Differentiation

$y = f(x)$	$\frac{\mathrm{d}y}{\mathrm{d}x} = f'(x)$
k, constant	0
x	1
x^2	$2x$
x^3	$3x^2$
x^n, any constant n	nx^{n-1}
e^x	e^x
e^{kx}	$k\mathrm{e}^{kx}$
$\ln kx = \log_{\mathrm{e}} kx$	$\frac{1}{x}$

The sum-difference rule

$$\frac{\mathrm{d}}{\mathrm{d}x}(u(x) \pm v(x)) = \frac{\mathrm{d}u}{\mathrm{d}x} \pm \frac{\mathrm{d}v}{\mathrm{d}x}$$

Constant multiples

$$\frac{\mathrm{d}}{\mathrm{d}x}(k \times f(x)) = k \times \frac{\mathrm{d}f}{\mathrm{d}x}$$

for k constant

The product and quotient rules

$$\frac{\mathrm{d}}{\mathrm{d}x}(uv) = u\frac{\mathrm{d}v}{\mathrm{d}x} + v\frac{\mathrm{d}u}{\mathrm{d}x} \qquad \frac{\mathrm{d}}{\mathrm{d}x}\left(\frac{u}{v}\right) = \frac{v\frac{\mathrm{d}u}{\mathrm{d}x} - u\frac{\mathrm{d}v}{\mathrm{d}x}}{v^2}$$

The chain rule for differentiation

If $y = y(u)$ where $u = u(x)$ then $\frac{\mathrm{d}y}{\mathrm{d}x} = \frac{\mathrm{d}y}{\mathrm{d}u} \cdot \frac{\mathrm{d}u}{\mathrm{d}x}$

Integration

$f(x)$	$\int f(x)\,\mathrm{d}x$
k, constant	$kx + c$
x	$\frac{x^2}{2} + c$
x^2	$\frac{x^3}{3} + c$
x^n, $(n \neq -1)$	$\frac{x^{n+1}}{n+1} + c$
$x^{-1} = \frac{1}{x}$	$\ln x + c$
e^x	$\mathrm{e}^x + c$
e^{kx}	$\frac{\mathrm{e}^{kx}}{k} + c$

Written by Tony Croft, Geoff Simpson, and Mark Holmes

for the Mathematics Learning Support Centre

at Loughborough University

Typesetting and artwork by the authors