# Year 9 Autumn T1 - Topic: Factors, Powers and Roots

**Prior learning:**

Basic understanding of the terms: e.g. factors, multiples and primes.
Identify primes, factors, multiples, odd, even squares, cubes.
Practice of listing factors and primes to support finding the HCF and LCM
Prime factor decomposition to supporting finding the HCF and LCM

## Objectives

### End Points

- Know and use the language of prime numbers, factors and multiple
- Write a number as a product of its prime factors
- Find the HCF and LCM of a pair of integers
- Calculate integer powers and their roots.
- Estimate the square or cube root of an integer
- Apply the laws of indices to numerical expressions
- (H) Manipulate the base to solve expressions

### Learning Steps

#### Foundation

- Find the factors of a number
- Find multiples of a number
- Identify prime numbers
- Recognise special types of numbers (even, odd, squares, cubes, factors, multiples)
- Rewrite repeated multiplication using powers
- Understand the meaning of roots
- Apply the multiplication and division rule of indices to numbers
- Write a number as a product of prime factors
- Find the HCF of two numbers using appropriate methods
- Find the LCM of two (or more) numbers using appropriate methods
- Calculate squares and square roots (with and without calc)
- Calculate cubes and cube roots (with and without calc)
- Evaluate calculations involving powers
- Estimate square and cube roots
- Know how to find roots (including using approximation)
- Apply the multiplication and division law of indices to simple numeric expressions such as $3^2 \times 3^3$ and $5^3/5^2$

#### Crossover

- Evaluate negative powers
- Use index notation and index laws for negative powers

#### Higher

- Evaluate fractional powers
- Use index notation and index laws for fractional powers
- Manipulate the base to solve simple equations
- Understand the difference between rational and irrational numbers

***Where will we use these ideas again:***

All of these topics will be revisited again as part of algebra units and incorporated into problem solving questions such as Area and Volume, and Pythagoras' Theorem
Indices will be revisited algebraically before applied to problem solving questions

# Year 9 Autumn Term 1 – Pythagoras' Theorem

**Prior learning:**

Recognise square numbers
To be able to square and square root values

<table>
<tr><th colspan="4">Objectives</th></tr>
<tr><th>End Points</th><th rowspan="3">Learning Steps</th><th>Foundation</th><th>Higher</th></tr>
<tr><td rowspan="2">○ Use Pythagoras' Theorem to find a missing side in a right-angled triangle.<br>○ (H) Find missing side lengths using Pythagoras Theorem in 3D</td><td>○ Use Pythagoras' theorem to find missing sides<br>○ Find the distance between two points using Pythagoras</td><td rowspan="2">○ Solve problems in 3D using Pythagoras</td></tr>
<tr><td>Crossover</td></tr>
<tr><td></td><td>○ Prove whether a triangle is right-angled by considering the lengths of its sides</td></tr>
</table>

***Where will we use these ideas again:***

This topic will be revisited again in the Trigonometry chapter.
In exams, Pythagoras' Theorem is often mixed with topics such as area to become a 5 or 6 mark problem solving exam question on both higher and foundation papers

# Year 9 Autumn Term 1 – Topic: Expressions, Equations and Formulae (Linear)

**Prior learning:**

Know and use correct algebraic conventions
Understand expressions, equations, formulae and identities
Understand how to translate basic phrases into algebra (e.g. more than, less than, double)
Simplify expressions with one or more variable
Simplify expressions by multiplying and dividing
Recognise inverse operations
Use function machines to find inputs and outputs
Solve one and two step equations

## Objectives

### End Points

- Use algebraic notation
- Use and understand the words expressions, equations, formulae, terms and factors
- Collect like terms and simplify expressions involving sums, products, powers.
- Application of rules of indices to algebra
- Expand single brackets
- Factorise into single brackets
- Form simple expressions
- Substitute numbers into formulae and expressions
- Rearrange formulae
- Represent and solve linear inequalities
- (H) Algebraic fractions - introduction

