Calculus – Differentiation

1. Introduction

- For 2 triangles (or 2 figures) to be congruent, they must be identities
- For triangles, this means all 3 pairs of corresponding sides and angle must be equal

2. Rules

a. Basic Rule
b. Chain Rule
c. Product Rule
d. Quotient Rule
e. Trigonometric Functions
f. Exponential Functions
g. Logarithmic Functions

Rule	Differentiation	Integration
1. *Basic Rule*	$\frac{d}{dx}ax^n = nax^{n-1}$	$\int ax^n\,dx = \frac{ax^{n+1}}{(n+1)} + C$
2. *Chain Rule*	$\frac{d}{dx}(ax+b)^n = an(ax+b)^{n-1}$	$\int (ax+b)^n\,dx = \frac{(ax+b)^{n^{n+1}}}{a(n+1)} + C$
	$\frac{d}{dx}\big(f(x)\big)^n = n\big(f(x)\big)^{n-1}f'(x)$	
3. *Product Rule*	$\frac{d}{dx}uv = u\frac{dv}{dx} + v\frac{du}{dx}$	
4. *Quotient Rule*	$\frac{d}{dx}\frac{u}{v} = \frac{v\frac{du}{dx} + u\frac{dv}{dx}}{v^2}$	
5. *Trigo. Function*	$\frac{d}{dx}\sin x = \cos x$	$\int \sin x\,dx = -\cos x + C$
	$\frac{d}{dx}\cos x = -\sin x$	$\int \cos x\,dx = \sin x + C$
	$\frac{d}{dx}\tan x = \sec^2 x$	$\int \sec^2 dx = \tan x + C$
	$\frac{d}{dx}\sin(ax+b) = a\cos(ax+b)$	$\int \sin(ax+b)\,dx = -\frac{1}{a}\cos x + C$
	$\frac{d}{dx}\cos(ax+b) = -a\sin(ax+b)$	$\int \cos(ax+b)\,dx = \frac{1}{a}\sin x + C$
	$\frac{d}{dx}\tan(ax+b) = a\sec^2(ax+b)$	$\int \sec^2(ax+b)\,dx = \frac{1}{a}\tan(ax+b) + C$
	$\frac{d}{dx}\sin^{\mathrm{n}} x = n\sin^{n-1}\cos x$	$\int \sin^2 x\,dx = \int \frac{1-\cos 2\mathrm{x}}{2}x\,dx$ $= \int \frac{1}{2} - \frac{1}{2}\cos 2\mathrm{x}\,\mathrm{dx}$ $= \frac{1}{2}x - \frac{1}{2}\sin x + c$
	$\frac{d}{dx}\cos^{\mathrm{n}} x = -n\cos^{n-1}\sin x$	$\int \cos^2 x\,dx = \int \frac{1}{2} + \frac{1}{2}\cos 2\mathrm{x}\,\mathrm{dx}$ $= \frac{1}{2}x + \frac{1}{2}\sin x + c$
	$\frac{d}{dx}\tan^{\mathrm{n}} x = n\tan^{n-1}\sec^2 x$	$\int \tan^2 x\,dx = \int \sec^2 x - 1\,dx$ $\tan^2 x - x + c$

Exponential Functions	$\frac{d}{dx}e^x = e^x$	$\int e^x\,dx = e^x + c$
	$\frac{d}{dx}e^{ax+b} = ae^{ax+b}$	$\int e^{ax+b}\,dx = \frac{1}{a}e^{ax+b} + c$
	$\frac{d}{dx}e^{f(x)} = f'(x)e^x$	
Logarithmic Functions	$\frac{d}{dx}\ln x = \frac{1}{x}$	$\int \frac{1}{x}dx = \ln x + c$
	$\frac{d}{dx}\ln(ax+b) = \frac{a}{ax+b}$	$\int \frac{1}{ax+b}dx = \frac{1}{a}\ln(ax+b) + c$
	$\frac{d}{dx}\ln f(x) = \frac{f'(x)}{f(x)}$	