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| **Year 2 pure unit 9: Differentiation** | **Road Map** |
| In this unit you will learn about pure maths. The aims are as follows:**LG1**: Knowledge**LG2**: Application**LG3**: Skills | Assessment Grades |  |  |
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| **Themes** | **Learning Goals/Outcomes/Content** |  |  |  |
| **9a. Differentiating Sinx and Cosx from first principles** | be able to find the derivative of sin *x* and cos *x* from first principles. |  |  |  |
| **9b. Differentiating exponentials and logarithms**  | be able to differentiate functions involving e*x*, ln *x* and related functions such as 6e4*x* and 5 ln 3*x* and sketch the graphs of these functions; |  |  |  |
| be able to differentiate to find equations of tangents and normals to the curve.  |  |  |  |
| **9c. Differentiating composite, products, quotients and trig functions.**  | be able to differentiate composite functions using the chain rule; |  |  |  |
| be able to differentiate using the product rule; |  |  |  |
| be able to differentiate using the quotient rule; |  |  |  |
| be able to apply the above to trigonometric functions |  |  |  |
| **9d. Differentiating parametric and implicit functions**  | be able to differentiate parametric equations; |  |  |  |
| be able to find the gradient at a given point from parametric equations; |  |  |  |
| be able to find the equation of a tangent or normal (parametric)) |  |  |  |
| be able to use implicit differentiation to differentiate an equation involving two variables; |  |  |  |
| be able to find the gradient of a curve using implicit differentiation; |  |  |  |
| be able to verify a given point is stationary (implicit). |  |  |  |
| **9e. Second derivatives (rates of change of gradient, inflections)** | be able to find and identify the nature of stationary points and understand rates of change of gradient. |  |  |  |

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| **Themes** | **Learning Goals/Outcomes/Content** |  |  |  |

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| **9f. Rates of change problems**  | be able to use a model to find the value after a given time; |  |  |  |
| be able to set up and use logarithms to solve an equation for an exponential growth or decay problem; |  |  |  |
| be able to use logarithms to find the base of an exponential; |  |  |  |
| know how to model the growth or decay of 2D and 3D objects using connected rates of change; |  |  |  |
| be able to set up a differential equation using given information which may include direct proportion. |  |  |  |

**Links:**

LG1: You will learn how to differentiate from first principles for sinx and cosx. You will learn how to use the second derivative as a rate of change of gradient and know the connection to different parts of a curve. You will learn how to differentiate a range of more complex function types. You will learn how to use product rule, quotient rule and chain rule to differentiate more complex functions. You will learn how to differentiate simple functions defined implicitly and differentiate simple parametric functions.

LG2: You will be able to apply your knowledge of differentiation to construct simple differential equations in pure maths and in contexts including kinematics, population growth and modelling the relationship between price and demand.

LG3: You will be able to solve a variety of routine and non-routine problems, by combining several Mathematical skill sets. For example, finding gradients and normal for exponential and log functions, using graphs to check and enhance the solutions.