Year 9 Higher Mathematics

Curriculum Overview

Autumn 1
Fractions and Decimals
Statistical Measures
Area of 2D Shapes

Autumn 2
3D Shapes
Algebraic Expressions
Ratio and Proportion

Spring 1
Linear Graphs
Representing Data

Spring 2
Angles
Collecting Data

Summer 1
Transformations
Solving Equations
Scatter Graphs

Summer 2
Constructions
Pythagoras' Theorem

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Contents

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Fractions and Decimals

Students learn how to solve problems with long multiplication and division using written methods. They use this knowledge to add, subtract, multiply and divide with fractions and mixed numbers.

Prerequisite Knowledge

- express one quantity as a fraction of another, where the fraction is less than 1 or greater than 1
- interpret fractions as operators
- estimate answers; check calculations using approximation and estimation, including answers obtained using technology
- order positive and negative decimals

Success Criteria

- apply the four operations, including formal written methods, simple fractions (proper and improper)
- express one quantity as a fraction of another, where the fraction is less than 1 or greater than 1
- apply the four operations, including formal written methods, to mixed numbers both positive and negative;
- calculate exactly with fractions

Key Concepts

- All rational numbers are written using exact proper or improper fractions.
- When adding or subtracting fractions the denominators need to be equal.
- Dividing fractions is equivalent to multiplying by a reciprocal.
- When calculating with decimal numbers encourage students to estimate the solution as means to check their working.
- Students may need to recap multiplying and diving by powers of ten when calculating the product of decimal numbers.
- Use equivalent fractions when performing long division. Simplifying the fractions help to break down the calculation.

Common Misconceptions

- A fraction with a smaller denominator has a lesser value.
- Fractions such as 3/5 can incorrectly assumed to have a decimal equivalence of 3.5.
- Students incorrectly consider multiplications to always increase a number and divisions to decrease.
- Students fail to spot incorrect calculations due to not estimating solutions.

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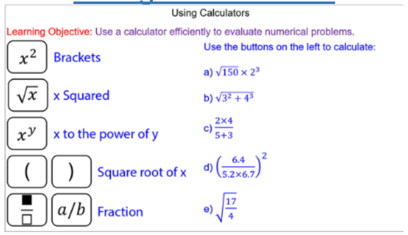
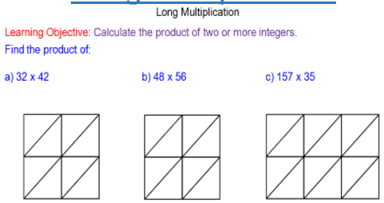
Lessons

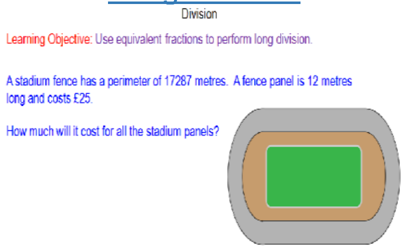
Using a Calculator



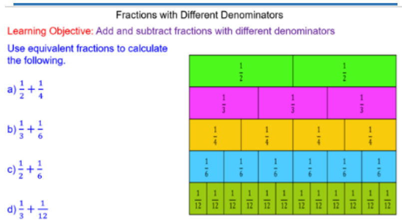
Long Multiplication



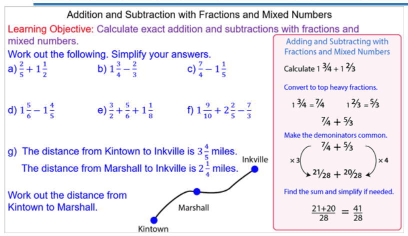
Long Division



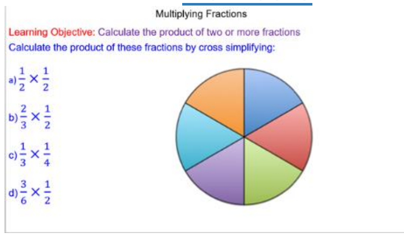
Adding and subtracting fractions with different denominators



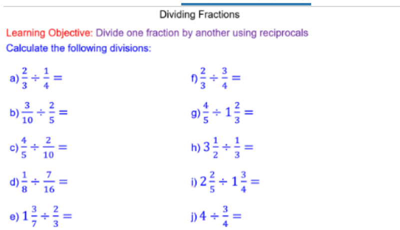
Addition and Subtraction with Fractions and Mixed Numbers



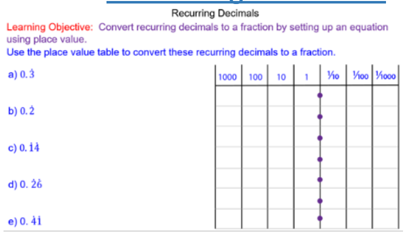
Multiplying Fractions and Mixed Numbers



Dividing Fractions and Mixed Numbers

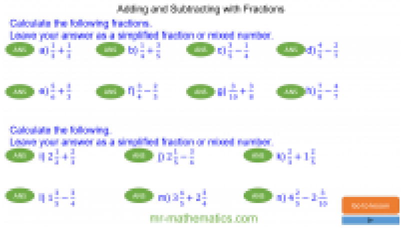


Recurring Decimals

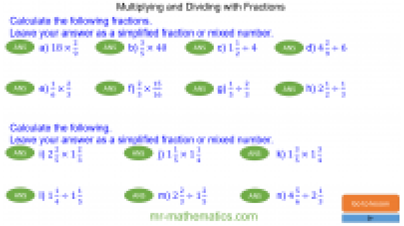


Problem Solving and Revision Lessons

Adding and Subtracting Fractions



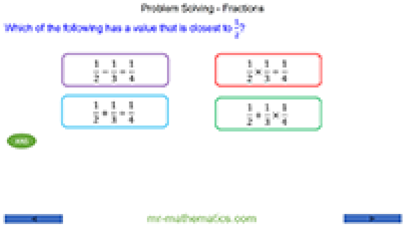
Multiplication and Division of Fractions



Product of Decimal Numbers

Division with Decimal Numbers

Problem Solving – Fractions



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Additional Departmental Resources

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Statistical Measures

Students learn how to calculate the area and circumference of circles. Later, as learning progresses, they find the composite area and perimeter of circular shapes, including sectors.

Prerequisite Knowledge

- Interpret and present discrete and continuous data using appropriate graphical methods, including bar charts and time graphs.
- Solve comparison, sum and difference problems using information presented in bar charts, pictograms, tables and other graphs.

Success Criteria

- Interpret, analyse and compare the distributions of data sets from univariate empirical distributions through:
- Appropriate graphical representation involving discrete, continuous and grouped data
- Appropriate measures of central tendency (median, mean, mode and modal class) and spread
- Construct and interpret stem and leaf diagrams
- Apply statistics to describe a population

Key Concepts

- A frequency table is used when the sample size increases beyond simple calculations being possible from a list.
- The median average of a class width is used as the mid-pint when calculating the mean from grouped data.

Common Misconceptions

- Students often find it difficult to calculate the median average from data presented in a frequency table.
- When sorting continuous data into a grouped data table students often struggle to fully understand the inequality notation.

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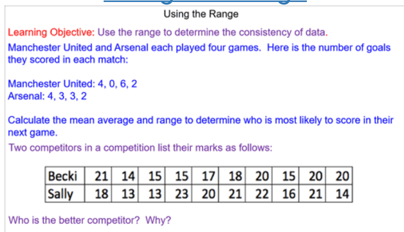
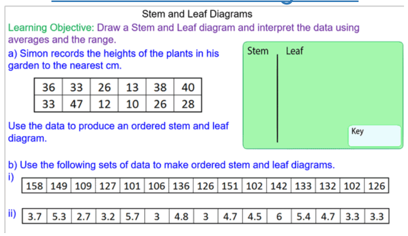
Lessons