### Learning Steps

#### Foundation

- Know and use correct algebraic conventions (e.g. 4 x $x$ = 4$x$, m/2) and form simple algebraic expressions from a given scenario
- Understand what expressions, equations, formulae and identities are
- Simplify expressions involving addition and subtraction with one variable such as a+2a+3a
- Simplify expressions involving addition and subtraction with more than one variable such as
- 2a + 5b - a -2b
- Simplify expressions by multiplying and dividing expressions
- Apply the multiplication and division law of indices to simplify algebraic expressions such as $3wx^2y^3$
- Understand how to translate basic phrases into algebra (e.g. more than, less than, double)
- Form simple algebraic expressions from a given scenario
- Use a formula written in words, such as Cost = 20 x distance travelled
- Expand a single set of brackets such as 3(x + 2) and 4x(x-3y
- Factorise expressions such as 6a + 8 and $x^2$ - 3x
- Substitute positive and negative numbers into a formula such as P = 2l + 2w
- Substitute numbers into more complicated formulae such as C = (A+1)D/9
- Solve one step equations such as 3x = 12 or x + 5 = 9
- Solve two step equations such as 3x -1 = 9 and 3(x+4) = 15Expand and simplify expressions such as x($x^2$ - 5) and 3(x+2) - 5(2x-1)
- Rearrange linear formulae such as p = 3q + 5
- Represent simple inequalities on a number line

#### Crossover

- Use index notation and index laws for negative powers
- Solve equations with the variable on both sides such as 3(x - 4) = 5 + x
- Apply the multiplication and division law of indices to algebraic expressions such as $3wx^2y^3$ x $6w^2xy$
- Solve linear inequalities
- Represent solutions to inequalities using set notation

#### Higher

- Use index notation and index laws for fractional powers
- Rearrange formulae that include brackets, fractions and square roots
- Rearrange formulae where the variable appears twice
- Simplify algebraic fractions (linear factorising)
- 4 operations with algebraic fractions

***Where will we use these ideas again:***

All of these topics will be revisited again as part of further algebra units and incorporated into problem solving questions such as Area and Volume, and Pythagoras' Theorem

# Year 9 Autumn T2 - Topic: Perimeters & Areas of 2D shapes (excluding circles)

**Prior learning:**

Understand the terms 'perpendicular lines' and 'parallel lines'
Measure lines accurately
Find the perimeter of a shape on square paper or when given sides
Area by countering squares
Know and use the formula to find the area of rectangles, triangles, parallelograms
Area of trapezium
Identify isosceles, equilateral, scalene and right angles triangles
Recognise and name shapes including quadrilaterals

## Objectives

| End Points | Learning Steps | Foundation | Crossover |
|---|---|---|---|
| ○ Convert between metric units<br>○ Find the perimeter of 2D shapes including compound shapes<br>○ Find the area of 2D Shapes including compound shapes<br>○ Problem solving questions for area including previous learning e.g. Pythagoras | | ○ To be able to convert between metric units such as m to cm, kg to g… etc<br>○ Classify quadrilaterals and triangles by their geometric properties<br>○ Work out the perimeter of a rectangle<br>○ Work out the perimeter of compound shapes<br>○ Know and use the formula for the area of a triangle<br>○ Know and use the formula for the area of a parallelogram<br>○ Know and use the formula for the area of a trapezium<br>○ Find the area of compound shapes<br>○ Derive and use the formula for the area of special compound shapes (kite, rhombus)<br>○ Solve tiling problems involving area calculations | ○ As the previous objectives but incorporating previous topics such as equations, indices and Pythagoras' Theorem<br><br>Higher |

***Where will we use these ideas again:***
Areas of 2D shapes will be revisited when looking at area of a circle. This will also be revisited when learning about surface area and volumes of 3D shapes.

# Year 9 Spring T1 - Topic: Similarity

**Prior learning:**

Angles in parallel lines
Equivalent fractions

<table>
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<tr><th>End Points</th><th rowspan="2">Learning Steps</th><th>Foundation</th><th>Crossover</th></tr>
<tr><td rowspan="2">○ Identify scale factors between similar shapes<br>○ Use scale factors to find missing lengths</td><td rowspan="2">○ Understand the word ‘similar’ in mathematical context<br>○ Identify similar shapes<br>○ Find the scale factor between two similar shapes<br>○ Use scale factor to find the missing sides of shapes</td><td>○ Apply ideas of similarity to nested shapes<br>○ Apply ideas of similarity to shapes within parallel lines</td></tr>
<tr><td>Higher</td></tr>
</table>

***Where will we use these ideas again:***
Similarity in 2D and 3D

# Year 9 Spring T1 - Topic: Data Collection

**Prior learning:**

Equivalent fractions

## Objectives

### End Points

- Identify different sampling methods
- Identify when a sample may be biased
- Apply sampling methods to data e.g. stratified sampling
- Find estimated population through capture/recapture
- Listing arrangements
- Product Rule

**Learning Steps**

#### Foundation

- Understand what is meant by sampling
- Know the difference between sample and population
- Discuss the reliability of different types of sample
- Identify possible sources of bias in sampling methods
- Identify possible sources of bias in the design and use of questionnaires
- Know and recognise primary and secondary data
- Know and recognise qualitative and quantitative data
- Know and recognise discrete and continuous data
- Use values given to calculate expected values (capture/recapture)
- Use results from a sample to estimate outcomes for a population
- Arrangements
- Product rule for counting

#### Crossover

- Use a variety of different sampling methods such as random and systematic
- Use stratified sampling methods

#### Higher

- Complex product rule problems

***Where will we use these ideas again:***

Data collection will be revisited when looking at data handling – calculating averages and creating graphs. The methods of sampling will later be linked to ratios and probability.

