U6 Chapter 9

Differentiation

Chapter Overview

1. Differentiate trigonometric, exponential and log functions.

2. Use chain, product and quotient rules.

3. Differentiate parametric equations.

4. Implicit Differentiation

5. Rates of change

  



**Differentiating trigonometric functions**

You need to be able to differentiate sin x and cos x from first principles.

**Example 1 Prove, from first principles, that the derivative of sin x is cos x.**

$\frac{d}{dx}\left(\sin(x)\right)=\cos(x)$

Things of helpfulness:

* As $x\rightarrow 0,  \sin(x)≈x$ and $\cos(x)≈1-\frac{1}{2}x^{2}$
* $\sin(\left(a+b\right))=\sin(a)\cos(b)+\cos(a)\sin(b)$

**If** $y=f(x)$ **then** $\frac{dy}{dx}=\lim\_{h\to 0}\frac{f\left(x+h\right)-f\left(x\right)}{h}$

**Why does this result only hold in radians?**



$$\frac{d}{dx}\left(\sin(kx)\right)=k\cos(kx)$$

$$\frac{d}{dx}\left(\cos(kx)\right)=-k\sin(kx)$$

**Quickfire Questions:**

$\frac{d}{dx}\left(\sin(3x)\right)=$

$\frac{d}{dx}\left(\cos(5x)\right)=$

$\frac{d}{dx}\left(3\sin(5x)\right)=$

$\frac{d}{dx}\left(4\cos(3x)\right)=$

$\frac{d}{dx}\left(-\frac{1}{2}\sin(x)\right)=$

$\frac{d}{dx}\left(-\frac{2}{3}\cos(\frac{1}{2}x)\right)$=

**Example**

[Textbook] A curve has equation $y=\frac{1}{2}x-\cos(2x)$. Find the stationary points on the curve in the interval $0\leq x\leq π$.

**Test Your Understanding**

A curve has equation $y=\sin(3x)+2x$. Find the stationary points on the curve in the interval $0\leq x\leq \frac{2}{3}π$.

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