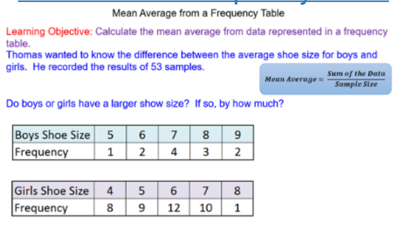
Using the Range



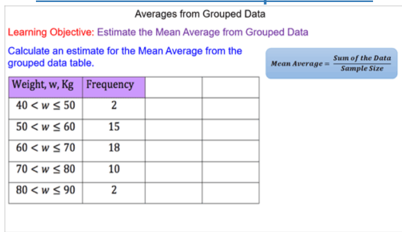
Stem and Leaf Diagrams



Mean from a Frequency Table

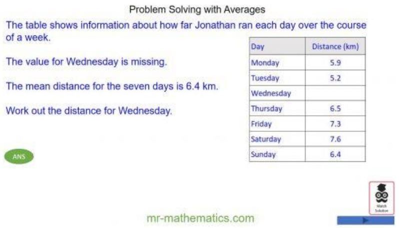


Mean from a Grouped Data

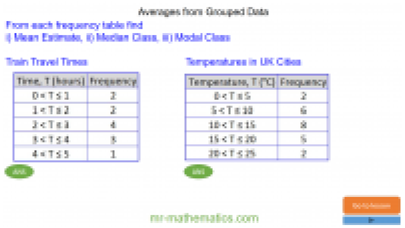


Problem Solving and Revision Lessons

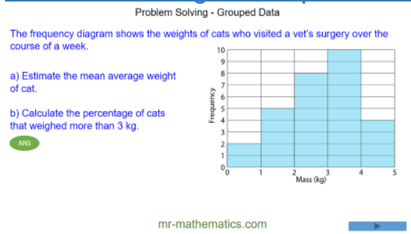
Problem Solving with Averages



Esimating the Mean from Grouped Data



Problem Solving – Grouped Data



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Area of 2D Shapes

Students learn how to find the area of various 2D shapes including parallelograms, trapezia, compound shapes and circles. Throughout the topic links are made to algebraic reasoning and estimation.

Prerequisite Knowledge

- Know and apply formulae to calculate the area of rectangles
- Calculate the perimeters of 2D shapes, including composite shapes;
- Compare and order lengths, mass, volume / capacity and record the results using >, < and =
- Measure, compare, add and subtract lengths (m/cm/mm); mass(kg/g); volume/capacity (l/ml)
- Identify and apply circle definitions and properties, including: centre, radius, chord, diameter, circumference, tangent, arc, sector and segment
-

Success Criteria

- Know and apply formulae to calculate: area of triangles, parallelograms and trapezia;
- Know the formulae: circumference of a circle = 2πr = πd, area of a circle = πr^2; calculate: perimeters of 2D shapes, including circles; areas of circles and composite shapes;
- Calculate arc lengths, angles and areas of sectors of circles

Key Concepts

- Demonstrate a triangle as being half a rectangle so students know to use the perpendicular height in their calculation. Demonstrate a parallelogram as having an equal area to a rectangle.
- To calculate the area of composite rectilinear shapes have students break them up in different ways.
- A sector is a fraction of 360° of the entire circle.

Common Misconceptions

- Students often confuse area and perimeter.
- When calculating the area of a triangle or parallelogram students tend to use the slanted height rather than the correct perpendicular height.
- Arc length and area of a sector are often rounded incorrectly. Encourage students to evaluate as a multiple of pi and calculate the decimal at the end.

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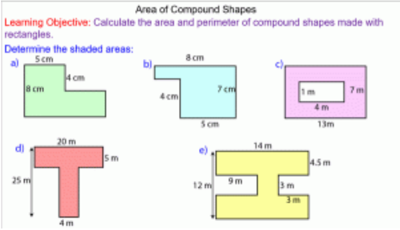
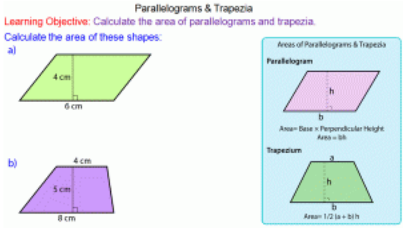
Lessons

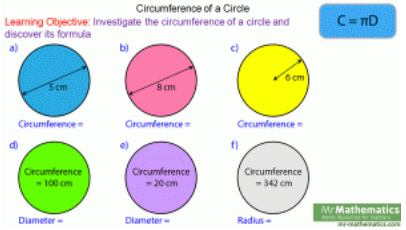
Area of Compound Shapes



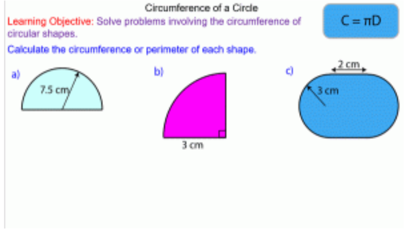
Parallelograms and Trapezia



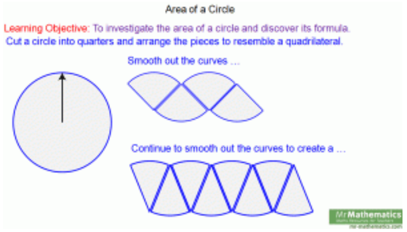
Circumference of Circles



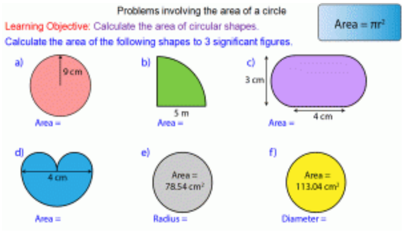
Circumference Problems



Area of a Circle



Area of Circle Problems



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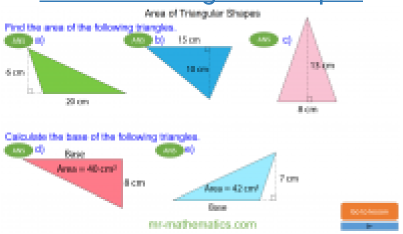
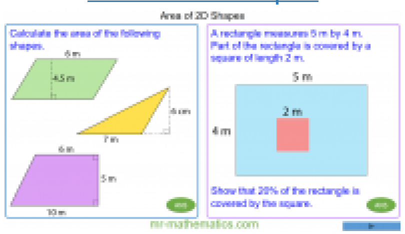
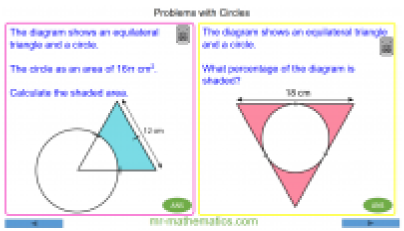
Area of Triangular Shapes



Area of 2D Shapes



Problems with Circles



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Additional Departmental Resources

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Drawing 3D Shapes

This topic teaches students how to draw them using isometric and elevation drawings. Learning progresses onto constructing nets of a range of solids.

Prerequisite Knowledge

- draw 2-D shapes and make 3-D shapes using modelling materials; recognise 3-D shapes in different orientations and describe them
- compare and classify geometric shapes, including quadrilaterals and triangles, based on their properties and sizes

Success Criteria

- identify properties of the faces, surfaces, edges and vertices of: cubes, cuboids, prisms, cylinders, pyramids, cones and spheres
- construct and interpret plans and elevations of 3D shapes.

Key Concepts

- Students need to understand the geometrical difference between a prism and pyramid.
- Horizontal lines are not drawn on isometric paper.
- Students need to sketch a solid from elevation drawings and vice-a-versa

Common Misconceptions

- Students often get confused which elevation to draw and how to include hidden detail.
- Some students find it difficult to draw 3D shapes on isometric paper. Encourage the use of multilink cubes to aid drawings.

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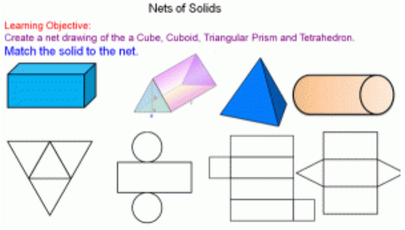
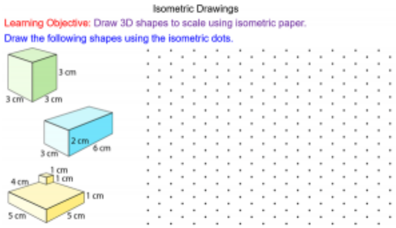
Lessons

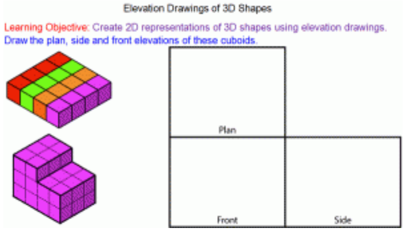
[Net Drawings](#)



[Isometric Drawings](#)

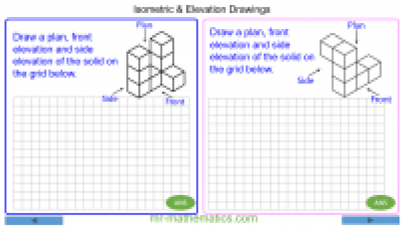


[Elevation Drawings](#)



Problem Solving and Revision Lessons

[Isometric and Elevation Drawings of 3D Shapes](#)



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Algebraic Expressions

Students learn how to expand and factorise algebraic linear and quadratic expressions. Learning progresses to expanding cubic and factorising quadratics in the form $ax^2 + bx + c$.