# Year 9 Spring T1 - Topic: Fraction, Decimal and Percentages

**Prior learning:**

Shading of fractions
Convert between improper to mixed
Comparing fractions
Simplifying fractions
Ordering fractions
FDP conversion
Fraction calculations

## Objectives

### End Points

- Find fractions and percentages of amounts
- Add, subtract, multiply and divide with fractions and mixed numbers
- Convert between fractions, decimals, and percentages
- Find percentage of amounts with and without a calculator
- Increase/decrease by a given fraction or percentage
- Increase/decrease using a multiplier
- (H) Convert recurring fractions to decimals
- (H) Solve algebraic fractions (linear)

### Learning Steps

#### Foundation

- Shade in a fraction of a picture
- Simplify and find equivalent fractions
- Order a set of fractions
- Add and subtract vulgar and mixed fractions
- Multiply vulgar and mixed fractions
- Find the reciprocal of a number
- Divide vulgar and mixed fractions
- Express fractions as percentages
- Express fractions as decimals
- Express percentages as fractions in their simplest form
- Express percentages as decimals
- Express decimals as fractions in their simplest form
- Express decimals as percentages
- Compare and order percentages, fractions and decimals
- Find fraction of an amount
- Calculate percentage of an amount using non-calculator methods
- Calculate percentage of an amount using calculator methods
- Increase and decrease by a fraction of an amount

#### Crossover

- Use a multiplier to increase and decrease by a percentage
- Identify recurring and terminating decimals
- Convert recurring decimals to fractions and vice versa using denominators of 9, 99, 999, etc.

#### Higher

- Convert recurring decimals to fractions and vice versa using algebraic methods
- Solve equations involving algebraic fractions that lead to linear equations (2x-1)/6 + (x+3)/3 = 5/2

***Where will we use these ideas again:***

A core numeracy topic that will be revisited in the majority of units.

# Year 9 Spring 2 – Accuracy and Calculations

**Prior learning:**

Place value
Calculations with integers
Addition and subtraction with decimals
Ordering decimals
Calculations with negatives

## Objectives

### End Points

- Calculations with integers
- Calculations with decimals
- Calculations with negatives
- Round to place values
- Round to decimal places
- Round to significant figure
- Use order of operations in multi-stage calculations.
- Estimate calculations
- Accurately use a calculator
- Use inequality notation to state error intervals and interpret limits of accuracy.
- Find the upper and lower bounds on the value of a quantity that has been rounded.
- Complete the upper and lower bounds of calculations and represent this to an appropriate degree of accuracy.

### Learning Steps

#### Foundation

- Order integers and decimals
- Calculations with integers
- Find the half-way value between two integers or decimals
- Using place value knowledge to manipulate a given calculation
- Addition and subtraction including decimals
- Multiplication including decimals
- Division including decimals
- Addition and subtraction with negative values
- Multiplication and division with negative values
- Solve questions involving negative numbers in real life (e.g. temperature, golf scores, sea level)
- Round an integer to the nearest power of 10, 100, 1000 etc.
- Round decimals to the nearest decimal place
- Round numbers to a given number of significant figures
- Use order of operations accurately
- Estimate answers to calculations
- Use a calculator to perform complex calculations
- State whether an estimation is an over- or underestimate

#### Crossover

- Find and use the upper and lower bounds of rounded numbers
- Find the error interval of a rounded number
- Find the error interval of truncated numbers

#### Higher

- Understand the difference between the bounds of discrete and continuous quantities
- Find the upper and lower bounds of calculations and round to an appropriate degree of accuracy

***Where will we use these ideas again:***

A core numeracy topic that will be revisited in the majority of units.

# Year 9 Spring 2 – Compound Measures

**Prior learning:**

Basic knowledge of time and 12/24 hour clock

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***Where will we use these ideas again:***

DMV will be combined with volume questions
FPA will be combined with area questions
SDT will lead to graphical interpretations
Conversion of measures will link to volumes of 3D shapes and flow rates.

