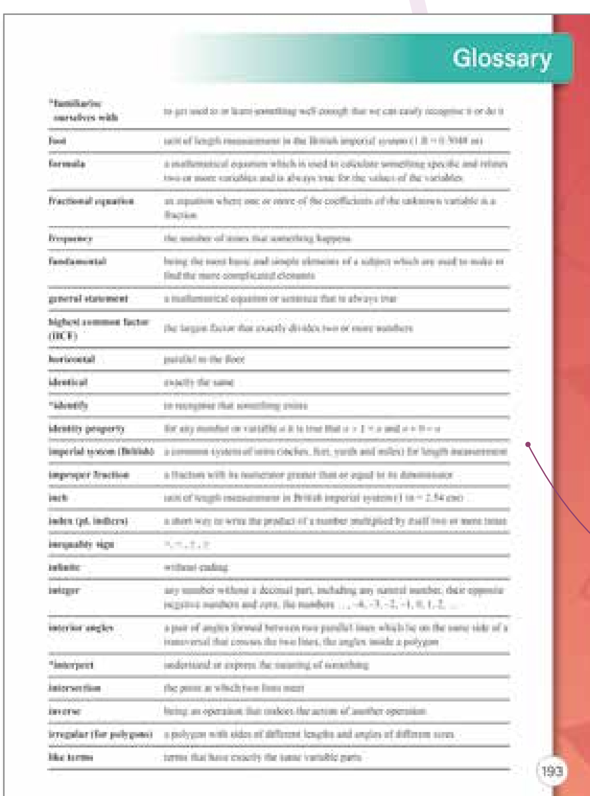
'Assessment' questions at the end of each unit for revision and consolidation of the main mathematical concepts.

Review pages with activities covering the first and the second half of the book.

