

## Table of Derivatives

Throughout this table,  $a$  and  $b$  are constants, independent of  $x$ .

$F(x)$	$F'(x) = \frac{dF}{dx}$
$af(x) + bg(x)$	$af'(x) + bg'(x)$
$f(x) + g(x)$	$f'(x) + g'(x)$
$f(x) - g(x)$	$f'(x) - g'(x)$
$af(x)$	$af'(x)$
$f(x)g(x)$	$f'(x)g(x) + f(x)g'(x)$
$f(x)g(x)h(x)$	$f'(x)g(x)h(x) + f(x)g'(x)h(x) + f(x)g(x)h'(x)$
$\frac{f(x)}{g(x)}$	$\frac{f'(x)g(x) - f(x)g'(x)}{g(x)^2}$
$\frac{1}{g(x)}$	$-\frac{g'(x)}{g(x)^2}$
$f(g(x))$	$f'(g(x))g'(x)$
1	0
$a$	0
$x^a$	$ax^{a-1}$
$g(x)^a$	$ag(x)^{a-1}g'(x)$
$\sin x$	$\cos x$
$\sin g(x)$	$g'(x) \cos g(x)$
$\cos x$	$-\sin x$
$\cos g(x)$	$-g'(x) \sin g(x)$
$\tan x$	$\sec^2 x$
$\csc x$	$-\csc x \cot x$
$\sec x$	$\sec x \tan x$
$\cot x$	$-\csc^2 x$
$e^x$	$e^x$
$e^{g(x)}$	$g'(x)e^{g(x)}$
$a^x$	$(\ln a) a^x$
$\ln x$	$\frac{1}{x}$
$\ln g(x)$	$\frac{g'(x)}{g(x)}$
$\log_a x$	$\frac{1}{x \ln a}$
$\arcsin x$	$\frac{1}{\sqrt{1-x^2}}$
$\arcsin g(x)$	$\frac{g'(x)}{\sqrt{1-g(x)^2}}$
$\arccos x$	$-\frac{1}{\sqrt{1-x^2}}$
$\arctan x$	$\frac{1}{1+x^2}$
$\arctan g(x)$	$\frac{g'(x)}{1+g(x)^2}$
$\operatorname{arccsc} x$	$-\frac{1}{ x \sqrt{x^2-1}}$
$\operatorname{arcsec} x$	$\frac{1}{ x \sqrt{x^2-1}}$
$\operatorname{arccot} x$	$-\frac{1}{1+x^2}$

## Table of Indefinite Integrals

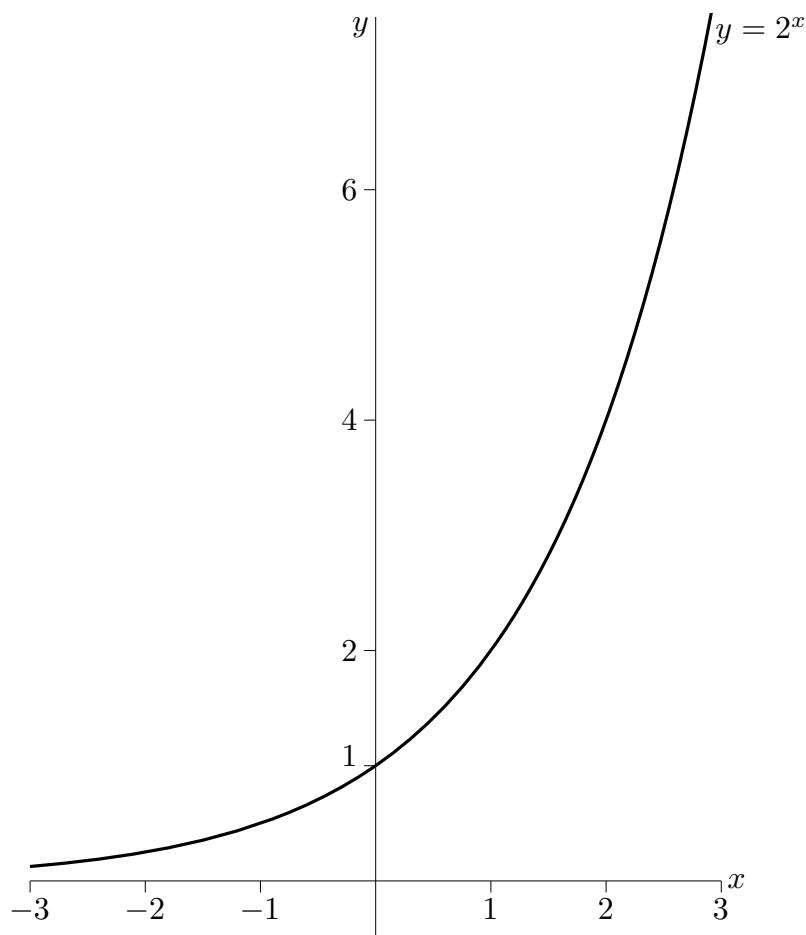
Throughout this table,  $a$  and  $b$  are given constants, independent of  $x$   
and  $C$  is an arbitrary constant.

