Knowledge Rich Curriculum Plan

Year 12 Maths

Unit 12 - Differentiation

Maths Year 12	Unit: Differentiation			
Lesson/Learning Sequence	Intended Knowledge: *Students will know that…*	Tiered Vocabulary	Prior Knowledge: *In order to know this students, need to already know that…*	Assessment
Lesson 60: Gradients of curves Lesson Objective: To learn how to find the gradient of a curve using a tangent.	• Students will know that the gradient of a curve is constantly changing. • Students will know that the gradient of the tangent at that particular point is the gradient of the curve at that particular point. • Students will know how to find the gradient at a given point on the curve using a tangent.		• *Students need to know how to find the gradient of a line segment.* • *Students need to know how to find the gradient of a straight line using two points.* • *Students need to know that a tangent is a straight line that touches the curves at one point.*	
Lesson 61: Finding the derivative Lesson Objective: To learn how to use differentiation from first principles to find the gradient of a curve.	• Students will know that as two points, A and B, get closer to each other on the curve the gradient of the chord AB gets closer to the gradient of the tangent • Students will know that h will tend to 0. • Students will know how to define the gradient function. • Students will know how to use the gradient function to find the gradient of the curve for any value of x using substitution. • Students will know how to find the derivative from using first principles.		• *Students need to know how to substitute into formulae.* • *Students need to know how to rearrange formulae.* • *Students need to know how to use the tangent to find the gradient at a point of a curve.* • *Students need to know how to find the gradient of a line segment.* • *Students need to know how to collect like terms.*	
Lesson 62: Differentiating (x^n/Quadratics/Functions with two or more terms) Lesson Objective: To learn how to differentiate expressions with multiple terms.	• Students will know how to differentiate by multiplying the function by the power and then subtracting 1 from the power. • Students will know to only differentiate when a term is written as a single power of x. • Students will know how to write derivative notation. • Students will know how to differentiate a term with a constant in front of it. • Students will know how to simplify expressions to get each term to a single power of x. • Students will know how to differentiate quadratic expressions. • Students will know how to differentiate function with two or more terms by differentiating one term at a time.		• *Students need to know how to collect like terms.* • *Students need to know how to use index laws to simplify algebraic expressions.* • *Students need to know how to manipulate negative indices.* • *Students need to know how to manipulate fractional powers.* • *Students need to know how to Simplify algebraic fractions.* • *Students need to know how to expand brackets.* • *Students need to know that differentiating is a way to find the gradient of a curve.*	
Lesson 63: Gradients, tangents and normal Lesson Objective: To learn how to find the equation of a tangent and normal at a point on a curve.	• Students will know how to find the gradient by differentiating a function and substituting in the x-coordinate. • Students will know how to find the equation of a tangent using the gradient and a point on the curve. • Students will know that the normal is the straight line perpendicular to the tangent.		• *Students need to know how to differentiate multiple terms.* • *Students need to understand differential notation.* • *Students need to know how to find the gradient using differentiation.*	