Prerequisite Knowledge

- ab in place of a × b
- 3y in place of 3 × y
- a^2 in place of a × a, a^3 in place of a × a × a and a^2b in place of a × a × b
- a/b in place of a ÷ b
- Coefficients written as fractions rather than decimals

Success Criteria

simplify and manipulate algebraic expressions by:

- Multiplying a single term over a bracket
- Taking out common factors
- Expanding products of two or more binomials
- Factorising quadratic expressions of the form $(a)x^2 + bx + c$, including the difference of two squares
- Simplifying expressions involving sums, products and powers including the laws of indices

Key Concepts

- Students need to appreciate that writing with algebra applies the rules of arithmetic to unknown numbers which are represented as letters.
- It is important to define the difference between an expression, equation and formula.
- Linear (x), quadratic (x2) and cube terms (x3) cannot be collected together.
- Understanding quadratics in the general form x2 + bx + c helps to factorise and expand expressions.
- Developing mental methods to factorise quadratics is key to gaining confidence with quadratics equations later on.

Common Misconceptions

- When multiplying out brackets students incorrectly forget to multiply the second term especially with negative products. E.g., 2(x + 5) = 2x + 10 and -2(x + 5) = -2x – 10
- When factorising expressions, a common misconception is to not fully factorise. E.g., 18x + 24y can be written as 9x + 12y
- When expanding the product of two or more brackets students often incorrectly collect the like terms associated to the linear unknown

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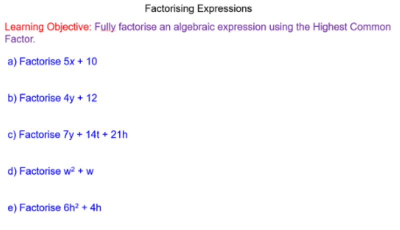
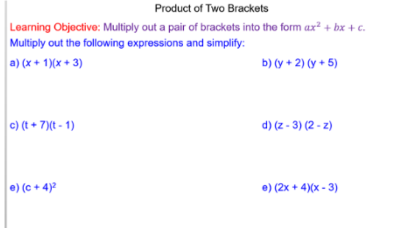
Lessons

Expanding Brackets

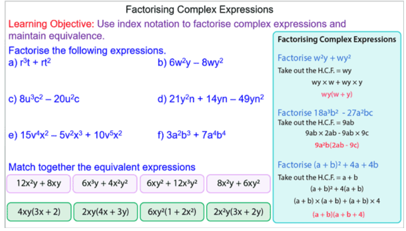
Factorising Terms



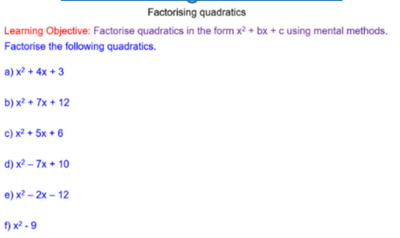
Expanding Quadratics



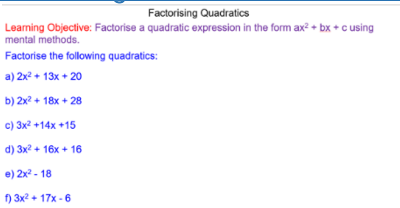
Factorising Expressions with Powers



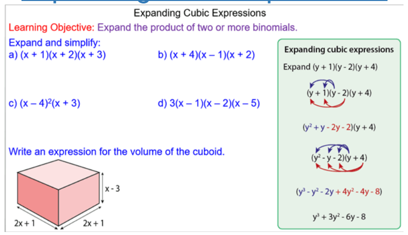
Factorising Quadratics



Factorising Quadratics $ax^2 + bx + c$

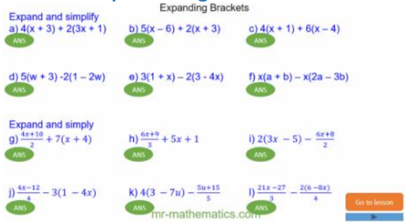


Expanding Cubic Expressions

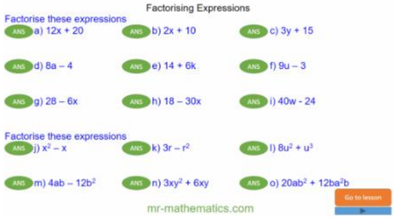


Problem Solving and Revision Lessons

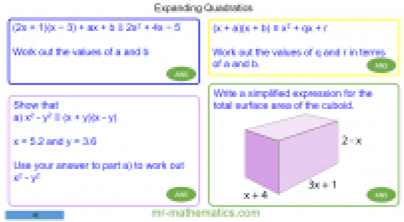
[Expanding Brackets]



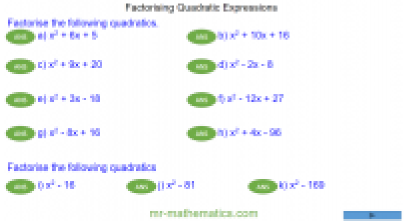
[Factorising Expressions]



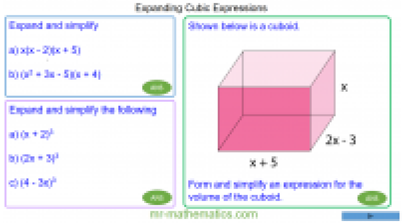
[Expanding Quadratics]



[Factorising Quadratics]



[Expanding Cubics]



Additional Departmental Resources

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Ratio and Proportion

Students learn how to simplify and use equivalent ratios to calculate proportionate amounts. They use this knowledge to share an amount using a ratio.

Prerequisite Knowledge

- solve problems involving the relative sizes of two quantities where missing values can be found by using integer multiplication and division facts
- solve problems involving the calculation of percentages
- solve problems involving unequal sharing and grouping using knowledge of fractions and multiples

Success Criteria

- use ratio notation, including reduction to simplest form
- express a multiplicative relationship between two quantities as a ratio
- understand and use proportion as equality of ratios
- relate ratios to fractions
- express the division of a quantity into two parts as a ratio
- apply ratio to real contexts and problems (such as those involving conversion, comparison, scaling, mixing, concentrations)
- understand and use proportion as equality of ratios

Key Concepts

- It is important for students to visualise equivalent and ratios by categorising objects and breaking them down into smaller groups.
- It is important to apply equivalent ratios when solving problems involving proportion. Including the use of the unitary method.
- To share amount given a ratio it is necessary to find the value of a single share.
- When two or more measurements increase at a linear rate they are in direct proportion. Inverse proportion is when one increases at the same rate the other decreases.

Common Misconceptions

- Ratios amounts are often confused with fractions involving the same digits. For instance 2 : 3 is confused with 2⁄3 or 1 : 2 = 1⁄2.
- When solving problems involving proportion students tend to struggle with forming a ratio. For instance, 3 apples cost 45p would form the ratio apples : cost.
- When writing ratios into the form 1 : n students incorrectly assume that n has to be an integer or greater than 1.