$f(x)$	$F(x) = \int f(x) dx$
$af(x) + bg(x)$	$a \int f(x) dx + b \int g(x) dx + C$
$f(x) + g(x)$	$\int f(x) dx + \int g(x) dx + C$
$f(x) - g(x)$	$\int f(x) dx - \int g(x) dx + C$
$af(x)$	$a \int f(x) dx + C$
$u(x)v'(x)$	$u(x)v(x) - \int u'(x)v(x) dx + C$
$f(y(x))y'(x)$	$F(y(x))$ where $F(y) = \int f(y) dy$
1	$x + C$
$a$	$ax + C$
$x^a$	$\frac{x^{a+1}}{a+1} + C$ if $a \neq -1$
$\frac{1}{x}$	$\ln  x  + C$
$g(x)^a g'(x)$	$\frac{g(x)^{a+1}}{a+1} + C$ if $a \neq -1$
$\sin x$	$-\cos x + C$
$g'(x) \sin g(x)$	$-\cos g(x) + C$
$\cos x$	$\sin x + C$
$\tan x$	$\ln  \sec x  + C$
$\csc x$	$\ln  \csc x - \cot x  + C$
$\sec x$	$\ln  \sec x + \tan x  + C$
$\cot x$	$\ln  \sin x  + C$
$\sec^2 x$	$\tan x + C$
$\csc^2 x$	$-\cot x + C$
$\sec x \tan x$	$\sec x + C$
$\csc x \cot x$	$-\csc x + C$
$e^x$	$e^x + C$
$e^{g(x)} g'(x)$	$e^{g(x)} + C$
$e^{ax}$	$\frac{1}{a} e^{ax} + C$
$a^x$	$\frac{1}{\ln a} a^x + C$
$\ln x$	$x \ln x - x + C$
$\frac{1}{\sqrt{1-x^2}}$	$\arcsin x + C$
$\frac{g'(x)}{\sqrt{1-g(x)^2}}$	$\arcsin g(x) + C$
$\frac{1}{\sqrt{a^2-x^2}}$	$\arcsin \frac{x}{a} + C$
$\frac{1}{1+x^2}$	$\arctan x + C$
$\frac{g'(x)}{1+g(x)^2}$	$\arctan g(x) + C$
$\frac{1}{a^2+x^2}$	$\frac{1}{a} \arctan \frac{x}{a} + C$
$\frac{1}{x\sqrt{x^2-1}}$	$\operatorname{arcsec} x + C$

## Properties of Exponentials

In the following,  $x$  and  $y$  are arbitrary real numbers,  $a$  and  $b$  are arbitrary constants that are strictly bigger than zero and  $e$  is 2.7182818284, to ten decimal places.

- 1)  $e^0 = 1, a^0 = 1$
- 2)  $e^{x+y} = e^x e^y, a^{x+y} = a^x a^y$
- 3)  $e^{-x} = \frac{1}{e^x}, a^{-x} = \frac{1}{a^x}$
- 4)  $(e^x)^y = e^{xy}, (a^x)^y = a^{xy}$
- 5)  $\frac{d}{dx} e^x = e^x, \frac{d}{dx} e^{g(x)} = g'(x)e^{g(x)}, \frac{d}{dx} a^x = (\ln a) a^x$
- 6)  $\int e^x dx = e^x + C, \int e^{ax} dx = \frac{1}{a} e^{ax} + C$  if  $a \neq 0$
- 7)  $\lim_{x \rightarrow \infty} e^x = \infty, \lim_{x \rightarrow -\infty} e^x = 0$   
 $\lim_{x \rightarrow \infty} a^x = \infty, \lim_{x \rightarrow -\infty} a^x = 0$  if  $a > 1$   
 $\lim_{x \rightarrow \infty} a^x = 0, \lim_{x \rightarrow -\infty} a^x = \infty$  if  $0 < a < 1$
- 8) The graph of  $2^x$  is given below. The graph of  $a^x$ , for any  $a > 1$ , is similar.



## Properties of Logarithms

In the following,  $x$  and  $y$  are arbitrary real numbers that are strictly bigger than 0,  $a$  is an arbitrary constant that is strictly bigger than one and  $e$  is 2.7182818284, to ten decimal places.

- 1)  $e^{\ln x} = x$ ,  $a^{\log_a x} = x$ ,  $\log_e x = \ln x$ ,  $\log_a x = \frac{\ln x}{\ln a}$
- 2)  $\log_a (a^x) = x$ ,  $\ln (e^x) = x$   
 $\ln 1 = 0$ ,  $\log_a 1 = 0$   
 $\ln e = 1$ ,  $\log_a a = 1$
- 3)  $\ln(xy) = \ln x + \ln y$ ,  $\log_a(xy) = \log_a x + \log_a y$
- 4)  $\ln\left(\frac{x}{y}\right) = \ln x - \ln y$ ,  $\log_a\left(\frac{x}{y}\right) = \log_a x - \log_a y$   
 $\ln\left(\frac{1}{y}\right) = -\ln y$ ,  $\log_a\left(\frac{1}{y}\right) = -\log_a y$ ,
- 5)  $\ln(x^y) = y \ln x$ ,  $\log_a(x^y) = y \log_a x$
- 6)  $\frac{d}{dx} \ln x = \frac{1}{x}$ ,  $\frac{d}{dx} \ln(g(x)) = \frac{g'(x)}{g(x)}$ ,  $\frac{d}{dx} \log_a x = \frac{1}{x \ln a}$
- 7)  $\int \frac{1}{x} dx = \ln |x| + C$ ,  $\int \ln x dx = x \ln x - x + C$
- 8)  $\lim_{x \rightarrow \infty} \ln x = \infty$ ,  $\lim_{x \rightarrow 0} \ln x = -\infty$   
 $\lim_{x \rightarrow \infty} \log_a x = \infty$ ,  $\lim_{x \rightarrow 0} \log_a x = -\infty$
- 9) The graph of  $\ln x$  is given below. The graph of  $\log_a x$ , for any  $a > 1$ , is similar.

