Y12 Pure Chapter 12—Differentiation

Y12 – Chapter 12 Differentiation

What do I need to be able to do?

By the end of this chapter you should be able to:

- Find the derivative of a simple function
- Use the derivative to solve problems involving gradients, tangents and normal
- Identify increasing and decreasing functions
- Find the second order derivative
- Find stationary points of functions and determine their nature
- Sketch the gradient function of a given function
- Model real life situations with differentiation

Differentiating from first principles

It's a proof so you have to show ALL steps use the formula, substituting in the function

$$\frac{dy}{dx} = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

Differentiating

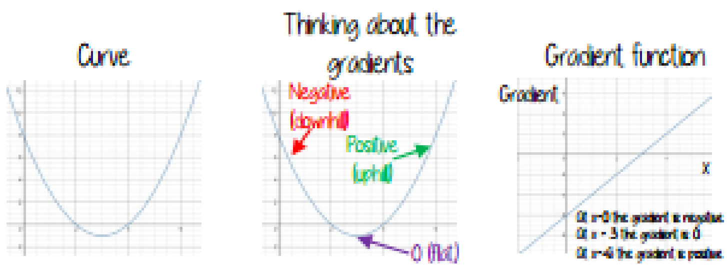
If $y = ax^n$ then $\frac{dy}{dx} = anx^{n-1}$

If $f(x) = ax^n$ then $f'(x) = anx^{n-1}$

When differentiating you multiply each term by its power and then reduce its power by 1

Sketching gradient functions

To sketch the gradient function, think about what is happening to the gradient at various points on the curve and sketch them



Key words:

- Derivative – a way to show rate of change: that is, the amount by which a function is changing at one given point
- Stationary point – A point on a curve where the slope is zero. This can be where the curve reaches a minimum or maximum

Notation and definitions

The gradient of a curve at a given point is defined as the gradient to the tangent to the curve at that point

The gradient function or derivative of the curve y = f(x) is written as f'(x) or $\frac{dy}{dx}$ or y' or $\frac{\delta y}{\delta x}$

The gradient function ($\frac{dy}{dx}$) measures the rate of change of y with respect to x

Tangents and normals

The tangent to the curve y = f(x) at the point (a, f(a)) has the equation:

y – f(a) = f'(a)(x – a)

The normal to the curve y = f(x) at the point (a, f(a)) has the equation:

y – f(a) = 1/f'(a)(x – a)

Stationary points

Solving $\frac{dy}{dx} = 0$ gives the x coordinate of the stationary points. Sub x value into y = f(x) to find the y coordinates

Solving $\frac{d^2y}{dx^2} = 0$ gives the nature of the stationary point. If $\frac{d^2y}{dx^2} > 0$ then it's a minimum. If $\frac{d^2y}{dx^2} < 0$ then it's a maximum

Pure Maths Year 1/AS