

Subject : Maths Higher

Scheme title	Half term 1 - June	Half term 2 - September
<b>Purpose of scheme</b>	To develop fluency, problem solving and reasoning skills across the 6 key areas of number, algebra, geometry and measures, statistics, probability and ratio and proportion	To develop fluency, problem solving and reasoning skills across the 6 key areas of number, algebra, geometry and measures, statistics, probability and ratio and proportion
<b>Skills</b>	<p>Number - Fractions and Decimals</p> <ul style="list-style-type: none"> <li>Calculate exactly with fractions</li> <li>Add and Subtract mixed numbers</li> <li>Find the reciprocal of a number (P)</li> <li>Recognise that recurring decimals are exact fractions and vice versa</li> <li>Long division(P)</li> <li>Convert recurring decimals to fractions and vice versa</li> </ul> <p>Geometry and Measure - Angles and Area</p> <ul style="list-style-type: none"> <li>Recognise corresponding, alternate and interior angles on parallel lines (P)</li> <li>Understand and use three-figure bearings</li> <li>Find the area of a triangle, trapezium and parallelogram</li> <li>Find the area and perimeter of shapes made from triangles and rectangles</li> <li>Calculate the circumference and area of a circle</li> <li>Work out the perimeter and area of compound shapes made from parts of a circle</li> </ul> <p>Algebra - Working with Symbols</p> <ul style="list-style-type: none"> <li>Expand brackets in context such as <math>x(x + 2)</math></li> <li>Factorise an expression such as <math>x^2 + 4x</math></li> <li>Expand and simplify an expression such as <math>x(2x + 1) - x(2x - 3)</math></li> <li>Expand and simplify two brackets in context such as <math>(x + 4)(x - 8)</math></li> <li>Expand and simplify two brackets in context such as <math>(3x + 4)(2x - 8)</math></li> <li>Expand and simplify triple bracket</li> </ul>	<p>Geometry and Measure – Pythagoras</p> <ul style="list-style-type: none"> <li>Knowledge of square numbers &amp; square roots (p)</li> <li>Use Pythagoras’ theorem to find the third side of a right-angled triangle</li> <li>Use Pythagoras’ theorem to prove that a triangle is right-angled</li> <li>Find the distance between two points from their coordinates</li> <li>Use Pythagoras’ theorem in 3-D problems</li> </ul> <p>Ratio, Proportion and rates of change – Ratio</p> <ul style="list-style-type: none"> <li>Use ratio notation, including reduction to its simplest form and link to fraction notation</li> <li>Solve simple ratio and proportion problems, such as finding and simplifying a ratio</li> <li>Solve more complex ratio and proportion problems</li> <li>Solve ratio and proportion methods using the unitary method</li> </ul> <p>Number – Percentages</p> <ul style="list-style-type: none"> <li>Increase or decrease by a given percentage</li> <li>Express one quantity as a percentage of another</li> <li>Work out percentage increase or decrease</li> <li>Use multipliers to solve repeated percentage changes and exponential growth</li> <li>Work out the values and draw graphs in situations involving exponential growth.</li> <li>Set up, solve and interpret the answers in growth and decay problems, including compound interest (and work with general iterative processes)</li> </ul> <p>Geometry and Measure - Area and Volume</p> <ul style="list-style-type: none"> <li>Convert between square units such as changing 2.6 m<sup>2</sup> to cm<sup>2</sup></li> <li>Convert between cube units such as changing 3.7 m<sup>3</sup> to cm<sup>3</sup></li> <li>Find the volume of prisms including cylinders</li> <li>Find the surface area of simple prisms</li> </ul> <p>Algebra - Equations and Formulae</p> <ul style="list-style-type: none"> <li>Solve equations such as <math>3x - 4 = 5 + x</math> or <math>2(5x + 1) = 28</math> (P)</li> <li>Distinguish between an expression, an equation, an identity and a formula</li> <li>Argue mathematically to show algebraic expressions are equivalent</li> <li>Substitute numbers into formulae such as <math>C = (A+1)D/9</math></li> <li>Derive complex expressions and formulae</li> <li>Solve equations such as <math>3x - 12 = 2(2x - 5)</math>, <math>2x/3 - x/4 = 5</math> or <math>((7-x))/3 = 2</math></li> <li>Solve equations such as <math>((2x - 1))/6 + ((x+3))/3 = 5/2</math></li> <li>Represent inequalities on a number line, identify integer solutions</li> <li>Solve inequalities including x on both sides.</li> <li>To and use algebra to support and construct arguments (and proofs)</li> </ul> <p>Geometry and Measure - Trigonometry 1</p> <ul style="list-style-type: none"> <li>Use sine, cosine and tangent to calculate a side in a right angled triangle</li> <li>Use sine, cosine and tangent to calculate an angle in a right angled triangle</li> <li>Use trigonometry to solve problems, including those involving bearings</li> <li>Know exact values of sin/cos/tan at the key angles</li> <li>Use trig ratios and inverse trig on a calculator (p)</li> </ul>
<b>Key Words</b>	Quantity Fraction Reciprocal Corresponding Interior Exterior Perimeter Expression Equation Expand Compound	Pythagoras Co-ordinates Dimensions Ratio Percentage Equations Exponential Growth Proportion Convert Prism Cylinder Multiples
<b>End Point</b>	Students are able to understand and apply the skills identified above.	Students are able to understand and apply the skills identified above.
<b>Assessment method</b>	After each topic in bold (listed opposite), students complete a reflection grid which is marked in class then later teacher marked. This will be stuck in books to record progress and support revision. Students complete one GCSE style assessment once per term. Results are recorded centrally by teachers on a central spreadsheet. Students complete RAG analysis to identify their strengths and areas for development. Assessments are cumulative and grade boundaries reflect GCSE Maths.	After each topic in bold (listed opposite), students complete a reflection grid which is marked in class then later teacher marked. This will be stuck in books to record progress and support revision. Students complete one GCSE style assessment once per term. Results are recorded centrally by teachers on a central spreadsheet. Students complete RAG analysis to identify their strengths and areas for development. Assessments are cumulative and grade boundaries reflect GCSE Maths.

