Basic derivatives and differentiation rules

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Basic derivatives

$f(x)$	$f'(x)$
$c,\ c \in \mathbb{R}$	0
$x^\alpha,\ \alpha \in \mathbb{R}$	$\alpha x^{\alpha-1}$
$\sin(x)$	$\cos(x)$
$\cos(x)$	$-\sin(x)$
$\tan(x)$	$\frac{1}{\cos^2(x)} = \sec^2 x \quad \text{or} \quad 1+\tan^2(x)$
e^x	e^x
$\ln x$	$\frac{1}{x}$
a^x	$a^x \ln a$
$\log_a x$	$\frac{1}{x \ln a}$
$\sin^{-1} x$	$\frac{1}{\sqrt{1-x^2}}$
$\cos^{-1} x$	$-\frac{1}{\sqrt{1-x^2}}$
$\tan^{-1} x$	$\frac{1}{1+x^2}$

Differentiation rules

- ⋆ **Constant multiple rule** : $[cf(x)]' = cf'(x)$.
- ⋆ **Sum rule** : $[f(x)+g(x)]' = f'(x)+g'(x)$.
- ⋆ **Difference rule** : $[f(x)-g(x)]' = f'(x)-g'(x)$.
- ⋆ **Product rule** : $[f(x)g(x)]' = f'(x)g(x)+f(x)g'(x)$.
- ⋆ **Quotient rule** : $\left[\frac{f(x)}{g(x)}\right]' = \frac{f'(x)g(x)-f(x)g'(x)}{[g(x)]^2}$.
- ⋆ **Chain rule** : $[f(g(x))]' = f'(g(x))g'(x)$.