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	• Students will know how to find the equation of a normal using the perpendicular gradient of the tangent and a point on the curve.		• *Students need to know how to find a perpendicular gradient.* • *Students need to know how to find the equation of a line using the tangent and a point.* • *Students need to know how to substitute into formulae.* • *Students need to know how to rearrange formulae.* • *Students need to know how to simplify expressions using index laws.* • *Students need to know that all terms need to be expressed as a single power of x.*	
Lesson 64: Increasing and decreasing functions Lesson Objective: To learn how to determine if a function is increasing or decreasing.	• Students will know that a function is increasing if the derivative is greater than or equal to zero for all values of x. • Students will know that a function is decreasing if the derivative is less than or equal to zero for all values of x. • Students will know how to determine if a function is increasing or decreasing using the derivative. • Students will know that some functions are increasing for a certain interval and decreasing for a certain interval.		• *Students need to know how to differentiate multiple terms.* • *Students need to know how to factorise expressions.* • *Students need to know how to solve linear inequalities.* • *Students need to know how to solve quadratic inequalities.* • *Students need to know how to use index laws to simplify algebraic expressions.*	
Lesson 65: Second order derivatives Lesson Objective: To learn how to find second order derivatives.	• Students will know how to use second order differential notation. • Students will know how to find second order derivatives. • Students will know that the second order derivative is found by differentiating a function twice. • Students will know that the second order derivative is the rate of change of the gradient function.		• *Students need to know how to differentiate multiple terms.* • *Students need to know how to use index laws to simplify algebraic expressions.* • *Students need to know how to substitute into formulae.* • *Students need to know how to solve equations.* • *Students need to know how to use differential notation.*	
Lesson 66: Stationary points Lesson Objective: To learn how to find the stationary points of a curve.	• Students will know that a stationary point is any point the curve has a gradient of zero. • Students will know how to find the coordinates of the stationary points using zero for the value of the gradient with the derivative and solving to find the x-coordinate.		• *Students need to know how to differentiate multiple terms.* • *Students need to know to find second order derivatives.* • *Students need to know how to rearrange formulae.*	

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	• Students will know that a stationary point is a local maximum when the gradient of the curve goes from positive to zero to negative. • Students will know that a stationary point is a local maximum when the second derivative is less than zero. • Students will know that a stationary point is a local minimum when the gradient of the curve goes from negative to zero to positive. • Students will know that a stationary point is a local minimum when the second derivative is greater than zero. • Students will know that a stationary point is a point of inflection when the gradient of the curve goes from either negative-zero-negative or positive-zero-positive. • Students will know that when the second derivative is equal to zero the stationary point could be a local maximum, local minimum or a point of inflection and to look at points on either side to determine its nature. • Students will know how to determine if a stationary point in a local maximum, local minimum or a point of inflection by using the second derivative.		• *Students need to know how to substitute into formulae.* • *Students need to know how to solve equations.* • *Students need to know how to use index laws to simplify expressions.* • *Students need to know how to find the y-coordinate using the x-coordinate and an equation.* • *Students need to know how to use the derivative to find the gradient of a curve at a particular point.*	
Lesson 67: Sketching gradient functions Lesson Objective: To learn how to sketch a gradient function.	• Students will know that a minimum or maximum in given function will cut the x-axis in the corresponding gradient function. • Students will know that a point of inflection in given function will touch the x-axis in the corresponding gradient function. • Students will know that a positive gradient in given function will be above the x-axis in the corresponding gradient function. • Students will know that a negative gradient in given function will be below the x-axis in the corresponding gradient function. • Students will know that a vertical asymptote in given function will become a vertical asymptote in the corresponding gradient function. • Students will know that a horizontal asymptote in given function will become a horizontal asymptote at the x-axis in the corresponding gradient function.		• *Students need to know how to sketch graphs.* • *Students need to know how to determine if a stationary point is a local maximum or local minimum using a drawing of the function.* • *Students need to know how to determine if a stationary point is a point of inflection using a drawing of the function.* • *Students need to know what an asymptote is and how a graph acts around it.* • *Students need to know if a line segment has a positive or negative gradient suing a drawing of the function.*	

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	• Students will know how to select the features of a given function and use them to sketch the corresponding gradient function.			
Lesson 68: Modelling with differentiation Lesson Objective: To learn how to model real-life situations using differentiation.	• Students will know how to set up a differential equation for a real-life situation. • Students will know how to set up differential equations involving shapes. • Students will know how to find the maximum or minimum perimeter/area/volume/surface area of a shape using second order differentiation. • Students will know how to solve problems involving shapes.		• *Students need to know how to find the area or perimeter of 2D shapes.* • *Students need to know how to find the volume or surface area of 3D shapes.* • *Students need to know how to differentiate multiple terms.* • *Students need to know how to find second order derivatives.* • *Students need to know how to mind the minimum or maximum points.* • *Students need to know how to form equations.* • *Students need to know how to use index laws.* • *Students need to know how to rearrange formulae.* • *Students need to know how to substitute into formulae.*	