Year Group:

**Half term 3 - November**

To develop fluency, problem solving and reasoning skills across the 6 key areas of number, algebra, geometry and measures, statistics, probability and ratio and proportion

**Geometry and Measure - Properties of Polygons**

- Classify a quadrilateral using geometric properties
- Calculate exterior and interior angles of a regular polygon
- Use the standard convention for labelling sides and angles of polygons
- Derive the sum of angles in a triangle
- Draw the plans and elevations of a solid on squared paper

**Algebra – Real life graphs**

- Make simple interpretations of real-life graphs/Further interpret real-life graph
- Discuss and interpret graphs modelling real life situations

**Ratio, Proportion and rates of change - Proportion**

- Solve direct and indirect proportion problems
- Understand that  $X$  is inversely proportional to  $Y$  is equivalent to  $X$  is proportional to  $1/Y$
- Construct and interpret equations that describe direct and inverse proportion
- Interpret the gradient of a straight line graph as a rate of change; recognise and interpret graphs that illustrate direct and inverse proportion

**Geometry and Measure - Reflection, Rotation, Translation**

- Know how to graph lines such as  $y = 2$ ,  $x = 4$  or  $y = x$  or  $y = -x$  ( $p$ )
- Reflect shapes in lines parallel to the axes, such as  $x = 2$  and  $y = -1$
- Reflect shapes in lines such as  $y = x$  and  $y = -x$
- Rotate shapes about any point
- Rotate shapes about the origin
- Describe fully reflections in a line and rotations about the origin
- Find the centre of rotation and describe it fully
- Describe reflections in any line parallel to axes,  $y=x$  or  $y = -x$ , and rotations about any point
- Translate a shape using a description such as 4 units right and 3 units down
- Translate a shape by a vector such as  $(4, -3)$
- Transform shapes by a combination of translation, rotation and reflection
- Use congruence to show that translations, rotations and reflections preserve length and angle, so that any figure is congruent to its image under any of these transformations
- Describe the changes and invariance achieved by combinations of rotations, reflections and translations