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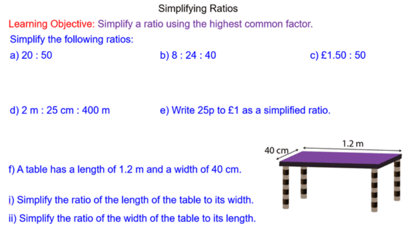
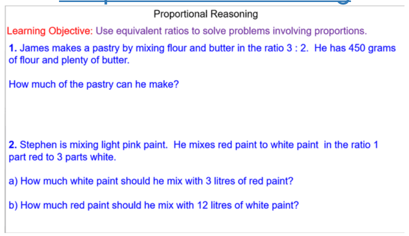
Lessons

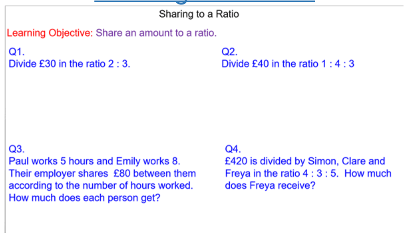
Simplifying Ratios



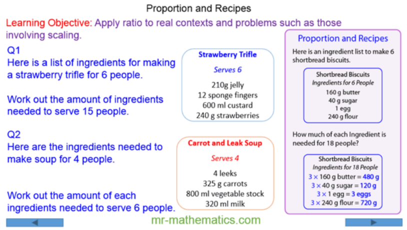
Proportional Reasoning



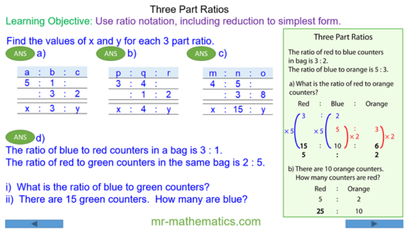
Sharing to a Ratio



Proportion and Recipes

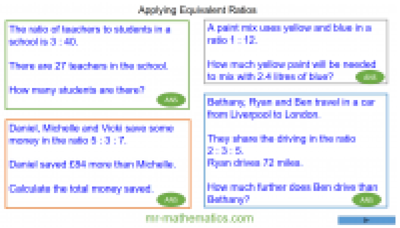


3-Part Ratios



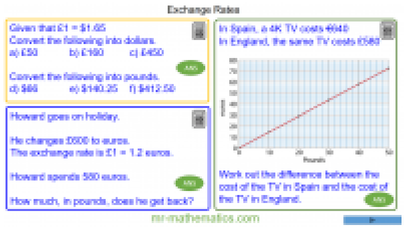
Problem Solving and Revision Lessons

Equivalent Ratios

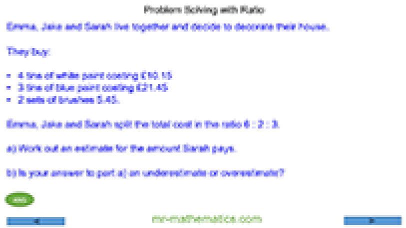


Sharing to a Ratio

Calculating Exchange Rates



Problem Solving with Ratio



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Additional Departmental Resources

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Equations of Straight-Line Graphs

Students learn how to plot and derive the equation of straight-line graphs in the form y = mx + c. Learning progresses on from this to find the equation of parallel and perpendicular lines in the form ax + by +c = 0.

Prerequisite Knowledge

- Recognise and describe linear number sequences, including those involving fractions and decimals, and find the term-to-term rule.
- Generate and describe linear number sequences

Success Criteria

- Plot graphs of equations that correspond to straight-line graphs in the coordinate plane;
- Use the form y = mx + c to identify parallel lines
- Find the equation of the line through two given points, or through one point with a given gradient
- Identify and interpret gradients and intercepts of linear functions graphically and algebraically

Key Concepts

- Gradient is a measure of rate of vertical change divided by horizontal change.
-
- Parallel lines have the same gradient
- The intercept always has the x value equal zero.

Common Misconceptions

- Students often confuse linear graphs to have the same notation as statistical graphs.
- The gradient can be calculated from any two points along the graph. Not necessarily from the origin.
- A linear function does not have to pass through the origin.
- It is beneficial to create a table of results when plotting a linear function. The coordinate pairs arise from the x and y values.

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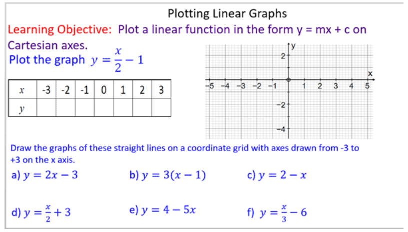
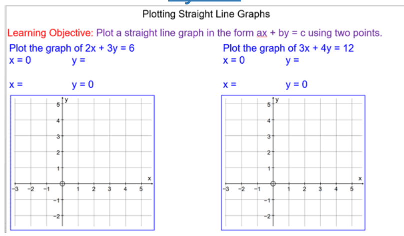
Lessons

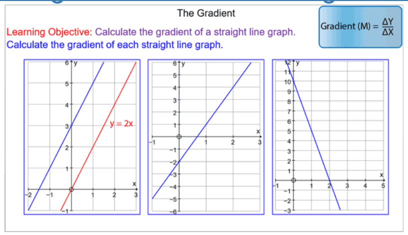
Plotting Straight Line Graphs y = mx + c



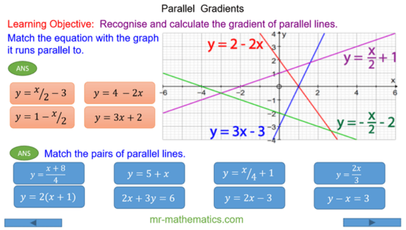
Straight Line Graphs in the Form ax + by = c



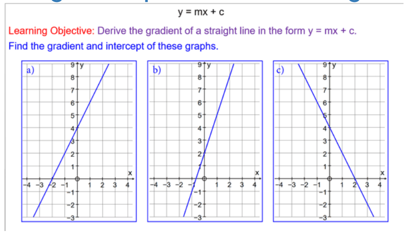
Finding the Gradient of Straight Lines



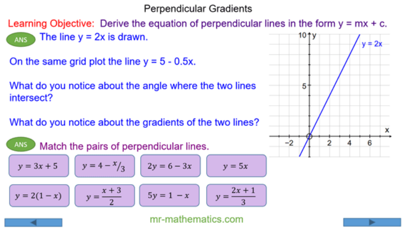
Gradient of Parallel Lines



Deriving the Equation of a Straight Line

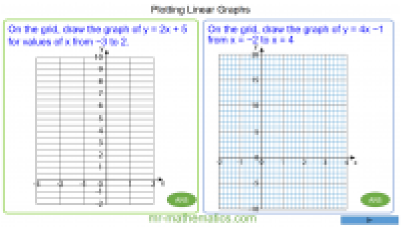


Gradient of Perpendicular Lines

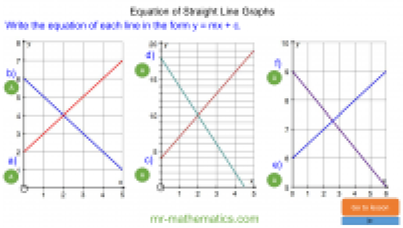


Problem Solving and Revision Lessons

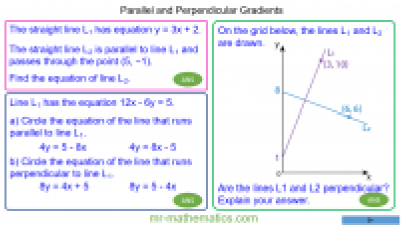
Plotting Linear Graphs



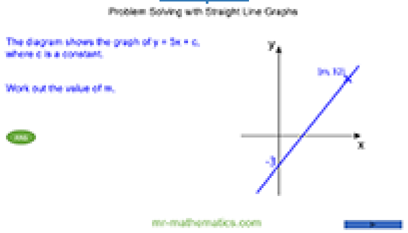
Equation of Straight Line Graphs



Perpendicular and Parallel Gradients



Problem Solving – Straight Line Graphs



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Plotting and Interpreting Statistical Diagrams

Students learn how to plot and interpret various statistical diagrams ranging from pie charts to histograms with unequal class widths. Throughout the unit emphasis is place on interpreting the diagrams as much as it is plotting them.

Prerequisite Knowledge

- Interpret and construct:
    - frequency tables
    - bar charts
    - pictograms
- for categorical data.
- Construct and interpret stem and leaf diagrams
- Apply statistics to describe a population

Key Concepts

- Students need to spend time interpreting the diagrams as well as creating them.
- When using pie charts to compare distributions the frequency of corresponding sectors is dependent on the total sample size.
- Frequency diagrams are used to represent discrete data whereas histograms are used for continuous data.
- Histograms with unequal class widths represent data with an unequal spread. Frequency is found using the area of a bar rather than its height.
- Cumulative frequency is the running total of the frequency.
- The interquartile range (IQR) shows the boundaries of where the most representative data is located.

Success Criteria

- Infer properties of populations or distributions from a sample, whilst knowing the limitations of sampling
- Interpret and construct tables and line graphs for time series data and know their appropriate use
- construct and interpret diagrams for grouped discrete data and continuous data, i.e. histograms with equal and unequal class intervals and cumulative frequency graphs, and know their appropriate use.

Common Misconceptions

- Histograms are often confused with frequency diagrams.
- Students tend to be more competent with constructing the various representations than using them to analyse and make summative comments about distributions.

