

KS3 STAGE 8, ALGEBRA, MATHS

Rationale and Context of Unit:	Core curriculum content:	Tier 2 & Tier 3 vocabulary explicitly taught:
<p>Prior content reviewed using pre-tests and whiteboard work at the start of each topic.</p> <p>Algebraic proficiency -Tinkering</p> <ul style="list-style-type: none"> Key skills: Manipulating expressions; use of letters, identifying like terms and simplify; multiply with brackets; explore functions and evaluate algebraic statements Know basic algebraic notation (the rules of algebra) Simplify an expression by collecting like terms Know how to multiply a single term over a bracket Substitute positive numbers into expressions and formulae Calculate with negative numbers <p>Pattern spotting</p> <ul style="list-style-type: none"> Key skills: Explore linear and non-linear sequences; find the term to term rule; describe a number sequence; solve problems using this rule Use a term-to-term rule to generate a sequence 	<p>Algebraic proficiency -Tinkering</p> <ul style="list-style-type: none"> Key skills: Indices and the multiplication law, simplify expressions, use fractions in algebra, factorise, re-arrange formulae, substitute positive and negative numbers, change the subject of a formula when 1 and 2 steps are required Indices You will learn about the notation of algebra Know the multiplication (division, power, zero) law of indices Understand that negative powers can arise Manipulating expressions You will learn that algebraic expressions can be written in different forms Simplify an expression involving terms with combinations of variables (e.g. $3a^2b + 4ab^2 + 2a^2 - a^2b$) Know how to write products algebraically Use fractions when working in algebraic situations 	<p>Product, Variable, Term, Coefficient, Common factor, Factorise, Power, Indices, Formula, Formulae, Subject, Change the subject, Sequence, Linear, Arithmetic, Term, Difference, Term-to-term rule, Position-to-term rule, Ascending, Descending, Algebra, algebraic, algebraically, Unknown, Equation, Operation, Solve, Solution, Brackets, Symbol, Substitute, Graph, Point of intersection, Plot, Equation (of a graph), Function, Formula, Linear</p> <p>Coordinate plane, Gradient, y-intercept, Quadratic, Piece-wise linear, Model Kinematic, Speed, Distance</p>

- Find the term-to-term rule for a sequence
- Describe a sequence using the term-to-term rule

Solving equations and inequalities

- Key skills: solve two and three step equations with brackets and when the solution is a whole number and a fraction
- Choose the required inverse operation when solving an equation
- Solve linear equations by balancing when the solution is a whole number or a fraction

Algebraic proficiency – visualising

- Use coordinates in all four quadrants
 - Write the equation of a line parallel to the x-axis or the y-axis
 - Draw a line parallel to the x-axis or the y-axis given its equation
 - Identify the lines $y = x$ and $y = -x$
 - Draw the lines $y = x$ and $y = -x$
- Substitute positive and negative numbers into formulae

- Identify common factors (numerical and algebraic) of terms in an expression
- Factorise an expression by taking out common factors
- **Rearranging formulae**
- Substitute positive and negative numbers into formulae
- Be aware of common scientific formulae
- Know the meaning of the 'subject' of a formula
- Change the subject of a formula when one step is required
- Change the subject of a formula when a two steps are required

Pattern spotting

- Key skills: Generate a term –to-term rule, use position-to-term rule in sequences, use algebra to describe rule in a linear sequence, generate a sequence using a spread sheet
- **Nth term of a linear sequence**
- You will explore how do describe any term in a linear sequence
- Generate a sequence from a term-to-term rule
- Understand the meaning of a position-to-term rule
- Use a position-to-term rule to generate a sequence

- Find the position-to-term rule for a given sequence
- Use algebra to describe the position-to-term rule of a linear sequence (the n th term)
- Use the n th term of a sequence to deduce if a given number is in a sequence
- Generate a sequence using a spreadsheet