**Geometry and Measure - Properties of Circles**

- Identify and apply circle definitions and properties, including: centre, radius, chord, diameter, circumference, tangent, arc, sector and segment
- Know the angle and tangent properties of a circle
- Understand the angle and tangent properties of a circle
- Understand the alternate segment theorem
- Prove the standard circle theorems and use them to find missing angles
- Know and use the equation of a circle

Geometric  
Polygons  
Parallel  
Perpendicular  
Interpret  
Elevation  
Plan  
Origin  
Translation  
Reflection  
Rotation  
Manipulate  
Trigonometry

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**Half term 4 - January**

To develop fluency, problem solving and reasoning skills across the 6 key areas of number, algebra, geometry and measures, statistics, probability and ratio and proportion

## Ratio, Proportion and rates of change – compound measures

- Calculate average speed
- Use compound measures such as speed and pressure
- Recognise that rounded measurements may be inaccurate by one half unit in either direction
- Use compound measures, such as density, for example find density given the cross-sectional area, length and mass
- Plot distance time and velocity time graphs
- Convert between related compound units (speed, rates of pay, prices, density, pressure) in numerical and algebraic contexts
- Interpret the gradient at a point on a curve as the instantaneous rate of change; apply the concepts of instantaneous and average rate of change (gradients of tangents and chords) in numerical, algebraic and graphical contexts
- Plot and interpret graphs (including reciprocal graphs (and exponential graphs)) and graphs of non-standard functions in real contexts, to find approximate solutions to problems such as simple kinematic problems involving distance, speed and acceleration
- Calculate or estimate gradients of graphs and areas under graphs (including quadratic and other non-linear graphs), and interpret results in cases such as distance-time graphs, velocity-time graphs and graphs in financial contexts

## Geometry and Measure – Enlargement

- Enlarge a shape by a positive scale factor from a given centre
- Enlarge a shape by a fractional scale factor/ negative scale factor

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## Geometry and Measure - Construction

- Draw a quadrilateral such as a kite, parallelogram or rhombus with given measurements
- Given the lengths of two sides and a non-included angle it may not produce a unique triangle
- Construct perpendicular bisectors and angle bisectors
- Match one angle and one side of congruent triangles given dimensions
- Construct perpendicular lines from a point to a line, perpendicular on a line and an angle of  $60^\circ$
- Match sides and angles of similar triangles
- Prove two triangles are congruent
- Prove construction theorems

## Geometry and Measure - Loci

- Construction (p)
- Understand the idea of locus
- Construct the locus of points equidistant from two fixed points and lines
- Solve loci problems, for examples find the points less than 3 cm from point P

Average  
Velocity  
Instantaneous  
Gradient  
Iteration  
Enlarge  
Scale factor  
Similarity  
Construction  
Perpendicular  
Perimeter

Congruent

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### Half term 5 - March

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#### Algebra - Quadratic Equations

- Draw graphs of quadratics such as  $y = x^2 + 2x + 1$
- Use a graph to estimate  $x$  – and  $y$  – values, giving answers to an appropriate degree of accuracy
- Draw graphs of harder quadratics such as  $y = 2x^2 - 7x + 5$
- Factorise an expression such as  $x^2 - 5x + 14$  or  $x^2 - 9$
- Solve an equation such as  $x^2 - 5x + 14 = 0$
- Factorise an expression such as  $3x^2 + 7x + 2$  or  $3x^2 - 27$
- Solve problems using equations that factorise such as  $3x^2 + 7x + 2 = 0$ , including those that require rearrangement
- Solve problems using equations such as  $2x^2 - 6x + 1 = 0$  by using the quadratic formula
- Find approximate solutions to equations such as  $x^2 + 3x + 2 = 5$  by graphical methods
- Recognise the difference of 2 squares and factorise expressions in this form.
- Solve problems using equations such as  $3/(x-2) + 4/(x-1) = 2$
- Identify and interpret roots, intercepts and turning points of quadratic functions graphically; deduce roots algebraically (and turning points by completing the square)

