Acle Academy

YEAR 10, HIGHER 3 YEAR GCSE, ALGEBRA, MATHS

Rationale and Context of Unit:	Core curriculum content:	Tier 2 & Tier 3 vocabulary explicitly taught:

BASIC ALGEBRA REVIEW
• Use and interpret algebraic notation
• coefficients written as fractions rather than decimals
• brackets
• Use conventional notation for priority of operations, including brackets, powers, roots and reciprocals
• understand and use the concepts and vocabulary of expressions, equations, formulae, identities, inequalities, terms and factors
• Simplify and manipulate algebraic expressions by:
• collecting like terms
• multiplying a single term over a bracket
• taking out common factors
 	
COORDINATES AND LINEAR GRAPHS
• Work with co-ordinates in all four quadrants
• Solve geometrical problems on co-ordinate axes
• Plot graphs of equations that correspond to straight line graphs in the co-ordinate plane
	SIMULTANEOUS EQUATIONS
	• Solve two simultaneous equations in two variables (linear / linear or linear/quadratic) algebraically
	• Find approximate solutions using a graph
	• Translate simple situations or procedures into algebraic expressions or formulae
	• Derive two simultaneous equations
	• Solve the equations and interpret the solution
	
	INTRODUCTION TO QUADRATICS AND REARRANGING FORMULAE
	• Simplify and manipulate algebraic expressions by:
	  • expanding products of two binomials
	  • factorising quadratic expressions of the form `$x^2 + bx + c$` including the difference of two squares
	  • simplifying expressions involving sums, products and powers, including the laws of indices
	• Understand and use standard mathematical formulae
		Simultaneous Equations, Solve, Eliminate, Scaling up, Variables, Addition, Subtraction, Quadratic, Graphs, Bisect, Derive, Coefficient, Expand, Sum, Product, Factorise, Square root, Base, Index, Power, Formulae, Rearrange, Balance, Subject, Axis, Accuracy, Linear, Parabola, Cubic Reciprocal, Equation, substitution, expression, linear equation.
		
		Highlighted words **MUST** be explicitly taught, defined and recorded in student books as they are first met. Other listed words may be introduced verbally or written in a similar format.

• Identify and interpret gradients and intercepts of linear functions graphically and algebraically. **SEQUENCES** • Generate terms of a sequence from either a term-to-term or a position-to-term rule • Recognise and use: • sequences of triangular, square and cube numbers • simple arithmetic progression • Fibonacci type sequences • quadratic sequences • and simple geometric progressions (`r^n` where `n` is an integer and `r` is a rational number > 0) • Other sequences • Deduce expressions to calculate the `n`th term of a linear and quadratic sequence **REAL LIFE GRAPHS** • Plot and interpret graphs (including reciprocal graphs and exponential graphs) and graphs of non-standard functions in real context, to find approximate solutions to problems such as simple kinematics problems	• Rearrange formulae to change the subject **ALGEBRA RECAP AND REVIEW** • Use the form y=mx+c to identify parallel and perpendicular 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 • 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 kinematics problems involving distance, speed and acceleration • Solve linear equations in one unknown algebraically • Including those with the unknown on both sides of the equation **SKETCHING GRAPHS** Recognise, sketch and interpret graphs of linear functions, quadratic functions, simple cubic functions and the reciprocal function	

involving distance, speed and acceleration. • Interpret the gradient of a straight line as a rate of change. **EQUATIONS** • Substitute numerical values into formulae and expressions, including scientific formulae • Solve linear equations in one unknown algebraically including those with the unknown on both sides of the equation	**LINEAR AND QUADRATIC EQUATIONS AND THEIR GRAPHS** • Solve linear equations in one unknown algebraically including those with the unknown on both sides of the equation • Find approximate solutions using a graph • Solve quadratic equations algebraically by factorising • Find approximate solutions using a graph • Translate simple situations or procedures into algebraic expressions or formulae; derive an equation and the solve the equation and interpret the solution	
Challenge and Support:	**World wide learning/ links to 21st century:**	**Cultural capital/ Industry/ Enrichment:**
ALGEBRA Notation, vocabulary and manipulation 1. use and interpret algebraic notation, including: • ab in place of $a \times b$ • $3y$ in place of $y + y + y$ and $3 \times y$ • a^2 in place of $a \times a$, a^3 in place of $a \times a \times a$, a^2b in place of $a \times a \times b$ • $\frac{a}{b}$ in place of $a \div b$ • coefficients written as fractions rather than as decimals	• Accounting involves a great deal of mathematics. Accountants set up computer spreadsheets to calculate and analyse data. Programs such as Microsoft Excel work by applying different equations to values in columns or cells, so you need to know what equations of formulae to use to get the results you need. • Algebra lets you describe and represent patterns using concise mathematical language.	Search Algebra for all ages NRICH website – access current articles and enrichment activities. • NRICH provides thousands of free online mathematics resources for ages 3 to 18 - completely free and available to all via their website