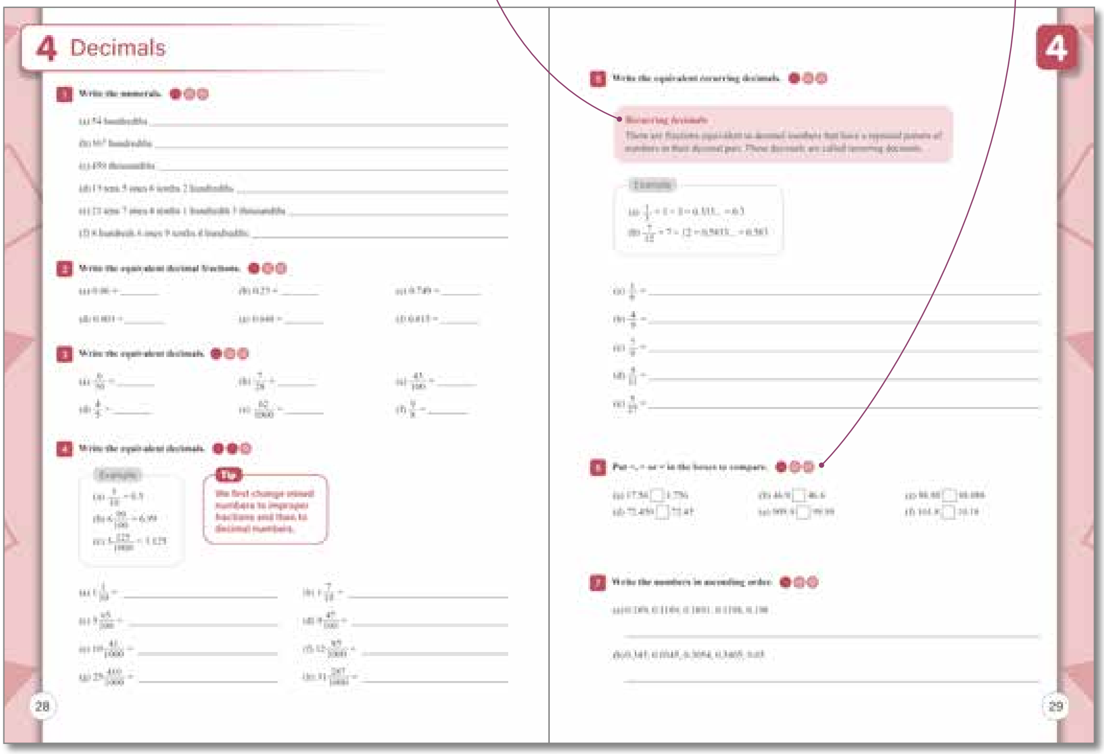


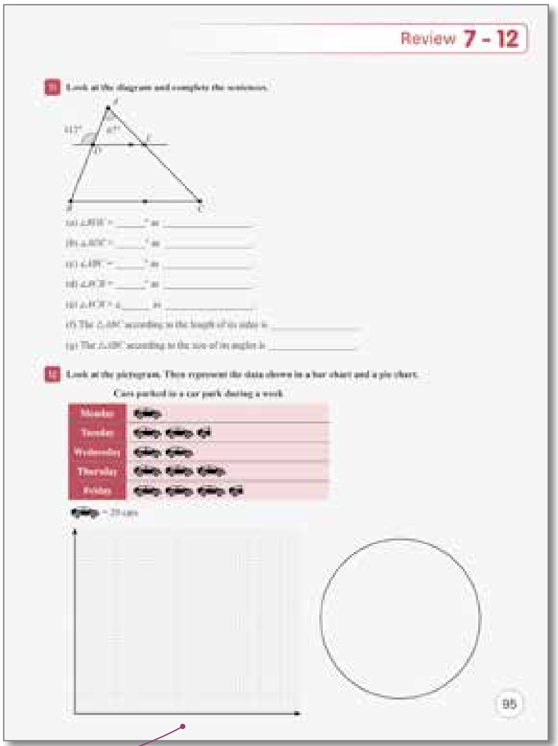


Glossary with age-appropriate definitions of critical mathematical terms at each level ensuring the gradual development of mathematical vocabulary.

Supplementary section with theory, worked examples or tips assisting students in completing activities.

Activities categorised according to the difficulty level into 3 categories.

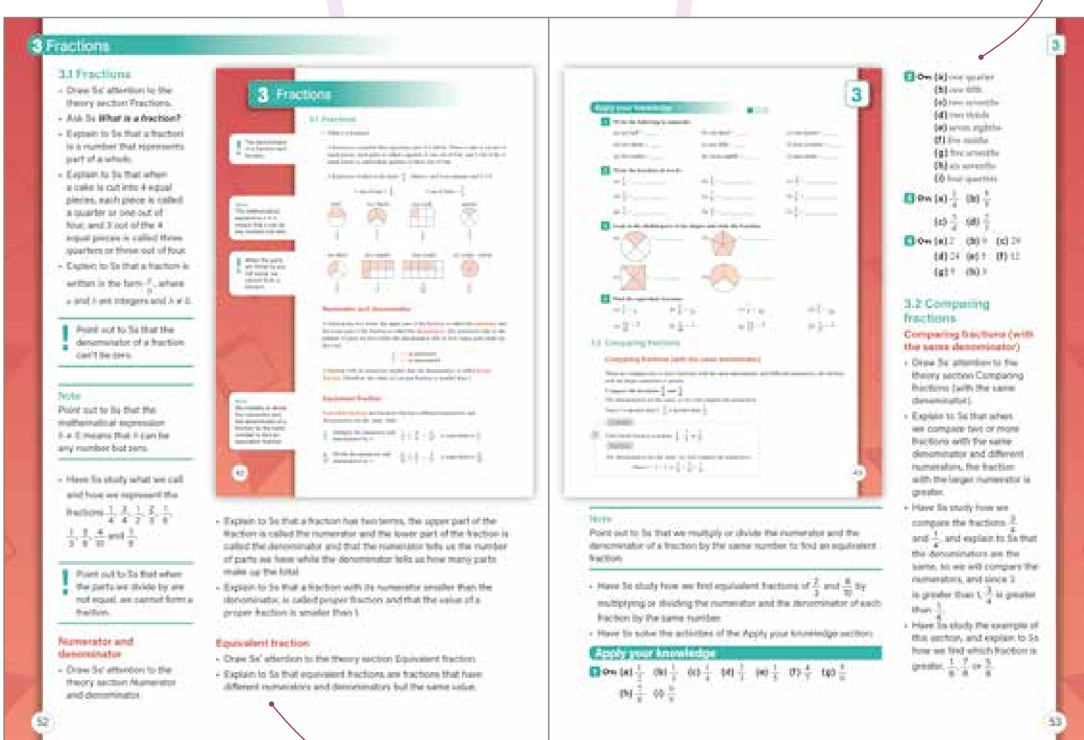




Two Review sections, in the middle and at the end of the Workbook, designed to provide the students with an opportunity to review and consolidate the main mathematical concepts and processes taught in the series.

