Techniques of Differentiation

First Principles:	$\lim\limits_{\delta x \to 0} \dfrac{f(x+\delta x) - f(x)}{\delta x}$
Chain Rule:	$\dfrac{dy}{dx} = \dfrac{dy}{du} \cdot \dfrac{du}{dx}$
Product Rule:	$\dfrac{d}{dx}(uv) = u\dfrac{dv}{dx} + v\dfrac{du}{dx}$
Quotient Rule:	$\dfrac{d}{dx}\left(\dfrac{u}{v}\right) = \dfrac{v\dfrac{du}{dx} - u\dfrac{dv}{dx}}{v^2}$

Differentiation of Standard Function

$\dfrac{dy}{dx}(c) = 0$, where c is a constant	$\dfrac{d}{dx}[f(x)]^n = n[f(x)]^{n-1} f'(x)$
Trigonometric Functions	
$\dfrac{d}{dx}[\sin f(x)] = f'(x) \cos f(x)$	$\dfrac{d}{dx}[\operatorname{cosec} f(x)] = -f'(x) \operatorname{cosec} f(x) \cot f(x)$
$\dfrac{d}{dx}[\cos f(x)] = -f'(x) \sin f(x)$	$\dfrac{d}{dx}[\sec f(x)] = f'(x) \sec f(x) \tan f(x)$
$\dfrac{d}{dx}[\tan f(x)] = f'(x) \sec^2 f(x)$	$\dfrac{d}{dx}[\cot f(x)] = -f'(x) \operatorname{cosec}^2 f(x)$
Exponential and Logarithmic Functions	
$\dfrac{d}{dx}[e^{f(x)}] = e^{f(x)} f'(x)$	$\dfrac{d}{dx}[a^{f(x)}] = a^{f(x)} (\ln a) f'(x)$
$\dfrac{d}{dx}[\ln f(x)] = \dfrac{f'(x)}{f(x)}$	$\dfrac{d}{dx}[\log_a f(x)] = \dfrac{f'(x)}{f(x) \ln a}$
Inverse Trigonometric Functions	
$\dfrac{d}{dx}[\sin^{-1} x] = \dfrac{1}{\sqrt{1-x^2}}, -1 < x < 1$	$\dfrac{d}{dx}[\sin^{-1} f(x)] = \dfrac{f'(x)}{\sqrt{1-[f(x)]^2}}, -1 < f(x) < 1$
$\dfrac{d}{dx}[\cos^{-1} x] = -\dfrac{1}{\sqrt{1-x^2}}, -1 < x < 1$	$\dfrac{d}{dx}[\cos^{-1} f(x)] = \dfrac{-f'(x)}{\sqrt{1-[f(x)]^2}}, -1 < f(x) < 1$
$\dfrac{d}{dx}[\tan^{-1} x] = \dfrac{1}{1+x^2}, x \in \mathbb{R}$	$\dfrac{d}{dx}[\tan^{-1} f(x)] = \dfrac{f'(x)}{1+[f(x)]^2}, f(x) \in \mathbb{R}$
Parametric Differentiation	
$\dfrac{dy}{dx} = \dfrac{dy}{dt} \times \dfrac{dt}{dx}$	$\dfrac{d^n y}{dx^n} \neq \dfrac{d^n y}{dt^n} \times \dfrac{d^n t}{dx^n}$ for $n \geq 2$