The Sutton Academy

Knowledge Rich Curriculum Plan

Year 9 Prime – Sequences and Graphs

Lesson objective	Intended Knowledge:	Tiered Vocabulary	Prior Knowledge:	Steps to Success	Feedback
To learn how to solve problems involving sequences	• Students will know how to generate a linear sequence using the nth term. • Students will know how to generate a quadratic sequence from the nth term. • Students will know how to find the value of any term in a sequence by substitution. E.g. Find the 100^{th} term. • Students will know how to find the nth term of a linear sequence. • Students will know how to find the nth term of a pattern sequence. • Students will know how to identify and reason whether a term can be in a sequence. E.g. The sequence is made from all even numbers and the term is odd. • Students will know how to identify whether a term can be in a sequence given its nth term by forming and solving a linear equation. • Students will know how to find and use the nth term to determine whether a number will be in a linear sequence.	**Sequence** - a particular order in which related things follow each other. **Linear or Arithmetic Sequence** – a number pattern which increases (or decreases) by the same amount each time **Geometric Sequence –** a sequence made by multiplying by the same value each time **Generate –** produce or create. **Substitute –** use or add in place of **Nth Term –** a formula that enables us to find any term in a sequence. The ' n ' stands for the term number	• Students need to know how to solve linear equations.	**Steps to Success – Using the nth term** **Step 1**: Identify the nth term, if this is not given to you then you will need to calculate it. **Step 2**: If the question is asking you to find a particular term in the sequence, for instance the 100^{th} term, you would substitute that number into the expression. **Step 3**: If the question is asking you to generate a sequence using the nth term you would substitute the numbers of the sequence in, e.g. for term 1, 1 for term 2, 2 etc **Finding the nth term of linear sequences – Steps to success** **Step 1:** Find the differences between each term – these should be the same number. **Step 2:** Place your number in front of the letter n to get an. **Step 3:** Substitute the number 1 into your nth term. **Step 4:** Work out what you would do to get to the first term in the sequence. **Step 5:** Make this adjustment to your nth term. **Steps to Success – Identifying if a term is within a sequence (Forming an equation)** **Step 1 –** If a sequence is given, you may firstly need to calculate the nth term, if a rule and the first term is given you will need to write out the sequence and the calculate the nth term. **Step 2 –** Write the nth term where the equation is equal to the number that needs to be solved to be found in the sequence. **Step 3 –** If the answer is an integer then it is in the sequence, if not it does not belong.	
To learn how to find the nth term of a quadratic sequence	• Students will know how to continue a quadratic sequence and use the nth term to generate terms • Students will know how to find the nth term of a quadratic sequence. • Students will know how to solve problems involving the nth term of quadratic sequences	**Quadratic –** involving a squared algebraic term but no other power higher than 2 **Substitute –** use or add in place of	• Students will need to know how to find the nth term of a linear sequence • Students will need to know how to generate a sequence for a given nth term, including those in the form an^2	**Steps to Success – quadratic nth term** Step 1: Find the differences between the terms in the sequence, if it isn't the same you have to find the second difference – this shows that it is a quadratic sequence. Step 2: Half the second difference and put it as the coefficient of n^2 if the second difference is 2 then the sequence contains $1n^2$ (we just write this as n^2). if the second difference is 4 the sequence contains $2n^2$ if the second difference is 6 then the sequence contains $3n^2$ and so on… Step 3: Write out an^2 – substitute in 1, 2, 3, 4, 5 to generate this sequence, remember the order of operations! Step 4: Subtract an^2 from your original sequence	