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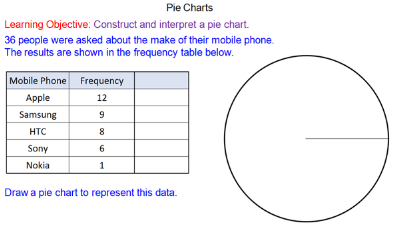
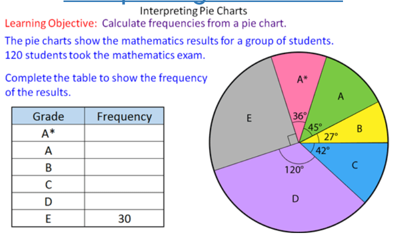
Lessons

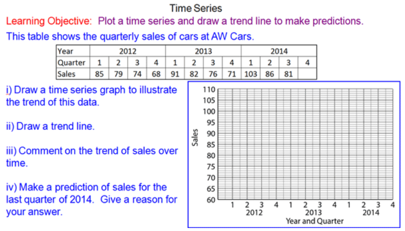
Drawing Pie Charts



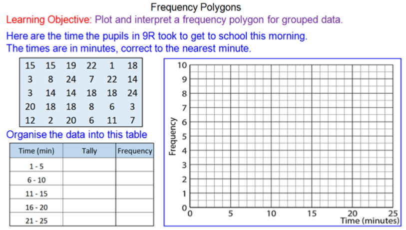
Interpreting Pie Charts



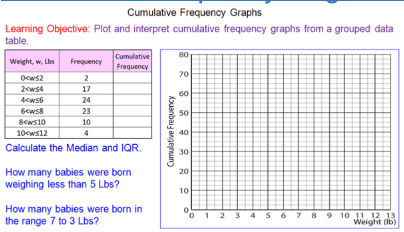
Plotting Time Series



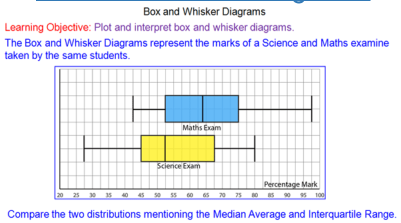
Frequency Diagrams and Polygons



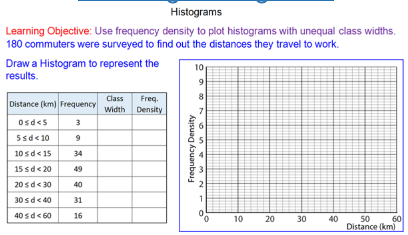
Cumulative Frequency Diagrams



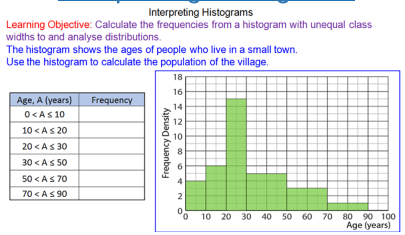
Box and Whisker Diagrams



Drawing Histograms

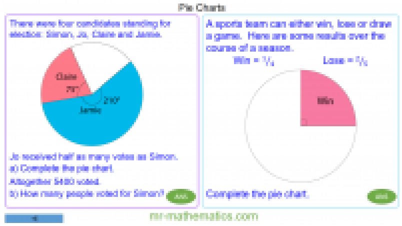


Interpreting Histograms

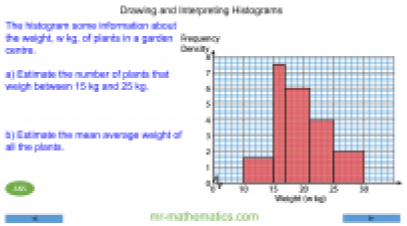


Problem Solving and Revision Lessons

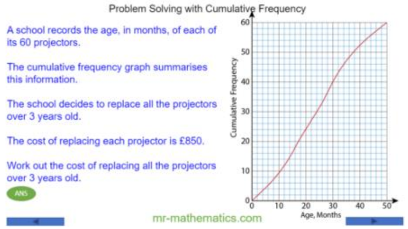
Pie Charts



Histograms



Problem Solving with Cumulative Frequency Graphs



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Additional Departmental Resources

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Angle Geometry

Students learn how to discover various angle properties such as angles on a straight line, about a point, in a triangle and on parallel lines. As learning progresses, they are challenged to construct polygons and solve problems involving their interior and exterior angles.

Prerequisite Knowledge

- Know angles are measured in degrees: estimate and compare acute, obtuse and reflex angles
- Draw given angles, and measure them in degrees (°)
- Identify:
    - angles at a point and one whole turn (total 360°)
    - angles at a point on a straight line and 1/2 a turn (total 180°)
    - other multiples of 90°
- Apply the properties of angles at a point, angles at a point on a straight line, vertically opposite angles;

Key Concepts

- Rather than being told (or given) angle properties students should have the opportunity to discover and make sense of them practically.
- Geometric problems can often be solved using various angle properties. Encourage students to look for and apply alternative properties.
- Demonstrate how a polygon is made up from interior triangles when calculating their angles.
- Bearings always go clockwise from North and have three digits. North lines are parallel.

Success Criteria

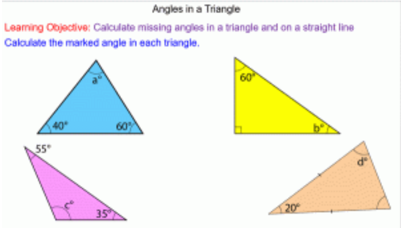
- Understand and use alternate and corresponding angles on parallel lines;
- Derive and use the sum of angles in a triangle (e.g. to deduce use the angle sum in any polygon, and to derive properties of regular polygons)
- Measure line segments and angles in geometric figures, including interpreting maps and scale drawings and use of bearings

Common Misconceptions

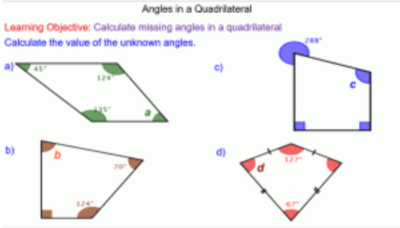
- Students often forget the definition of properties associated to angles in parallel lines.
- Exterior angles in a polygon have to travel in the same direction for the sum to be 360°.

Lessons

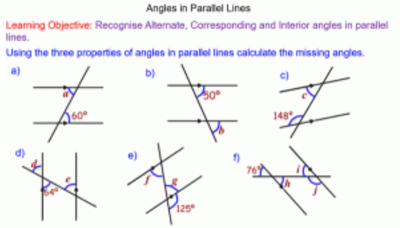
[Angles in a Triangle](#)



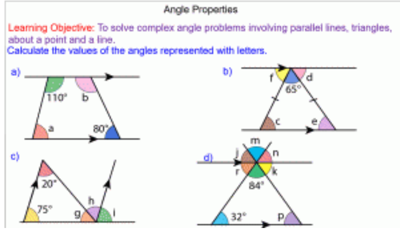
[Angles in a Quadrilateral](#)



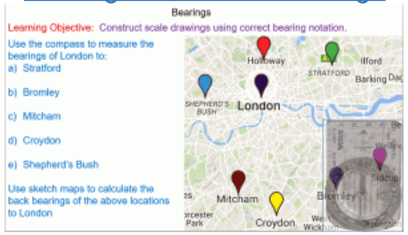
[Angles in Parallel Lines](#)



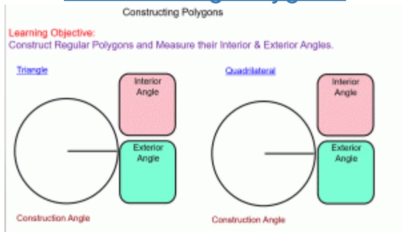
[Problems with Parallel Lines](#)



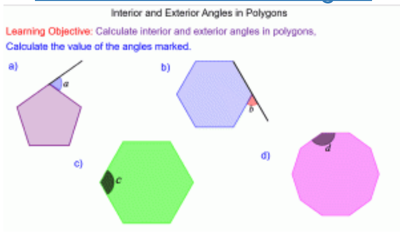
[Bearings and Scale Drawings](#)



[Constructing Polygons](#)

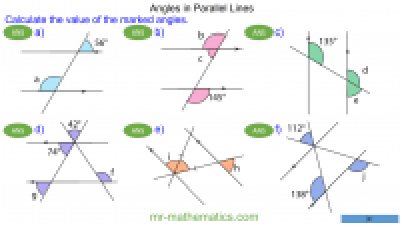


[Interior and Exterior Angles](#)

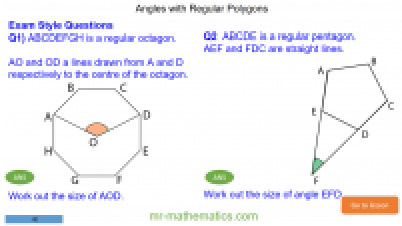


Problem Solving and Revision Lessons

[Angles in Parallel Lines](#)



[Angles in Regular Polygons](#)



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Collecting Data

Students learn how to design a questionnaire without bias to collect primary qualitative and quantitative data sets. As learning progresses, they use stratified sampling to determine sample size and how to design two-way tables and frequency trees to organise these data.