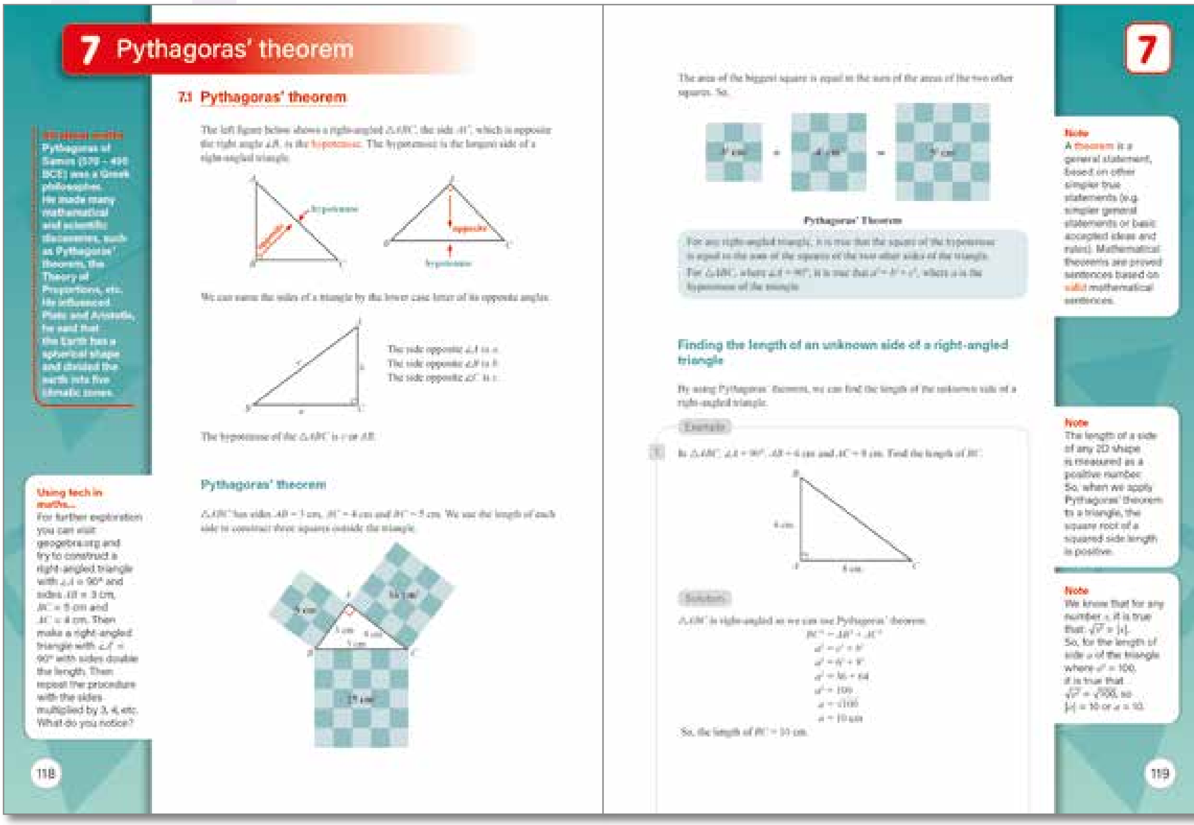
Map of the units shows the mathematical content of each unit and enables teachers to monitor the progression of knowledge throughout the units.

Answers to each activity of the Student's Book.

