Differentiation Formulae

Standard Derivatives

$f(x)$	$f`(x)$
x^n	nx^{n-1}
$(ax+b)^n$	$an(ax+b)^{n-1}$
$\sin x$	$\cos x$
$\cos x$	$-\sin x$
$\sin(ax+b)$	$a\cos(ax+b)$
$\cos(ax+b)$	$-a\sin(ax+b)$

Trigonometric Functions

$\tan x = \dfrac{\sin x}{\cos x}$ $\quad$ $\operatorname{cosec} x = \dfrac{1}{\sin x}$ $\quad$ $\sec x = \dfrac{1}{\cos x}$ $\quad$ $\cot x = \dfrac{1}{\tan x} = \dfrac{\cos x}{\sin x}$

$f(x)$	$f`(x)$
$\tan x$	$\sec^2 x$
$\operatorname{cosec} x$	$-\operatorname{cosec} x \cot x$
$\sec x$	$\sec x \tan x$
$\cot x$	$-\operatorname{cosec}^2 x$
$\sin^{-1} x$	$\dfrac{1}{\sqrt{1-x^2}}$
$\cos^{-1} x$	$-\dfrac{1}{\sqrt{1-x^2}}$
$\tan^{-1} x$	$\dfrac{1}{1+x^2}$

Differentiation of Exponential Functions

$$\frac{d}{dx}\left(e^x\right) = e^x$$

Differentiation of Logarithmic Functions

$$\frac{d}{dx}\ln x = \frac{1}{x}$$

Implicit Differentiation

The derivative of y^2 w.r.*x.* is found using the chain rule as follows:

$$\frac{d}{dx}(y)^2 = 2y \cdot \frac{dy}{dx}$$

Similarly

$$\frac{d}{dx}(y)^3 = 3y^2 \cdot \frac{dy}{dx}$$

$$\frac{d}{dx}\sin(y) = \cos y \cdot \frac{dy}{dx}$$

$$\frac{d}{dx}e^{(y)} = e^y \cdot \frac{dy}{dx}$$

$$\frac{d}{dx}\ln(y) = \frac{1}{y} \cdot \frac{dy}{dx}$$

Parametric Differentiation

An expression for $\frac{dy}{dx}$ in terms of *t* is:

$$\frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}} \qquad \text{or} \qquad \frac{dy}{dx} = \frac{dy}{dt} \times \frac{dt}{dx}$$

The Second Derivative of a Parametric Function.

$$\boxed{\frac{d^2y}{dx^2} = \frac{d}{dt}\left(\frac{dy}{dx}\right) \cdot \frac{dt}{dx}}$$

Logarithmic Differentiation

Differentiate $y = 2^{\sin x}$

Take ln of both sides

$\ln y = \ln 2^{\sin x}$

$= \sin x \ln 2$

Differentiate implicitly

$$\frac{1}{y}\frac{dy}{dx} = \cos x \ln 2$$

$$\frac{dy}{dx} = y \cos x \ln 2$$

$= 2^{\sin x} \cos x \ln 2$