

## Differentiation

$$(cu)' = cu' \quad (c \text{ constant})$$

$$(u + v)' = u' + v'$$

$$(uv)' = u'v + uv'$$

$$\left(\frac{u}{v}\right)' = \frac{u'v - uv'}{v^2}$$

$$\frac{du}{dx} = \frac{du}{dy} \cdot \frac{dy}{dx} \quad (\text{Chain rule})$$

$$(x^n)' = nx^{n-1}$$

$$(e^x)' = e^x$$

$$(e^{ax})' = ae^{ax}$$

$$(a^x)' = a^x \ln a$$

$$(\sin x)' = \cos x$$

$$(\cos x)' = -\sin x$$

$$(\tan x)' = \sec^2 x$$

$$(\cot x)' = -\csc^2 x$$

$$(\sinh x)' = \cosh x$$

$$(\cosh x)' = \sinh x$$

$$(\ln x)' = \frac{1}{x}$$

$$(\log_a x)' = \frac{\log_a e}{x}$$

$$(\arcsin x)' = \frac{1}{\sqrt{1-x^2}}$$

$$(\arccos x)' = -\frac{1}{\sqrt{1-x^2}}$$

$$(\arctan x)' = \frac{1}{1+x^2}$$

$$(\operatorname{arccot} x)' = -\frac{1}{1+x^2}$$

## Integration

$$\int uv' dx = uv - \int u'v dx \quad (\text{by parts})$$

$$\int x^n dx = \frac{x^{n+1}}{n+1} + c \quad (n \neq -1)$$

$$\int \frac{1}{x} dx = \ln |x| + c$$

$$\int e^{ax} dx = \frac{1}{a} e^{ax} + c$$

$$\int \sin x dx = -\cos x + c$$

$$\int \cos x dx = \sin x + c$$

$$\int \tan x dx = -\ln |\cos x| + c$$

$$\int \cot x dx = \ln |\sin x| + c$$

$$\int \sec x dx = \ln |\sec x + \tan x| + c$$

$$\int \csc x dx = \ln |\csc x - \cot x| + c$$

$$\int \frac{dx}{x^2 + a^2} = \frac{1}{a} \arctan \frac{x}{a} + c$$

$$\int \frac{dx}{\sqrt{a^2 - x^2}} = \arcsin \frac{x}{a} + c$$

$$\int \frac{dx}{\sqrt{x^2 + a^2}} = \operatorname{arcsinh} \frac{x}{a} + c$$

$$\int \frac{dx}{\sqrt{x^2 - a^2}} = \operatorname{arccosh} \frac{x}{a} + c$$

$$\int \sin^2 x dx = \frac{1}{2}x - \frac{1}{4}\sin 2x + c$$

$$\int \cos^2 x dx = \frac{1}{2}x + \frac{1}{4}\sin 2x + c$$

$$\int \tan^2 x dx = \tan x - x + c$$

$$\int \cot^2 x dx = -\cot x - x + c$$

$$\int \ln x dx = x \ln x - x + c$$

$$\begin{aligned} \int e^{ax} \sin bx dx \\ = \frac{e^{ax}}{a^2 + b^2} (a \sin bx - b \cos bx) + c \end{aligned}$$

$$\begin{aligned} \int e^{ax} \cos bx dx \\ = \frac{e^{ax}}{a^2 + b^2} (a \cos bx + b \sin bx) + c \end{aligned}$$