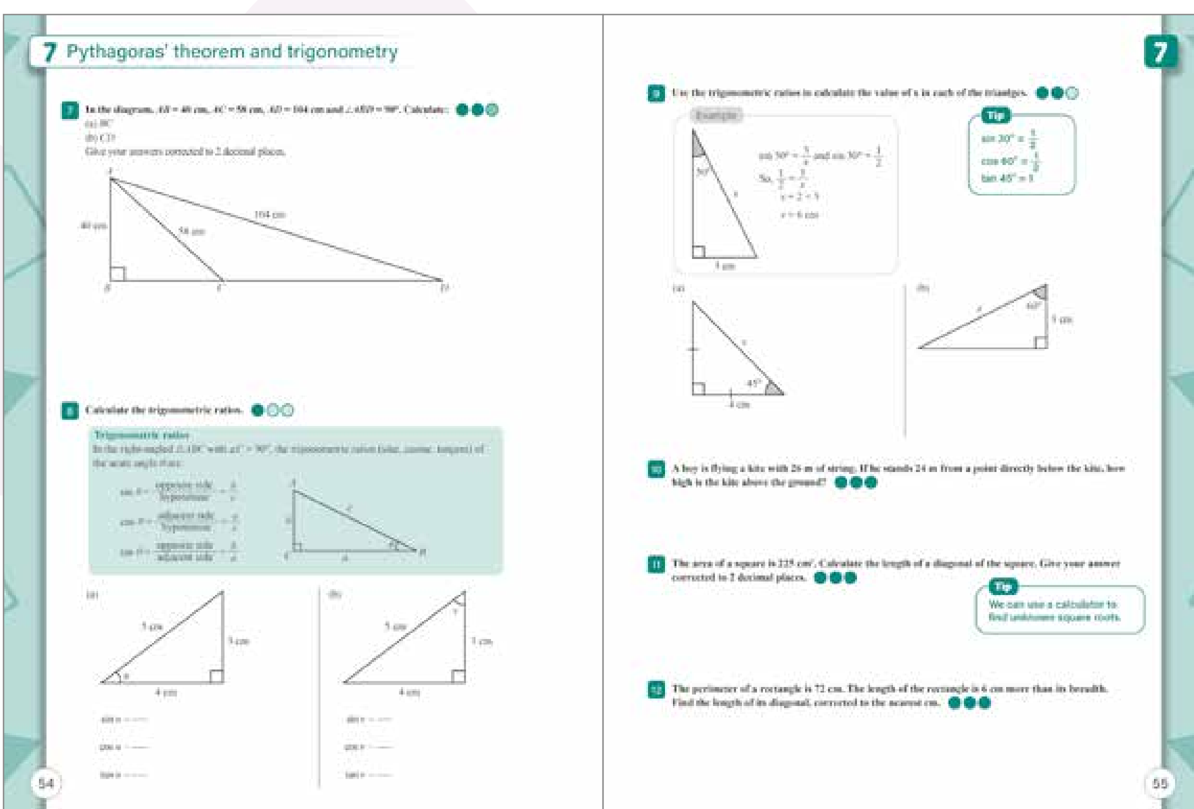


Step-by-step guidelines for the corresponding Student's Book theory section and teaching notes facilitating the teaching of the new concepts and processes.

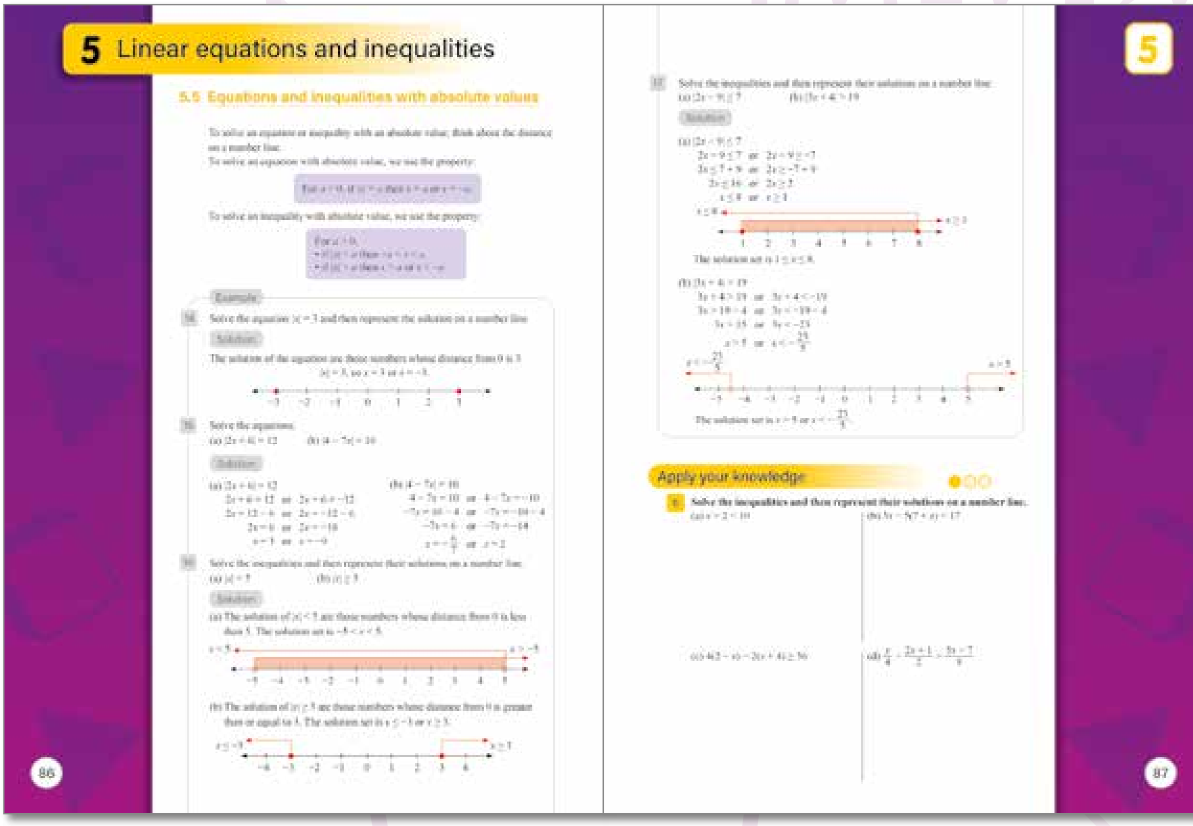
Sample page • Student's Book • Let's Explore! Maths 2