Prerequisite Knowledge

- Interpret and construct statistical diagrams for discrete and continuous data and know their appropriate use.
- interpret, analyse and compare the distributions of data sets from univariate empirical distributions through:
  - appropriate graphical representation involving discrete, continuous and grouped data
  - appropriate measures of central tendency (median, mean, mode and modal class) and spread

Success Criteria

- Infer properties of populations or distributions from a sample, whilst knowing the limitations of sampling.
- apply statistics to describe a population
- Interpret, analyse and compare the distributions of data sets from univariate empirical distributions through appropriate graphical representation involving discrete, continuous and grouped data.

Key Concepts

- Students need to understand the benefits of using two-way tables to exhaustively cover each outcome for multiple events and use them to calculate probabilities.
- When designing questionnaires students need to consider time periods, multiple check boxes which do not overlap and the need to collect a wide-ranging sample to reduce bias.
- It is important to recognise the different statistical techniques that are used to analyse and represent qualitative, quantitative, discrete and continuous data.

Common Misconceptions

- Students often have difficulty designing two-way tables.
- When designing questionnaires common errors include:
  - No time period
  - Overlapping responses
  - Lack of ‘none’ or ‘other’ option.
  - Check boxes with unequal widths.
  - Double negative questions.
- Students often try to represent continuous data using methods that are only applicable for discrete sets.

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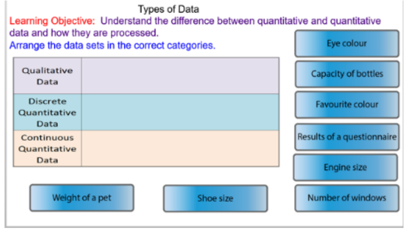
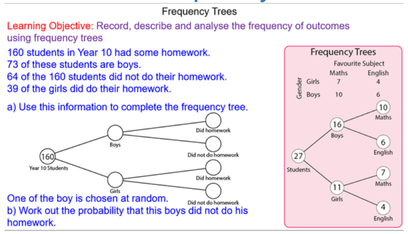
Lessons

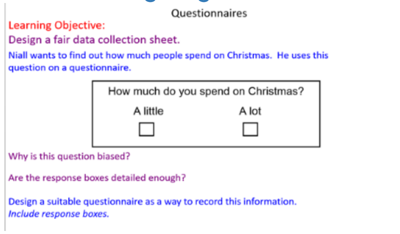
Types of Data



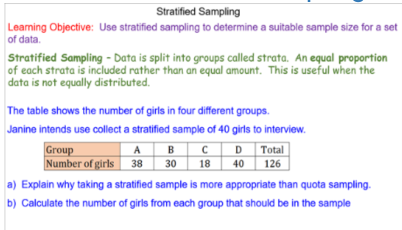
Frequency Trees



Designing Questionnaires

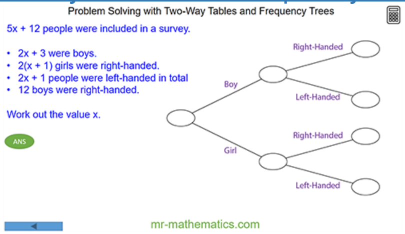


Stratified Sampling



Problem Solving and Revision Lessons

Two-Way Tables and Frequency Trees



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Additional Departmental Resources

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Performing and Describing Transformations

At the start of this unit students learn how to perform and describe reflections, rotations, translations and enlargements on a grid. As learning progresses, they are challenged to describe a combination of transformations using the correct terminology.

Prerequisite Knowledge

- Use conventional terms and notations: points, lines, vertices, edges, planes, parallel lines, perpendicular lines, right angles, polygons, regular polygons and polygons with reflection and/or rotation symmetries;
- Identify an order of rotational and reflective symmetry for two dimensional shapes
- Use the standard conventions for labelling and referring to the sides and angles of triangles; draw diagrams from written description
- Recognise linear functions in the form y = ± a and x = ±

Success Criteria

- Identify, describe and construct congruent and similar shapes, including on coordinate axes, by considering rotation, reflection, translation and enlargement (including fractional and negative scale factors)

Key Concepts

- An object is transformed to create an image.
- Rotation, Translation and Reflections involve congruent objects and images whereas enlargement leads to the object being similar to the image.
- Translation vectors are used to describe movements along Cartesian axes.
- When reflecting objects the image is always the same distance from the line of reflection as the object.
- Rotations and enlargements are constructed from a centre.
- A negative scale factor transforms the object through the centre.

Common Misconceptions

- Translation vectors can incorrectly be written using the name notation as coordinate pairs.
- Translations, Rotations, Enlargement and Reflections all come under the umbrella term of transformation. Students often confuse the term translation for transformation.
- Students often have more difficulty describing single transformations rather than performing them.
- Enlargements can involve making a shape smaller as well as bigger. Fractional scale factors between 0 and 1, not negative, decrease the size.

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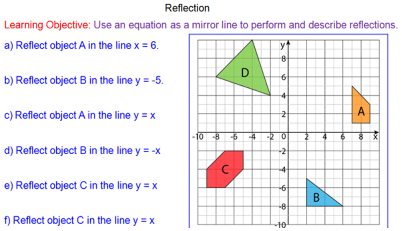
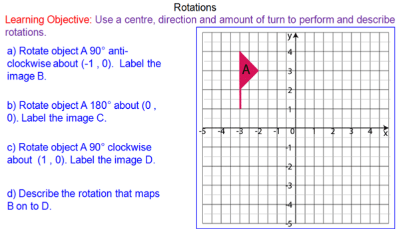
Lessons

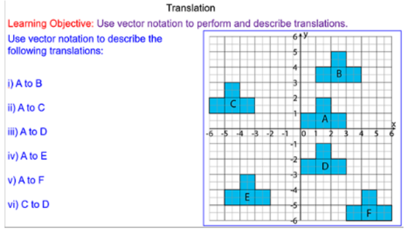
Reflections



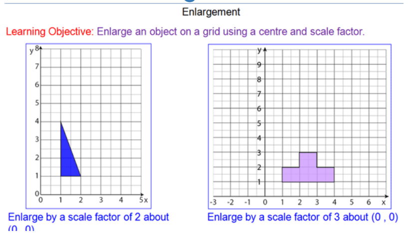
Rotations



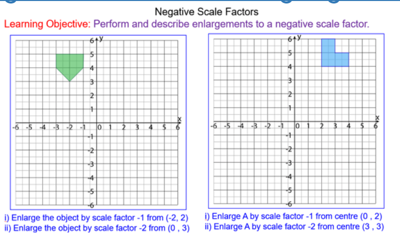
Translations



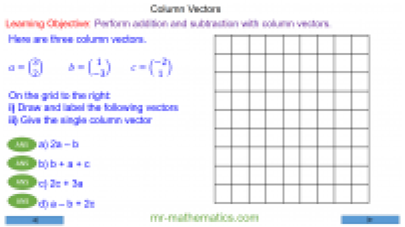
Enlargements



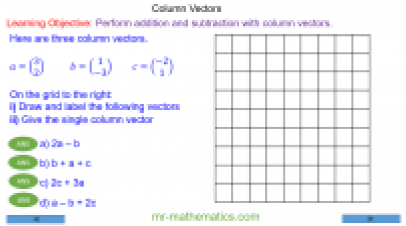
Negative Scale Factor Englargements



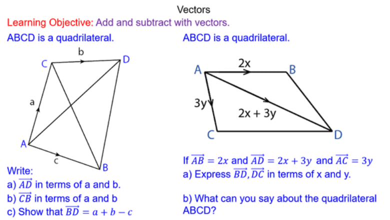
Describing Transformations



Addition and Subtraction with Column Vectors

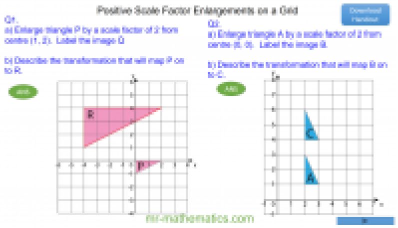


Vector Notation

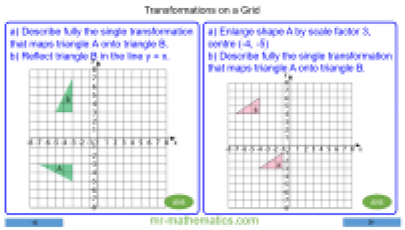


Problem Solving and Revision Lessons

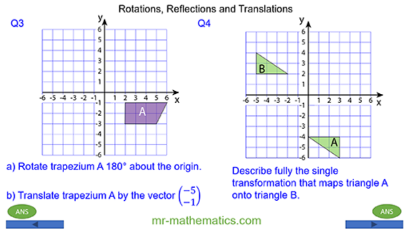
Enlargements on a Grid



Performing and Describing Transformations



Rotations, Translations and Reflections



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Solving Linear Equations

Students learn how to solve an equation using the balance method and trial and improvement. As learning progresses, they are taught how to form and solve a pair of simultaneous equations from known geometrical facts and real-life problems.