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				Step 5: Find the nth term of the linear sequence that is left over after the subtraction - if it is the same number repeating it is just +/- that number Step 6: Write your answer in the form $an^2 + bn + c$	
To learn how to draw straight line graphs.	• Students will know how to plot straight line graphs in the form y = mx + c by first completing a given table of values • Students will know how to plot straight line graphs in the form y = mx + c by constructing their own table of values • Students will know how to plot and draw graphs of straight lines in the form x + y = c **Opportunity for Challenge:** • Students will know how to plot and draw graphs of straight lines in the form ax + by = c	**Substitute –** use or add in place of **Quadrant –** one of the four quarters of the coordinate plane	• Students need to know how to draw and identify graphs that are parallel to either the x- or y-axis (equations in the form y = a, x = a).	**Steps to Success – Plotting Straight Line Graphs** **Step 1**: Use the table of values for your coordinates for drawing the graph. If a table is not provided, create one using the x values on the axis as the x values in your table. Substitute your x values into the equation of the line in order to find your y coordinates. Remember to use brackets and follow BIDMAS. **Step 2**: Choose a pair of coordinates (x,y) from your table to plot on the graph. Remember that the 'x' coordinate is for the horizontal axis and the 'y' coordinate is for the vertical axis. Mark this point on the graph. **Step 3:** Continue this process until all pairs of coordinates have been plotted. **Step 4:** Join up the points with one straight line using a pencil and a ruler. If the coordinates do not form a straight line, check each coordinate is plotted correctly.	
To learn how to find the equation of a straight line from a graph.	• Students will know that the equation of a straight line can be written in the form y = mx + c where m tells us the gradient of the line and c tells us the y-intercept. • Students will know how to identify the gradient and y-intercept of a straight line given the equation in the form y = mx + c • Students will know how to calculate gradient between two pairs of coordinates. • Students will know that $gradient = \frac{change\ in\ y}{change\ in\ x}$ • Students will know how to find the equation of a given straight line.	**Intercept** – cross **Y-intercept** – the y-intercept tells us where a graph crosses the y-axis, this where x = 0 **Gradient** – steepness. The gradient of a line tells us how steep the line is. **Equation –** A mathematical statement that two amounts, or groups of symbols representing an amount, are equal: E.g. 3x - 3 = 15	• Students need to know how to plot and identify coordinates.	**The equation of a straight line – Steps to Success** The equation of any straight line can be written in the general form **y = mx + c** Where **m** is the gradient of the line and **c** is the y-intercept **Step 1:** Identify two pairs of integer coordinates on the given straight line **Step 2:** Work out the difference between the y-coordinates **Step 3:** Work out the difference between the x-coordinates **Step 4:** Calculate the gradient between the two pairs of coordinate using: $$gradient = \frac{change\ in\ y\ coordinates}{change\ in\ x\ coordinates}$$ **Step 5:** Identify the y-intercept of the straight line, this is the point at which the line crosses the y-axis **Step 6:** Substitute the gradient and y-intercept into the equation of the straight line. If the y-intercept is positive, the equation of the line will end in +c, if it is negative it will end in – c	
To learn how to find the equation of a straight line.	• Students will know how to find the equation of a straight line given the gradient and a coordinate in the form (x, y) where the x-coordinate is 0. • Students will know how to find the equation of a straight line given the gradient and a coordinate in the form (x, y) where x and y take any integer values		• Students need to know how to find the gradient from 2 points. • Students need to know how to substitute numbers into formulae.	**The equation of a straight line – Steps to Success** **Step 1:** Work out the difference between the y-coordinates **Step 2:** Work out the difference between the x-coordinates **Step 3:** Calculate the gradient between the two pairs of coordinate using: $$gradient = \frac{change\ in\ y\ coordinates}{change\ in\ x\ coordinates}$$	