Sample page • Workbook • Let's Explore! Maths 2



Let's Explore! Maths 3 • Student's Book • Sample page


5 Linear equations and inequalities

5.5 Equations and inequalities with absolute values

Example

Solution

Apply your knowledge

86

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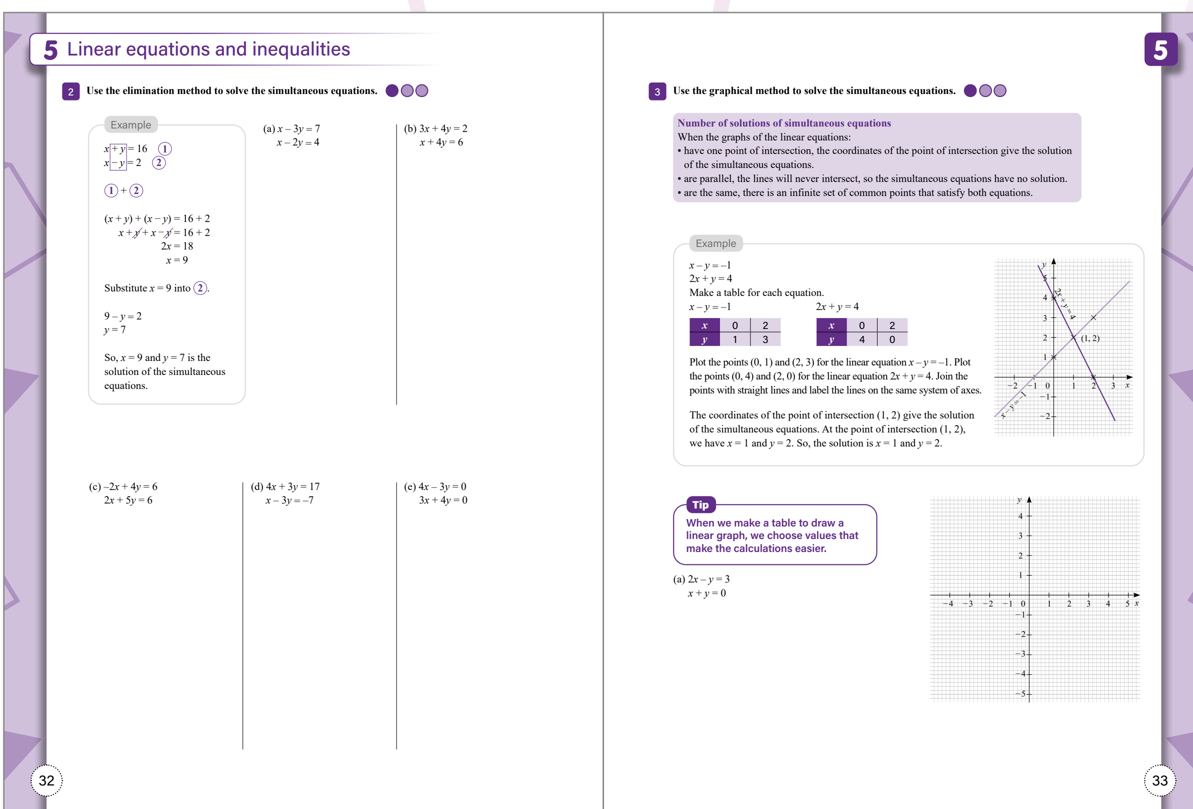
Let's Explore! Maths 3 • Workbook • Sample page