• brackets 2. substitute numerical values into formulae and expressions, including scientific formulae 3. understand and use the concepts and vocabulary of expressions, equations, formulae, identities inequalities, terms and factors 4. simplify and manipulate algebraic expressions (including those involving surds **and algebraic fractions**) by: • collecting like terms • multiplying a single term over a bracket • taking out common factors • expanding products of two **or more** binomials • factorising quadratic expressions of the form $x^2 + bx + c$, including the difference of two squares**; factorising quadratic expressions of the form $ax^2 + bx + c$** • simplifying expressions involving sums, products and powers, including the laws of indices 5. understand and use standard mathematical formulae; rearrange formulae to change the subject 6. know the difference between an equation and an identity; argue mathematically to show algebraic expressions are equivalent, and use	• This is useful in many different careers including accounting, navigation, building, plumbing, health, medicine, science and computing. • Without algebra, we would not be bale to work with large mechanical forces – so there would be no skyscrapers or suspension bridges; we would also not be able to understand electronics, so there would be no tablets or mobile phones. • A geophysicist studies the Earth using gravity, magnetic, electrical and seismic methods. Graphs are used in a study of the Pacific and Atlantic Oceans. They need to be able to understand equations and recognise the features of graphs to understand and interpret it. • Kinematics is the topic within maths that deals with motion. By writing equations and drawing graphs that the describe the relationship between distance, speed and acceleration, it is possible to calculate things such as speed of a vehicle at a particular time during its journey.	(nrich.maths.org/). These resources aim to: ○ 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 • Problem solving opportunities – Applied Mathematics. • Challenge problems. • Extension work. • Assessment sections in texts

algebra to support and construct arguments **and proofs** 7. 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'.** Graphs 8. work with coordinates in all four quadrants 9. plot graphs of equations that correspond to straight-line graphs in the coordinate plane; use the form $y = mx + c$ to identify parallel **and perpendicular lines**; find the equation of the line through two given points, or through one point with a given gradient 10. identify and interpret gradients and intercepts of linear functions graphically and algebraically 11. identify and interpret roots, intercepts, turning points of quadratic functions graphically; deduce roots algebraically **and turning points by completing the square** 12. recognise, sketch and interpret graphs of linear functions, quadratic functions, simple cubic functions, the reciprocal function $y = \frac{1}{x}$ with $x \neq 0$**, exponential functions $y = x^k$ for positive values of k, and the trigonometric functions (with arguments in degrees) y =**		

sin *x* , *y* = cos *x* and *y* = tan *x* for angles of any size 13. **sketch translations and reflections of a given function** 14. 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 15. **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** 16. **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.** Solving equations and inequalities 17. solve linear equations in one unknown algebraically (including those with the unknown on both sides of the equation); find approximate solutions using a graph 18. solve quadratic equations (**including those that require rearrangement**) algebraically by factorising**, by completing the square and by using the quadratic formula**; find approximate solutions using a graph		

19. solve two simultaneous equations in two variables (linear/linear **or linear/quadratic**) algebraically; find approximate solutions using a graph 20. **find approximate solutions to equations numerically using iteration** 21. 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. 22. solve linear inequalities in one **or two** variable**(s), and quadratic inequalities in one variable**; represent the solution set on a number line**, using set notation and on a graph** Sequences 23. generate terms of a sequence from either a term-to-term or a position-to-term rule 24. recognise and use sequences of triangular, square and cube numbers, simple arithmetic progressions, Fibonacci type sequences, quadratic sequences, and simple geometric progressions (r^n where n is an integer, and r is a rational number > 0 **or a surd**) **and other sequences** 25. deduce expressions to calculate the nth term of linear **and quadratic** sequences.		

Historical, Social, Moral, Spiritual, Cultural context:	Cross curricular links/ literacy/numeracy:	Common misconceptions:
• 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.	The lower case and upper case of a letter should not be used interchangeably when worked with algebra Juxtaposition is used in place of '×'. 2a is used rather than a2. • Division is written as a fraction • Algebra allows students to be able to communicate efficiently and to solve problems in Science (especially Physics) • Correct use of specialised mathematical terms and phrases is crucial.	• Some pupils may think that it is always true that a=1, b=2, c=3, etc. • A common misconception is to believe that a^2 = a × 2 = a2 or 2a (which it can do on rare occasions but is not the case in general) • When working with an expression such as 5a, some pupils may think that if a=2, then 5a = 52. • Some pupils may think that 3(g+4) = 3g+4 • The convention of not writing a coefficient of 1 (i.e. '1x' is written as 'x' may cause some confusion. In particular some pupils may think • When describing a number sequence some students may not appreciate the fact that the starting number is required as well as a term-to-term rule • Some pupils may think that all sequences are ascending • Some pupils may think the $(2n)^{th}$ term of a sequence is double the nth term of a (linear) sequence • Some pupils may think that equations always need to be presented in the form ax + b = c rather than c = ax + b.

		• Some pupils may think that the solution to an equation is always positive and/or a whole number. • Some pupils may get the use the inverse operations in the wrong order, for example, to solve 2x + 18 = 38 the pupils divide by 2 first and then subtract 18.

Assessment timeline:

- Topic test assessments 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
Unit:																													