Prerequisite Knowledge

- Use simple formulae
- Generate and describe linear number sequences
- Express missing number problems algebraically
- Find pairs of numbers that satisfy an equation with two unknowns
- Use and interpret algebraic notation
- Simplify and manipulate algebraic expressions by:
    - collecting like terms
    - multiplying a single term over a bracket

Key Concepts

- To solve an equation is to find the only value (or values) of the unknown that make the mathematical sentence correct.
- For every unknown an equation is needed.
- Students need to have a secure understanding of adding and subtracting with negatives when eliminating an unknown.
- Coefficients need to be equal in magnitude to eliminate an unknown

Success Criteria

- Solve linear equations in one unknown algebraically (including those with the unknown on both sides of the equation)
- Solve two simultaneous equations in two variables algebraically;
- Find approximate solutions to simultaneous equations in two variables using a graph;
- solve linear equations in one unknown algebraically (including those with the unknown on both sides of the equation)
- Translate simple situations or procedures into algebraic expressions or formulae; derive an equation (or two simultaneous equations), solve the equation(s) and interpret the solution.

Common Misconceptions

- Students can forget to apply the same operation to both sides of the equation therefore leaving it unbalanced.
- Students often struggle knowing when to add or subtract the equations to eliminate the unknown. Review addition with negatives to address this.
- Equations need to be aligned so that unknowns can be easily added or subtracted. If equations are not aligned students may add or subtract with non like variables.
- Students often try to eliminate variables with their coefficients being equal.

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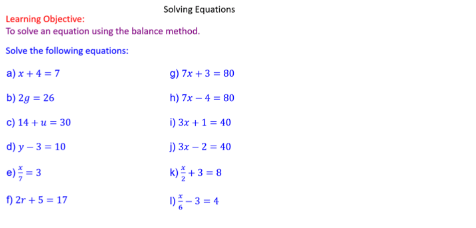
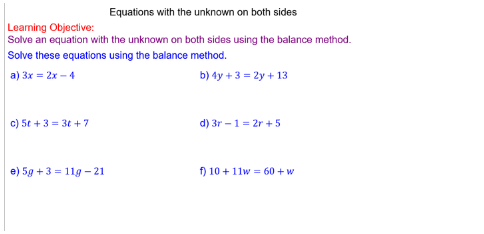
Lessons

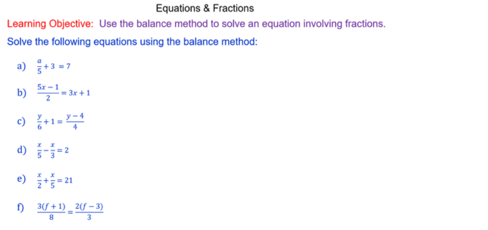
[Equations and the Balance Method](#)



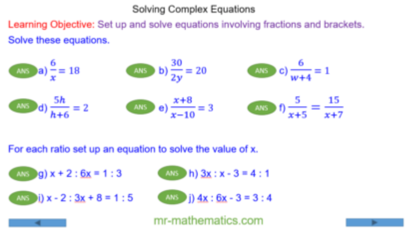
[Unknown on Both Sides](#)



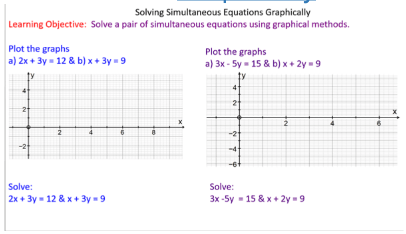
[Equations and Fractions](#)



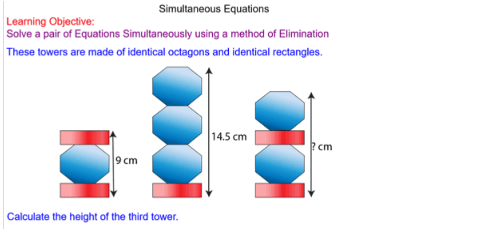
[Complex Linear Equations](#)



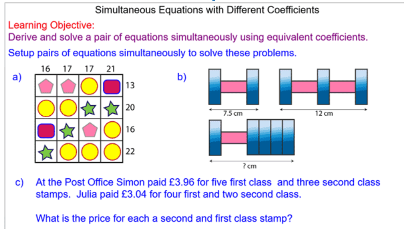
[Solving Simultaneous Equations Graphically](#)



[Solving Simultaneous Equations using the Elimination Method](#)



[Problems with Simultaneous Equations](#)



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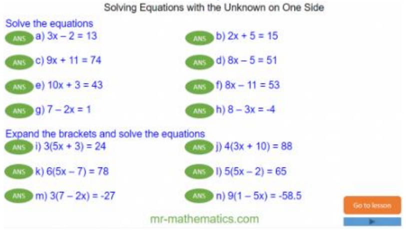
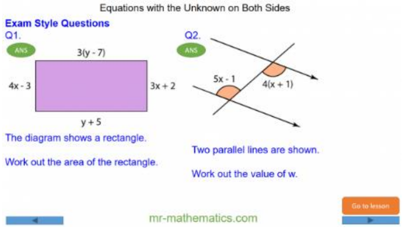
Problem Solving and Revision Lessons

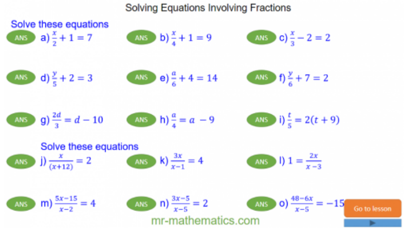
Solving Equations



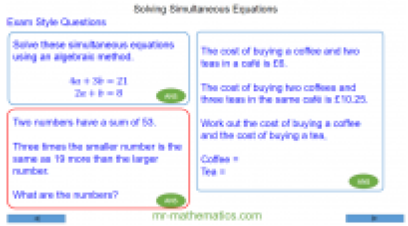
Solving Equations with the Unknown on Both Sides



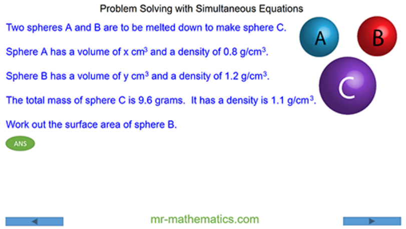
Solving Equations with Fractions



Simultaneous Equations by Elimination



Problem Solving with Simultaneous Equations



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Additional Departmental Resources

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Scatter Graphs

Students learn how to plot and interpret a scatter graph. Learning progresses from using the line of best fit to find missing values to understanding whether correlation means causation.

Prerequisite Knowledge

- Solve comparison, sum and difference problems using information presented in a line graph
- Interpret and present discrete and continuous data using appropriate graphical methods, including bar charts and time graphs.
- Work with coordinates in all four quadrants

Key Concepts

- Scatter graphs need to be drawn on graph paper or using I.C.T to ensure accuracy and help identify the line of best fit.
- Two measurements are ‘associated’ if the points lie approximately along a straight line. This shows a linear relationship. However, an association between two variables can exist in a non-linear relationship.
- Correlation is used to describe the strength of a linear relationship between two variables. If no correlation exists (the points do not appear to follow a trend of direction) the two variables are considered to have no linear relationship.

Success Criteria

- apply statistics to describe a population
- use and interpret scatter graphs of bivariate data; recognise correlation and know that it does not indicate causation;
- draw estimated lines of best fit; make predictions; interpolate and extrapolate apparent trends whilst knowing the dangers of doing so.