5 Linear equations and inequalities

2 Use the elimination method to solve the simultaneous equations.

Example

$x + y = 16$ (1)
$x - y = 2$ (2)

(1) + (2)

$(x + y) + (x - y) = 16 + 2$
$x + y + x - y = 16 + 2$
$2x = 18$
$x = 9$

Substitute $x = 9$ into (2).

$9 - y = 2$
$y = 7$

So, $x = 9$ and $y = 7$ is the solution of the simultaneous equations.

(a) $x - 3y = 7$
$x - 2y = 4$

(b) $3x + 4y = 2$
$x + 4y = 6$

(c) $-2x + 4y = 6$
$2x + 5y = 6$

(d) $4x + 3y = 17$
$x - 3y = -7$

(e) $4x - 3y = 0$
$3x + 4y = 0$

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5

3 Use the graphical method to solve the simultaneous equations.

Number of solutions of simultaneous equations
When the graphs of the linear equations:
- have one point of intersection, the coordinates of the point of intersection give the solution of the simultaneous equations.
- are parallel, the lines will never intersect, so the simultaneous equations have no solution.
- are the same, there is an infinite set of common points that satisfy both equations.

Example

$x - y = -1$
$2x + y = 4$
Make a table for each equation.

$x - y = -1$

x	0	2
y	1	3

$2x + y = 4$

x	0	2
y	4	0

Plot the points (0, 1) and (2, 3) for the linear equation $x - y = -1$. Plot the points (0, 4) and (2, 0) for the linear equation $2x + y = 4$. Join the points with straight lines and label the lines on the same system of axes.

The coordinates of the point of intersection (1, 2) give the solution of the simultaneous equations. At the point of intersection (1, 2), we have $x = 1$ and $y = 2$. So, the solution is $x = 1$ and $y = 2$.

Tip
When we make a table to draw a linear graph, we choose values that make the calculations easier.

