



HIGH SCHOOL MATHEMATICS

DIFFERENTIATION II

The derivatives you need to know:

- $y = x^n \rightarrow \frac{dy}{dx} = nx^{n-1}$
- $y = kx^n \rightarrow \frac{dy}{dx} = nkx^{n-1}$
- $y = f(x)^n \rightarrow \frac{dy}{dx} = nf(x)^{n-1} \times f'(x)$
- $y = kf(x)^n \rightarrow \frac{dy}{dx} = nk \times f(x)^{n-1} \times f'(x)$
- $y = a^x \rightarrow \frac{dy}{dx} = a^x \ln a \quad (a > 0)$
- $y = e^x \rightarrow \frac{dy}{dx} = e^x$
- $y = ke^x \rightarrow \frac{dy}{dx} = ke^x$
- $y = e^{f(x)} \rightarrow \frac{dy}{dx} = f'(x) e^{f(x)}$
- $y = \ln x \rightarrow \frac{dy}{dx} = \frac{1}{x}$
- $y = \ln(f(x)) \rightarrow \frac{dy}{dx} = \frac{f'(x)}{f(x)}$
- $y = \sin(x) \rightarrow \frac{dy}{dx} = \cos(x)$
- $y = \cos(x) \rightarrow \frac{dy}{dx} = -\sin(x)$
- $y = \tan(x) \rightarrow \frac{dy}{dx} = \sec^2(x)$

Algebraic Functions

Exponentials & Logarithms

These trigonometric derivatives are provided in formulae booklets.

Trigonometric

f(x)	f'(x)
$\tan kx$	$k \sec^2 kx$
$\sec x$	$\sec x \tan x$
$\cot x$	$-\operatorname{cosec}^2 x$
$\operatorname{cosec} x$	$-\operatorname{cosec} x \cot x$

Chain Rule

$$\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$$

Product rule

$$y = f(x)g(x) \rightarrow \frac{dy}{dx} = f'(x) \times g(x) + g'(x) \times f(x)$$

Reciprocal

$$\frac{dy}{dx} = \frac{1}{\frac{dx}{dy}}$$

Quotient rule (provided in the booklet)

$$y = \frac{f(x)}{g(x)} \rightarrow \frac{dy}{dx} = \frac{f'(x) \times g(x) - g'(x) \times f(x)}{(g(x))^2}$$