

# Derivatives

## Basic derivatives

Simple functions		Composed functions	
$y$	$y'$	$y$	$y'$
$k$	0		
$x$	1		
$x^n$	$nx^{n-1}$	$u^n$	$nu^{n-1}u'$
$\sqrt{x}$	$\frac{1}{2\sqrt{x}}$	$\sqrt{u}$	$\frac{u'}{2\sqrt{u}}$
$\sqrt[n]{x}$	$\frac{1}{n\sqrt[n]{x^{n-1}}}$	$\sqrt[n]{u}$	$\frac{u'}{n\sqrt[n]{u^{n-1}}}$
$\frac{1}{x}$	$-\frac{1}{x^2}$	$\frac{1}{u}$	$-\frac{u'}{u^2}$
$e^x$	$e^x$	$e^u$	$e^u u'$
$a^x$	$a^x \ln(a)$	$a^u$	$a^u \ln(a) u'$
$x^x$	$xx^{x-1} + x^x \ln(x)$	$u^v$	$v u^{v-1} u' + u^v \ln(u) v'$
$\ln(x)$	$\frac{1}{x}$	$\ln(u)$	$\frac{u'}{u}$
$\log_a(x)$	$\frac{1}{x} \log_a(e)$	$\log_a(u)$	$\frac{u'}{u} \log_a(e)$
$\sin(x)$	$\cos(x)$	$\sin(u)$	$\cos(u) u'$
$\cos(x)$	$-\sin(x)$	$\cos(u)$	$-\sin(u) u'$
$\tan(x)$	$\frac{1}{\cos(x)^2}$	$\tan(u)$	$\frac{u'}{\cos(u)^2}$
$\cot(x)$	$\frac{-1}{\sin(x)^2}$	$\cot(u)$	$\frac{-u'}{\sin(u)^2}$
$\sec(x)$	$\frac{\sin(x)}{\cos(x)^2}$	$\sec(u)$	$\frac{\sin(u)}{\cos(u)^2} u'$
$\csc(x)$	$\frac{-\cos(x)}{\sin(x)^2}$	$\csc(u)$	$\frac{-\cos(u)}{\sin(u)^2} u'$
$\arcsin(x)$	$\frac{1}{\sqrt{1-x^2}}$	$\arcsin(u)$	$\frac{u'}{\sqrt{1-u^2}}$
$\arccos(x)$	$\frac{-1}{\sqrt{1-x^2}}$	$\arccos(u)$	$\frac{-u'}{\sqrt{1-u^2}}$
$\arctan(x)$	$\frac{1}{1+x^2}$	$\arctan(u)$	$\frac{u'}{1+u^2}$
$\text{arccot}(x)$	$\frac{-1}{1+x^2}$	$\text{arccot}(u)$	$\frac{-u'}{1+u^2}$
$\text{arcsec}(x)$	$\frac{1}{x\sqrt{x^2-1}}$	$\text{arcsec}(u)$	$\frac{u'}{u\sqrt{u^2-1}}$
$\text{arccsc}(x)$	$\frac{-1}{x\sqrt{x^2-1}}$	$\text{arccsc}(u)$	$\frac{-u'}{u\sqrt{u^2-1}}$

## Derivative rules

### Sum

$$(f(x) + g(x))' = f'(x) + g'(x)$$

### Difference

$$(f - g)'(x) = f'(x) - g'(x)$$

### Product

$$(fg)'(x) = f'(x)g(x) + f(x)g'(x)$$

### Quotient

$$\left(\frac{f(x)}{g(x)}\right)' = \frac{f'(x)g(x) - f(x)g'(x)}{g(x)^2}$$

### Chain rule

$$(f(g))'(x) = f'(g(x))g'(x)$$

### Inverse

$$(f^{-1})'(x) = \frac{1}{f'(x)}$$