(a) $2x - y = 3$
$x + y = 0$

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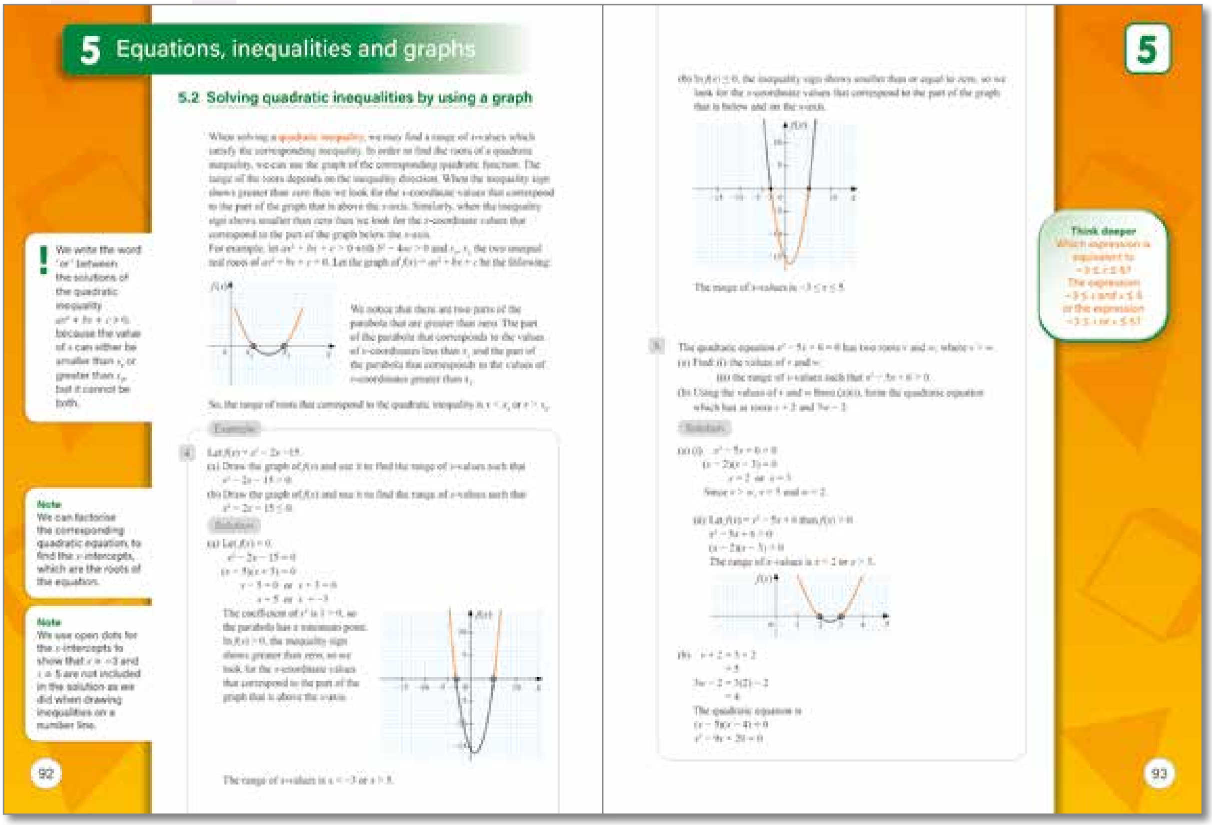
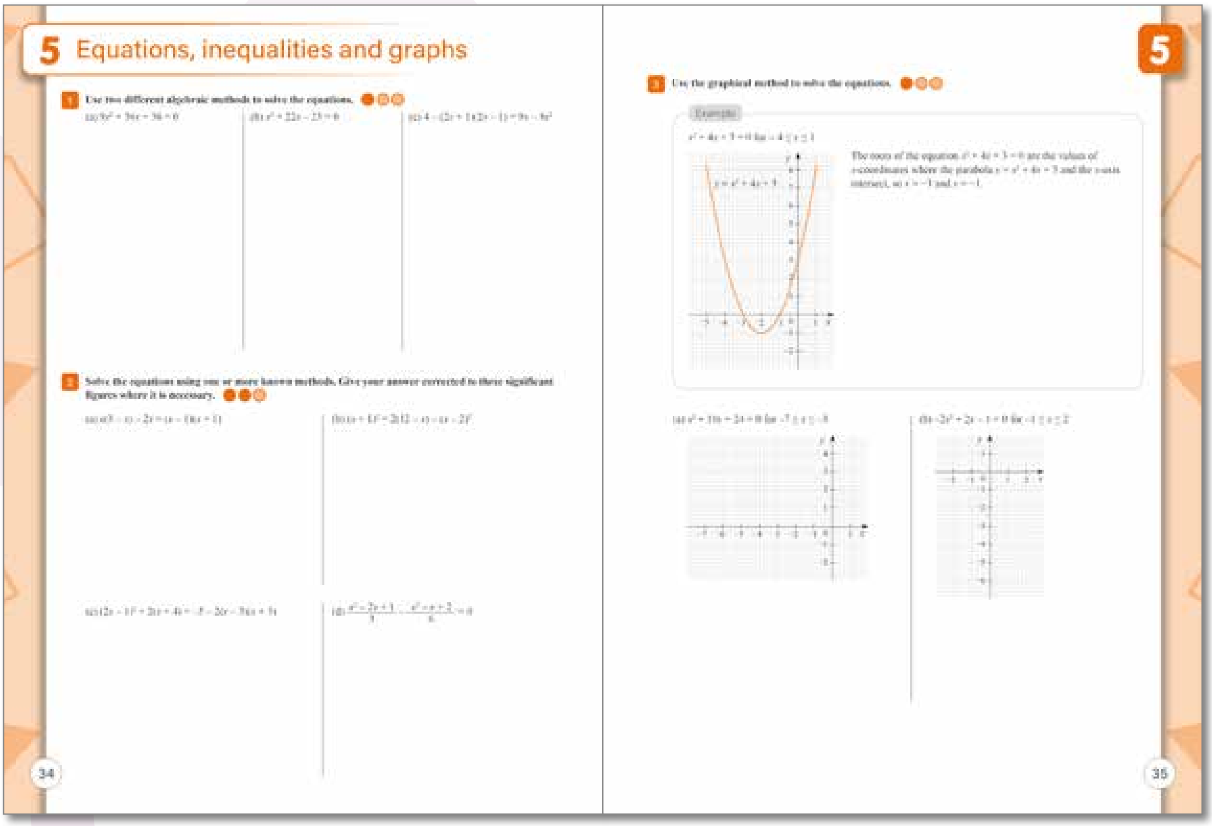
Sample page • **Student's Book** • Let's Explore! Maths 4