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	• Students will know how to find the equation of a line between two pairs of coordinates by first calculating the gradient between the two points			**Step 4:** Identify the y-intercept of the straight line, this is the point at which the line crosses the y-axis **Step 5:** Substitute the gradient and y-intercept into the equation of the straight line. If the y-intercept is positive, the equation of the line will end in +c, if it is negative it will end in – c	
To learn how to find the equation of parallel lines.	• Students will know that parallel lines have the same gradient. • Students will know how to write the equation of any straight line that is parallel to another given line. • Students will know how to find the equation of a particular straight line that is parallel to another given line and passes through a certain coordinate. **Opportunity for Challenge:** • Students will know how to solve more complex problems involving finding the equation of parallel lines.	**Parallel –** parallel lines are two lines that are side by side and have the same distance continuously between them.	• Students need to know how to calculate gradient • Students need to know how to solve linear equations in the form a + x = c where a and c are integers or fractions	**Steps to success – Parallel Lines** **Step 1:** Identify the gradient of the line that your line is parallel to. **Step 2:** Write the equation of the line as y = mx + c and substitute in the gradient of the line (this is the same as the gradient of the line that it is parallel to). **Step 3:** Substitute in the coordinates given to you in the question, replacing x with the x coordinate and y with the y coordinate. **Step 4:** Solve the resulting equation to find c. **Step 5:** Substitute the gradient and y-intercept into the correct places in y = mx + c	
To consolidate understanding of Straight line graphs	• Students will know how to plot straight line graphs • Students will know how to find the gradient of a line both from a graph and when given sets of coordinates. • Students will know how to find the equation of a line from a graph and when given coordinates. • Students will know how to find the equation of parallel lines. • Students will know how to find the equation of perpendicular lines.		• Students will know how to identify the gradient and y-intercept of a straight line given the equation in the form y = mx + c	Use steps from Previous lessons.	
To learn how to solve linear simultaneous equations.	• Students will know how to solve linear simultaneous equations or find estimates to their solutions given two straight lines drawn on a graph. • Students will know how to draw two straight lines to identify the point of intersection to solve two simultaneous equations. • Students will know how to use elimination to solve linear simultaneous equations algebraically.	**Intersection –** a point at which two or more things cross **Simultaneous –** occurring, operating, or done at the same time. **Simultaneous equations –** equations involving two or more unknowns that are to have the same values in each equation. **Linear Equation –** an equation between two variables that can be written in the form y = mx + c. Linear equations give a straight line when plotted on a graph.	• Students need to know how to plot a straight line graph.	**Steps to Success – Solving Simultaneous Equations graphically** **Step 1:** Check if both your equations are in the form of y = mx + c. If they are not, rearrange them into this. **Step 2**: Plot your first equation on your graph, if it is not already plotted. **Step 3**: Plot your second equation on your graph, if it is not already plotted. **Step 4:** Find the point of intersection, this co-ordinate is the solution for x and y. **Step 5:** State the values for x and y. **Step 6:** Check your answer by substituting you value for x and y into a different equation to ensure your values are correct.	