# Year 9 Spring 2 – Compound Measures

**Prior learning:**

Basic knowledge of time and 12/24 hour clock

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***Where will we use these ideas again:***

DMV will be combined with volume questions
FPA will be combined with area questions
SDT will lead to graphical interpretations
Conversion of measures will link to volumes of 3D shapes and flow rates.

# Year 9 Summer 1 – Quadratics

**Prior learning:**

Properties of angles
Properties of polygons and triangles
Recognise regular and irregular shapes
Use correct notation for an angle
Estimate and measure angles
Draw angles

## Objectives

| End Points | Learning Steps | Foundation | Crossover |
|---|---|---|---|
| ○ Deduce and use the angle sum in any polygon<br>○ Calculate interior and exterior angles for regular polygons<br><br>○ Recap - describe and apply the properties of angles<br>○ Recap – angles within parallel lines.<br>○ Recap - Derive and apply the properties and definitions of special types of triangles and quadrilaterals<br>○ Recap - Derive and use the sum of angles in a triangle | | ○ Calculate the sum of angles in any polygon<br>○ Calculate interior angles of a regular and irregular polygon<br>○ Calculate exterior angles of a regular and irregular polygon<br>○ Problem solving including interior and exterior angles of polygons<br><br>Recap:<br>○ Angle and polygon notation<br>○ Estimate angles, measure and draw them accurately<br>○ Use properties of opposite angles, angles at a point and angles on a straight line to find missing angles<br>○ Recognise corresponding, alternate and co-interior angles<br>○ Use angle properties of isosceles, equilateral and right-angled triangles<br>○ Use properties of triangles to find missing angles | ○ Reasoning question including angles in polygons, angles facts and angles in parallel<br><br>Higher |

***Where will we use these ideas again:***
Constructions and Loci
Forming and solving equations with angles

(H) These will be integrated with circle theorems and vectors

# Year 9 Summer 1 – Angles in Polygons

**Prior learning:**

Properties of angles
Properties of polygons and triangles
Recognise regular and irregular shapes
Use correct notation for an angle
Estimate and measure angles
Draw angles

## Objectives

| End Points | Learning Steps | Foundation | Crossover / Higher |
|---|---|---|---|
| ○ Deduce and use the angle sum in any polygon<br>○ Calculate interior and exterior angles for regular polygons<br><br>○ Recap - describe and apply the properties of angles<br>○ Recap – angles within parallel lines.<br>○ Recap - Derive and apply the properties and definitions of special types of triangles and quadrilaterals<br>○ Recap - Derive and use the sum of angles in a triangle | | ○ Calculate the sum of angles in any polygon<br>○ Calculate interior angles of a regular and irregular polygon<br>○ Calculate exterior angles of a regular and irregular polygon<br>○ Problem solving including interior and exterior angles of polygons<br><br>Recap:<br>○ Angle and polygon notation<br>○ Estimate angles, measure and draw them accurately<br>○ Use properties of opposite angles, angles at a point and angles on a straight line to find missing angles<br>○ Recognise corresponding, alternate and co-interior angles<br>○ Use angle properties of isosceles, equilateral and right-angled triangles<br>○ Use properties of triangles to find missing angles | Crossover<br>○ Reasoning question including angles in polygons, angles facts and angles in parallel<br><br>Higher |

***Where will we use these ideas again:***
Constructions and Loci
Forming and solving equations with angles

(H) These will be integrated with circle theorems and vectors

# Year 9 Spring T1 & 2 – Surds (Higher Only)

**Prior learning:**

Recurring or terminating decimals
Square roots

| Objectives | | | |
|---|---|---|---|
| **End Points** | **Learning Steps** | Crossover | Higher |
| ○ Simplify surds<br>○ Calculations with surds<br>○ Expand brackets with surds<br>○ Fraction calculations with surds<br>○ Rationalise the denominator with a single surd<br>○ Pythagoras and Surds<br>○ Area and Perimeter and surds | | ○ Understand the difference between rational and irrational numbers<br>○ Recognise surds<br>○ Simplifying surds<br>○ Multiply and divide with surds<br>○ Addition and subtraction with surds<br>○ Expand brackets with surds<br>○ Apply calculations with surds and Pythagoras Theoren<br>○ Complete area and perimeter questions incorporating surds<br>○ Rationalise the denominator with a single surd | ○ Expanding double brackets with surds<br>○ Fractions calculations with surds as the numerator or denominator and simplify |

***Where will we use these ideas again:***
A core numeracy topic that will be revisited in the majority of units.