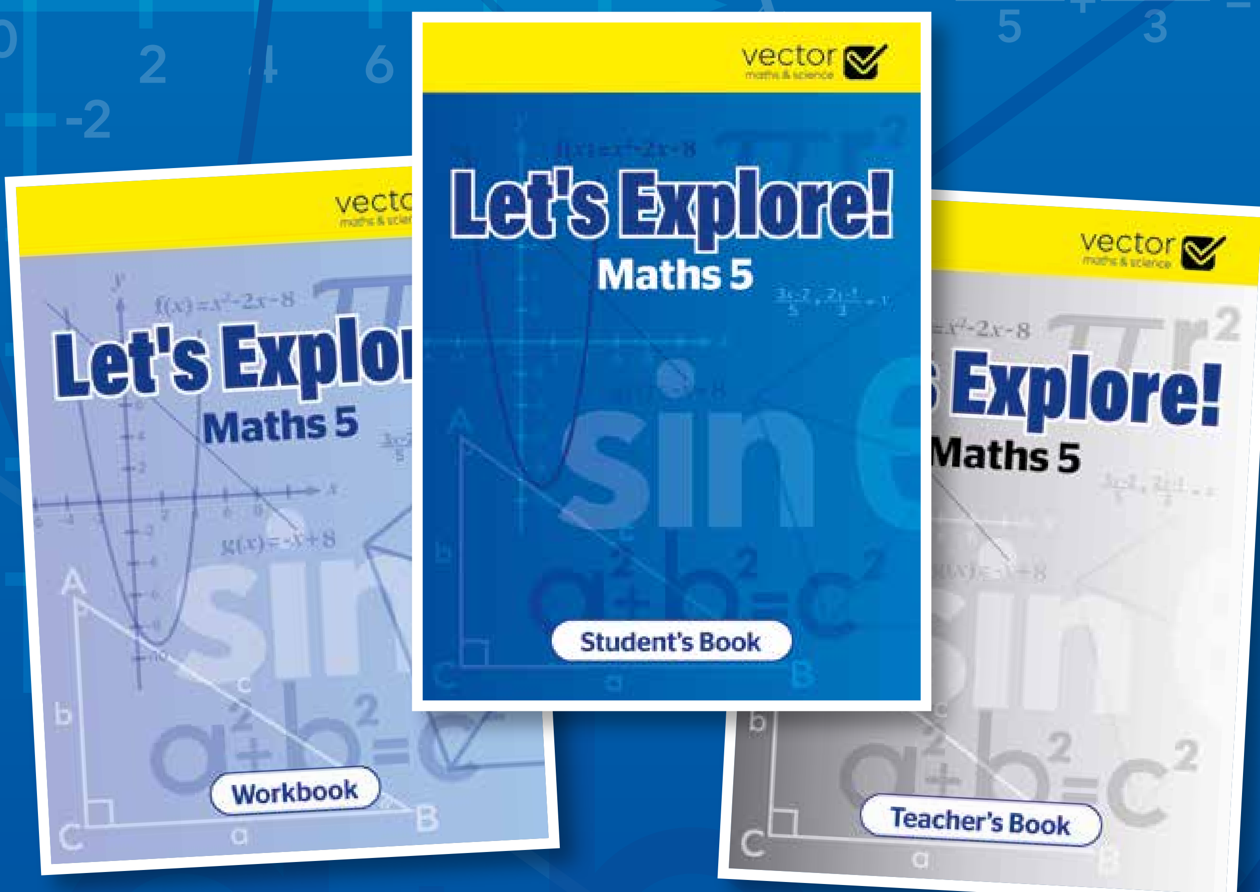


Sample page • **Workbook** • Let's Explore! Maths 4



Let's Explore!

Maths 5



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Let's Explore!

Maths

Levels 1 - 5

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