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To learn how to solve linear simultaneous equations.	• Students will know how to use elimination to solve linear simultaneous equations algebraically. • Students will know how to solve linear simultaneous equations representing a real-life situation and interpret the solution in the context of the problem.		• Students need to know how to solve linear equations.	**Steps to Success – Solving Simultaneous Equations** **Step 1**: Check to see if the coefficients of y are the same in both of the equations. **Step 2**: If they are different, multiply one or both of the equations to make them the same (or find the Lowest Common Multiple of the coefficients of y) **Step 3**: Eliminate the y's by either adding the two equations together (when the signs in front the of the y's are different) or by subtracting the two equations from each other (when the signs in front of the ys are the same). **Step 4**: Solve the remaining equation for x. **Step 5**: Substitute the value of x into the any of your equations. **Step 6**: Solve this equation for y. **Step 7**: Check your answer by substituting you value for x and y into a different equation to ensure your values are correct.	
To learn how to draw quadratic graphs.	• Students will know how to use a calculator to generate points for a quadratic graph in the form $y = ax^2 + bx + c$ where a = 1 and b and c are any integer including 0 both with and without a calculator. • Students will know how to plot a quadratic graph once they have generated the points. • Students will know that the points for a quadratic graph should be joined with a smooth curve. • Students will know how to generate points for a quadratic graph in the form $y = ax^2 + bx + c$ where $a \neq 1$ and b and c are any integer including 0 both with and without a calculator.	**Quadratic –** An expression or equation where the highest power is 2. **Parabola –** the U or ∩ shape of a quadratic graph	• Students need to know how to substitute both positive and negative integers into formulae. • Students need to know how to use the order of operations.	**Steps to Success- Plotting Quadratic** **Step 1**: If one isn't given, construct a table with one row for x-values and another for y-values. Use the values given in the question to determine what x-coordinates to use. **Step 2**: Substitute each x-value into the given equation to generate each y-value. **Step 3**: Plot each coordinate pair on the graph with an x. **Step 4:** Connect the points together with a curve, Do not use a ruler!	
To learn how to draw quadratic graphs and find roots and turning points.	• Students will know how to recognise graphs of quadratic functions. • Students will know how to generate points and plot graphs for quadratic functions, with and without a calculator. • Students will know how to identify the line of symmetry of a quadratic graph. • Students will know how to find approximate and exact solutions to quadratic equations by identifying the roots of a graph. • Students will know how to identify the turning point for a drawn quadratic graph. **Opportunity for Challenge:** • Students will know how to find approximate and exact solutions to quadratic equations in the form $ax^2 + bx + c = d$ where d is an integer or decimal number by drawing a suitable horizontal straight line.	**Quadratic –** An expression or equation where the highest power is 2. **Symmetry –** A shape or object has symmetry if it can be divided into 2 or more identical pieces. **Turning Point** – The point at which the gradient changes of a curve (the maximum or minimum point on a curve). **Root** – A solution to an equation where a line or curve crosses the x-axis. **Parabola –** the U or ∩ shape of a quadratic graph	• Students need to know how to substitute both positive and negative numbers into equations involving squared terms.	**Steps to Success- Interpreting Quadratic Graphs** **Solutions or roots to quadratic graphs** If you are asked to find the solution or root of a quadratic graph, it is asking for the x coordinate of where the line touches or crosses the x-axis. **Turning point** If you are asked to find the turning point of a quadratic, it is asking for the highest or lowest co-ordinate depending on the quadratic, where it "turns around".	

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To learn how to factorise and solve quadratics.	• Students will know how to factorise and solve quadratic equations in the form $ax^2 + bx + c = 0$ where $a = 1$ • Students will know that in order to factorise and solve quadratic equations they must be equal to zero. • Students will know how to rearrange equations to make them equal to zero before factorising and solving them. **Opportunity for Challenge:** • Students will know how to factorise and solve quadratic equations where the coefficient of x^2 is 1.	**Factorise –** put back into brackets by bringing common factors outside **Quadratic –** involving a squared algebraic term but no other power higher than 2	• Students need to be able to factorise quadratics where the co-efficient of x^2 is 1.	**Steps to success – Solving quadratics by factorising** **Step 1:** Check that your quadratic equals 0. If not, rearrange your equation to make it equal 0. **Step 2:** Factorise your equation, remember it needs to equal 0. **Step 3:** There are usually two solutions to each quadratic. Make each bracket equal to 0 and solve for your variable. **Step 4:** The solution to each variable is your answer. Remember to check your signs.	
To learn how to solve quadratic equations using the quadratic formula.	• Students will know that the quadratic formula is $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$ • Students will know that we use the quadratic formula when a quadratic cannot be factorised. • Students will know how to identify the values for a, b and c from a quadratic equation including where the equation is not necessarily in the order $ax^2 + bx + c$. • Students will know how to substitute the values for a, b and c into the quadratic formula to solve the corresponding quadratic equation. • Students will know that in order to solve quadratic equations they must be equal to zero. • Students will know how to rearrange equations to make them equal to zero before using the quadratic formula to solve them. **Opportunity for Challenge:** • Students will know how to form and solve quadratic equations using the quadratic formula.	**Formula –** A mathematical relationship or rule expressed in symbols.	• Students need to be able to use a calculator efficiently. • Students need to be able to substitute numbers into formulae.	**Steps to Success – Using the Quadratic Formula** **Step 1:** Identify the values of a, b and c **Step 2:** Substitute the values for a, b and c into the correct places in the formula **Step 3:** Write out the calculation twice, once with the + and once with the – in place of the ± **Step 4:** Use your calculator to work out the answer to each of the calculations produced in step 3 **Step 5:** Check you've rounded to the correct degree of accuracy	
Mini-Assessment 4					