Solving equations and inequalities

- Key skills: Solve linear equations with unknown on both sides when the solution is a negative number, a fraction or involves brackets, link point of intersection on a graph to the equation
- **Linear Equations**
- You will learn how to solve linear equations with the unknown on one side and solve linear equations with the unknown on both sides
- Identify the correct order of undoing the operations in an equation
- Solve linear equations with the unknown on one side when the solution is a negative number

- Solve linear equations with the unknown on both sides when the solution is a whole number
- Solve linear equations with the unknown on both sides when the solution is a fraction
- Solve linear equations with the unknown on both sides when the solution is a negative number
- Solve linear equations with the unknown on both sides when the equation involves brackets
- Recognise that the point of intersection of two graphs corresponds to the solution of a connected equation n
- Check the solution to an equation by substitution
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Algebraic proficiency – visualising

- Key skills: Use table of values to calculate points on a linear graph, understand concept of a gradient on a straight line and finding the Y-intercept, plotting Quadratic Graphs, plotting real life graphs plot, Interpret distance and time graph
- **Linear graphs**
- You will learn how to use a table of values to calculate points which satisfy a linear equation

- Know that graphs of functions of the form $y = mx + c$, $x \pm y = c$ and $ax \pm by = c$ are linear
- Plot graphs of functions of the form $y = mx + c$ ($x \pm y = c$, $ax \pm by = c$)
- Understand the concept of the gradient of a straight line
- Find the gradient of a straight line on a unit grid
- Find the y-intercept of a straight line
- Sketch a linear graph
- **Quadratic graphs**
- You will learn to recognize and plot a simple quadratic graph
- Distinguish between a linear and quadratic graph
- Plot graphs of quadratic functions of the form $y = x^2 \pm c$
- Sketch a simple quadratic graph
- **Real life graphs**
- Plot and interpret graphs of piece-wise linear functions in real contexts
- Plot and interpret distance-time graphs (speed-time graphs)
- Find approximate solutions to kinematic problems involving distance and speed

Challenge and Support:	World wide learning/ links to 21 st century:	Cultural capital/ Industry/ Enrichment:
<ul style="list-style-type: none"> • Convince me $a^0 = 1$. • What is wrong with this statement and how can it be corrected: $5^2 \times 5^4 = 5^8$? • Jenny thinks that if $y = 2x + 1$ then $x = (y - 1)/2$. Kenny thinks that if $y = 2x + 1$ then $x = y/2 - 1$. Who do you agree with? Explain your thinking. • Show me a sequence that could be generated using the nth term $4n \pm c$. And another. And another ... • What's the same, what's different: 4, 7, 10, 13, 16, , 2, 5, 8, 11, 14, ... , 4, 9, 14, 19, 24, and 4, 10, 16, 22, 28, ...? • The 4th term of a linear sequence is 15. Show me the nth term of a sequence with this property. And another. And another ... • Convince me that the nth term of the sequence 2, 5, 8, 11, ... is $3n - 1$. • Kenny says the 171 is in the sequence 3, 9, 15, 21, 27, ... Do you agree with Kenny? Explain your reasoning. • Show me an (one-step, two-step) equation with a solution of -8 (negative, fractional solution). And another. And another ... 	<ul style="list-style-type: none"> • Vets use formulae to make sure they are giving animals the correct dosage of medicine for their age and mass. A poodle weighing 6kg, needs a far smaller dose than a 35kg retriever. • Finding a pattern and working out how the parts of a pattern fit together is important in scientific discovery. Scientists use sequences to model and solve real life problems, such as estimating how quickly a disease will spread. • Accounting involves a great deal of maths. Accountants set up computer spreadsheets to calculate and analyse data. Programs such as excel work by applying different equations to values in columns of cells, you need to know what equation or formulae to use to get the results you need. • The curves and lines of The Gherkin in London were designed using complex equations and their graphs. Architecture is just one profession in which people plot and use graphs. 	<p style="text-align: center;">Search Algebra ages 11-14</p> <p>NRICH website – access current articles and enrichment activities.</p>  <ul style="list-style-type: none"> • NRICH provides thousands of free online mathematics resources for ages 3 to 18 - completely free and available to all via their website (nrich.maths.org/). These resources aim to: <ul style="list-style-type: none"> ○ Enrich and enhance the experience of the mathematics curriculum for all learners ○ Develop mathematical thinking and problem-solving skills ○ Offer challenging, inspiring and engaging activities • Transition Day – Cluedo activity using Coordinates. • Code breaking • Functional Skills Projects