#### Algebra - Iteration

- Find approximate solutions using iteration

#### Geometry and Measures - Vectors

- Add, subtract and multiply vectors
- Use addition, subtraction and multiplication of vectors to solve simple geometric problems
- Understand the relationship between parallel vectors
- Solve more difficult geometric problems using vectors
- Use vectors to construct geometric arguments and proofs

#### Algebra - Simultaneous Equations

- Solve a pair of simultaneous equations such as  $x + 3y = 9$  and  $3x - 2y = 5$
- Solve a pair of linear equations graphically; identifying the point of intersection as the solution
- Solve a pair of simultaneous equations such as  $y = 4x + 5$  and  $y = x^2$
- Find the points of intersection of a linear and a quadratic equation; recognising that the solution could be found from the points of intersection of the graphs

#### Ratio, Proportion and rates of change – Similarity

- Compare the area of an enlarged shape with the original area
- Find the ratio of the corresponding lengths in similar shapes and identify this as the SF of enlargement
- Use ratios in similar shapes to find missing lengths
- Compare lengths, areas and volumes using ratio notation and/or scale factors; make links to similarity (including trigonometric ratios)
- Compare lengths, areas and volumes of enlarged shapes
- Use the effect of enlargement on perimeter, area and volume in calculations

#### Statistics - Scatter graphs

- Consider outliers when calculating the range of a distribution
- Draw a scatter graph by plotting points on a graph
- Interpret the scatter graph & interpret the line of best fit
- Identify the type and strength of the correlation
- Know that correlation does not imply causation

#### Accuracy

#### Equations

#### Graphical

#### Manipulate

#### Co-ordinate

#### Vector

#### Geometric

#### Linear

#### Negative

#### Simultaneous

#### Intersection

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### Half term 6 - May

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#### Algebra - Cubic, circular and exponential functions

- Complete tables for, and draw graphs of, cubic functions and use the graphs to solve equations
- Complete tables for, and draw graphs of, reciprocal functions and use the graphs to solve equations
- Sketch and draw circular graphs such as  $\sin x$  and  $\cos x$
- Use graphs to solve equations
- Sketch and draw graphs of exponential functions and use them to solve equations
- Recognise and use the equation of a circle with centre at the origin; find the equation of a tangent to a circle at a given point
- Recognise the shapes of graphs of functions including cubic functions, reciprocal functions, circular functions and exponential functions including  $y = k^x$
- Recognise functions when solving problems

#### Geometry and Measure - Trigonometry 2

- Use the sine and cosine rules to solve 2-D problems
- Calculate the area of a triangle using  $\frac{1}{2}ab\sin C$
- Use the sine and cosine rules to solve 3-D problems
- Know the exact  $\sin/\cos/\tan$  angles
- Confident use of a calculator (p)
- Confident ability to read questions and translate into a mathematical problem/diagram (p)

#### Geometry and Measure - Area and Volume 2

- Calculate the lengths of arcs of circles
- Calculate the areas of sectors of circles
- Solve problems involving surface areas and volumes of pyramids, cones and spheres
- Solve problems involving complex shapes and solids, including segments of circles and frustums of cones and composite solids
- Confident use of  $\pi$  on a calculator (p)

#### Algebra - Transforming Functions

- Understand and apply function notation - including composite and inverse.
- Given  $y = f(x)$  or a sketch of  $y = f(x)$ , draw transformations of  $f(x)$
- Understand that  $(y/a)=f(x)$  and  $y=f(x/a)$  represent a one-way stretch with a scale factor  $a$  parallel to the  $y$ - and  $x$ - axis respectively of  $y = f(x)$
- Understand that  $y = f(x) + a$  and  $y = f(x-a)$  represent translations of  $y = f(x)$
- Multiplying by  $-1$  (p)
- Reflection of graphs in  $x$  and  $y$  axis (p)
- Where appropriate, interpret simple expressions as functions with inputs and outputs; {interpret the reverse process as the 'inverse function'; interpret the succession of two functions as a 'composite function'}
- Find combined functions eg  $fg(x)$  and evaluate problems for example  $fg(x) = 4$

Equations  
Exponential  
Cubic  
Functions  
Cosine  
Sine  
Translate  
Arcs  
Sectors  
Substitution  
Apply  
Translation  
Reflection

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