Common Misconceptions

- Students often have difficulty choosing a suitable scale to use for each axis. Encourage the use of graph paper to ensure the graph is appropriately scaled.
- When drawing the line of best fit by eye it should represent the directional trend of the data. It does not have to intersect the origin or travel through every point.
- Correlation does not always imply a causal relationship since other factors could contribute.

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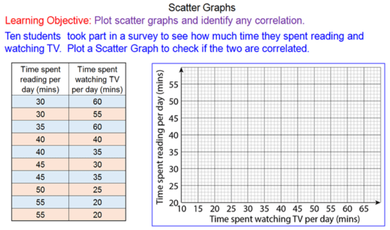
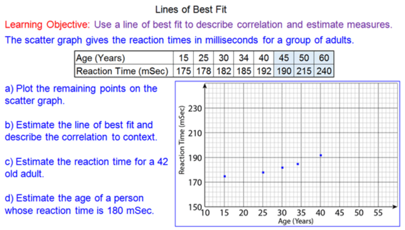
Lessons

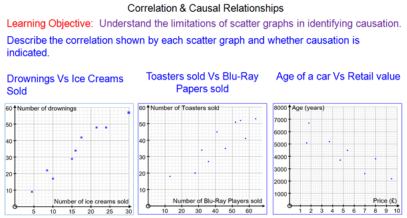
Plotting Scatter Graphs



Interpreting Scatter Graphs

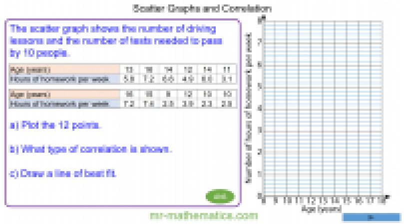


Causation Vs Correlation



Problem Solving and Revision Lessons

Scatter Graphs and Correlation



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Constructions and Loci

Students learn how to construct angle and line bisectors using a pair of compasses. Later, students apply this knowledge to solve problems involving loci about a point and line.

Prerequisite Knowledge

- Identify and construct a radius, diameter, circumference, area, chord, tangent and arc.
- Measure and begin to record lengths and heights
- Identify acute and obtuse angles and compare and order angles up to two right angles by size

Key Concepts

- It is important for students to sketch the diagram before attempting their construction. The sketch should be drawn freehand and contain all the necessary information.
- Bisectors are used to half an angle as well as a length of a line segment.
- Constructing a 60° angle using a pair of compasses is an essential skills throughout this topic as it goes on to equilateral triangles and reflex angles.

Success Criteria

- Identify and construct a radius, diameter, circumference, area, chord, tangent and arc.
- Measure and begin to record lengths and heights
- Identify acute and obtuse angles and compare and order angles up to two right angles by size

Common Misconceptions

- Students often have difficulty constructing smooth arcs using a pair of compasses. Encourage them to try different techniques such as rotating the paper rather than the compasses.
- It is important to leave in construction lines as these form the working out.

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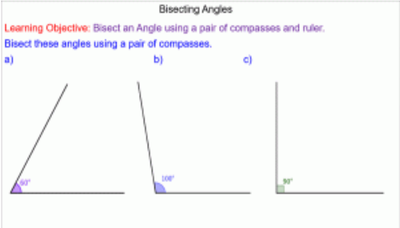
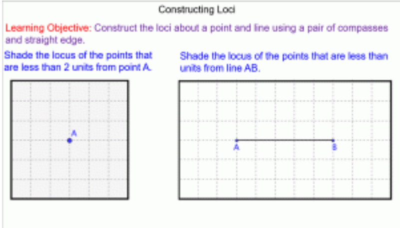
Lessons

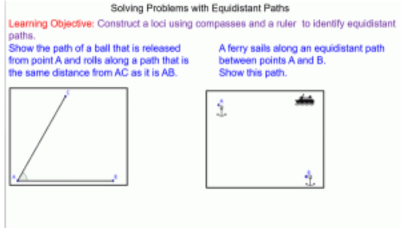
Constructing Bisectors



Locus about a Point and Line

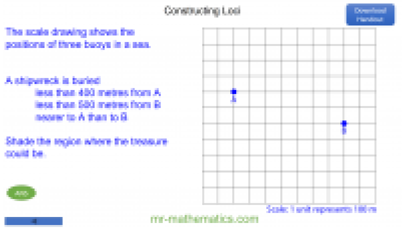


Equidistant Paths



Problem Solving and Revision Lessons

Constructing Loci



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Pythagoras' Theorem

Students are guided through the discovery of Pythagoras' Theorem using Pythagorean Triples. They use Pythagoras' Theorem to find the hypotenuse and shorter side of any right-angled triangle. As learning progresses, they begin to find lengths in 3D shapes.

Prerequisite Knowledge

- derive and apply the properties and definitions of: special types of quadrilaterals, including square, rectangle, parallelogram, trapezium, kite and rhombus; and triangles and other plane figures using appropriate language
- calculate the perimeters of 2D shapes, including composite shapes;
- use the standard conventions for labelling and referring to the sides and angles of triangles; draw diagrams from written description

Success Criteria

- know the formulae for: Pythagoras' theorem, $a^2 + b^2 = c^2$
- apply angle facts, triangle congruence, similarity and properties of quadrilaterals to conjecture and derive results about angles and sides, including Pythagoras' Theorem and the fact that the
- base angles of an isosceles triangle are equal, and use known results to obtain simple proofs

Key Concepts

- Pythagoras' Theorem identifies how the three sides of a right-angled triangle are connected by the areas of shapes on each edge. To fully engage with this concept students could construct the theorem using a 3,4,5 triangle to measure the hypotenuse and calculate the area of each square. Their hypothesis can then by tested on a 5, 12, 13 triangle.
- Pythagoras' Theorem can be applied to a wide variety of geometrical and real-world problems. Students need to practise identifying when the theorem can be applied by recognising triangular components.

Common Misconceptions

- Students often believe that the areas of the shapes on the edges have to be squares in order for $a^2 + b^2 = c^2$ to apply. In fact, the formula applies for all shapes as long as the dimensions are in proportion to the edges of the triangle.
- Confusion often lies in identifying the Hypotenuse side of a right-angled triangle since it is not always apparent which side is longest. Encourage students to identify the hypotenuse as opposite the right angle.
- There is often difficulty when trying to calculate a shorter side of a triangle since students tend to memorise the formula with the hypotenuse as the subject.

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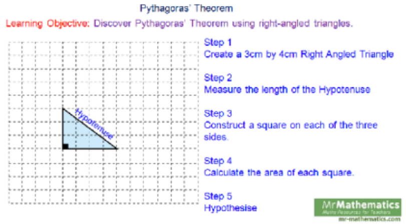
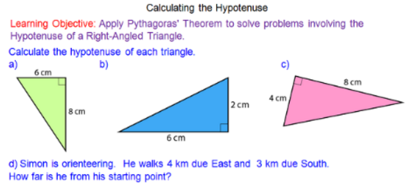
Lessons

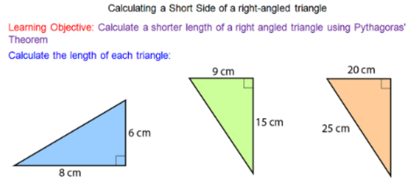
Introducing Pythagoras' Theorem



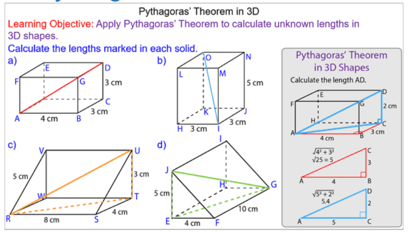
Finding the Hypotenuse



Finding the Shorter Side

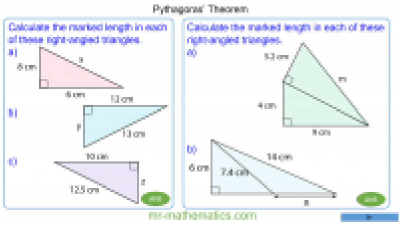


Pythagoras' Theorem in 3D

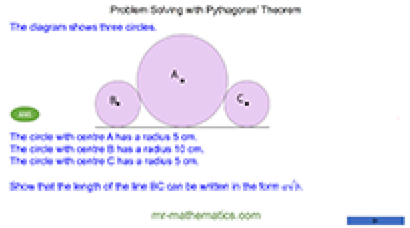


Problem Solving and Revision Lessons

Applying Pythagoras' Theorem



Problem Solving with Pythagoras' Theorem



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