<ul style="list-style-type: none"> • Show me a two-step equation that is 'easy' to solve. And another. And another ... • What's the same, what's different: $2x + 7 = 25$, $3x + 7 = x + 25$, $x + 7 = 7 - x$, $4x + 14 = 50$? • Convince me how you could use graphs to find solutions, or estimates, for equations. • Draw a distance-time graph of your journey to school. Explain the key features. • Show me a point on this line (e.g. $y = 2x + 1$). And another, and another ... • (Given an appropriate distance-time graph) convince me that Kenny is stationary between 10: 00 a.m. and 10:45 a.m. 		
<p>Historical, Social, Moral, Spiritual, Cultural context:</p>	<p>Cross curricular links/ literacy/numeracy:</p>	<p>Common misconceptions:</p>
<ul style="list-style-type: none"> • Algebra allows students to use spreadsheets, solve real world problems, use and understand modern technology and to work efficiently in the workplace. It is also fundamental to understanding patterns in the natural world. 	<p>The lower case and upper case of a letter should not be used interchangeably when worked with algebra Juxtaposition is used in place of 'x'. $2a$ is used rather than a^2.</p> <ul style="list-style-type: none"> • Division is written as a fraction • Algebra allows students to be able to communicate efficiently and to solve problems in Science (especially Physics) 	<ul style="list-style-type: none"> • Some pupils may misapply the order of operation when changing the subject of a formula • Many pupils may think that $a^0 = 0$ • Some pupils may not consider $4ab$ and $3ba$ as 'like terms' and therefore will not 'collect' them when simplifying expressions • Some pupils will think that the nth term of the sequence 2, 5, 8, 11, ... is $n + 3$.

- Correct use of specialised mathematical terms and phrases is crucial.

- Some pupils may think that the $(2n)$ th term is double the n th term of a linear sequence.
- Some pupils may think that sequences with n th term of the form ' $ax \pm b$ ' must start with ' a '.
- Some pupils may think that you always have to manipulate the equation to have the unknowns on the LHS of the equal sign, for example $2x - 3 = 6x + 6$
- Some pupils think if $4x = 2$ then $x = 2$.
- When solving equations of the form $2x - 8 = 4 - x$, some pupils may subtract ' x ' from both sides.
- When plotting linear graphs some pupils may draw a line segment that stops at the two most extreme points plotted
- Some pupils may think that a sketch is a very rough drawing. It should still identify key features, and look neat, but will not be drawn to scale
- Some pupils may think that a positive gradient on a distance-time graph corresponds to a section of the journey that is uphill
Some pupils may think that the graph $y = x^2 + c$ is the graph of $y = x^2$ translated horizontally.

- Topic test assessments (BAM tests) are conducted at the end of each topic. These are roughly after 2 weeks per topic, but this may vary.
- Pre-checks are conducted at the start of the topic to test student prior knowledge. This informs lesson planning and delivery.
- Tracking assessments are conducted once a term with end of year formal exams, for reporting and checking cumulative knowledge.
- Testing data leads to discussions about setting, intervention groups and individual in-class intervention.
- All students have access to a wide range of resources to develop their understanding.

Home learning

- Homework is set weekly for each group. This will often be via interactive websites with immediate feedback and support.
- Teachers have the autonomy to use whichever resource they wish within the criteria set for the topic.
- Students have access to lots of resources at home, including: Kerboodle, MyMaths, Mathswatch, PiXL Maths APP, PiXL Tmes Table App.

Feedback

Feedback is given after each topic test, tracking assessment and end of year exams. After tracking and end of year exams, this will include “Formative Marking” sheets which give feedback question by question to help support the students with priorities for further work.

Length of unit (duration indicated in lessons)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30		
31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60		
Unit:																															