Notation The following notation is used interchangeably to denote derivatives:

Leibniz's (1675) notation: $\frac{df}{dx}$ and $\frac{d^2f}{dx^2}$ for the first and second derivative.

Lagrange's (1772) notation: f', f'' for the first and second derivative. This notation is shorter but assumes that we know that derivates are taken with respect to x.

Taking the first derivative of f' we obtain the second derivative f''.

Note that we write f and $f(x)$ interchangeably. The former is shorter, but it assumes that we know that f is actually a function of x.

Optimisation

- Minimum: $f'(x) = 0$ and $f''(x) > 0$
- Maximum: $f'(x) = 0$ and $f''(x) < 0$

Differentiation rules In the following a is a constant and u, v and f are functions of x.

$f =$	$f' =$
a	0
au	au'
$u + v$	$u' + v'$
uv	$u'v + uv'$
$u(v)$	$u'(v)v'$
$\frac{u}{v}$	$\frac{u'v - v'u}{v^2}$
x^n	nx^{n-1}
e^x	e^x
$\ln x$	$1/x$
$\sin x$	$\cos x$
$\cos x$	$-\sin x$