

Table of Integrals

Engineers usually refer to a table of integrals when performing calculations involving integration. This leaflet provides such a table. Sometimes restrictions need to be placed on the values of some of the variables. These restrictions are shown in the third column.

1. A table of integrals

$f(x)$	$\int f(x) dx$	
k , any constant	$kx + c$	
x	$\frac{x^2}{2} + c$	
x^2	$\frac{x^3}{3} + c$	
x^n	$\frac{x^{n+1}}{n+1} + c$	$n \neq -1$
$x^{-1} = \frac{1}{x}$	$\ln x + c$	
e^x	$e^x + c$	
e^{kx}	$\frac{1}{k}e^{kx} + c$	
$\cos x$	$\sin x + c$	
$\cos kx$	$\frac{1}{k}\sin kx + c$	
$\sin x$	$-\cos x + c$	
$\sin kx$	$-\frac{1}{k}\cos kx + c$	
$\tan x$	$\ln(\sec x) + c$	$-\frac{\pi}{2} < x < \frac{\pi}{2}$
$\sec x$	$\ln(\sec x + \tan x) + c$	$-\frac{\pi}{2} < x < \frac{\pi}{2}$
$\operatorname{cosec} x$	$\ln(\operatorname{cosec} x - \cot x) + c$	$0 < x < \pi$
$\cot x$	$\ln(\sin x) + c$	$0 < x < \pi$
$\cosh x$	$\sinh x + c$	
$\sinh x$	$\cosh x + c$	
$\tanh x$	$\ln \cosh x + c$	
$\coth x$	$\ln \sinh x + c$	$x > 0$
$\frac{1}{x^2+a^2}$	$\frac{1}{a} \tan^{-1} \frac{x}{a} + c$	$a > 0$
$\frac{1}{x^2-a^2}$	$\frac{1}{2a} \ln \frac{x-a}{x+a} + c$	$ x > a > 0$
$\frac{1}{a^2-x^2}$	$\frac{1}{2a} \ln \frac{a+x}{a-x} + c$	$ x < a$
$\frac{1}{\sqrt{x^2+a^2}}$	$\sinh^{-1} \frac{x}{a} + c$	$a > 0$
$\frac{1}{\sqrt{x^2-a^2}}$	$\cosh^{-1} \frac{x}{a} + c$	$x \geq a > 0$
$\frac{1}{\sqrt{x^2+k}}$	$\ln(x + \sqrt{x^2+k}) + c$	
$\frac{1}{\sqrt{a^2-x^2}}$	$\sin^{-1} \frac{x}{a} + c$	$-a \leq x \leq a$

Exercises

1. In each case, use the Table of Integrals to integrate the given function with respect to x .

a) x

b) x^6

c) x^{-2}

d) x^{-3}

e) x^{-1} , (be careful!)

f) $x^{1/2}$

g) $x^{-1/2}$

h) e^{3x}

i) e^{7x}

j) e^{-2x}

k) $e^{0.5x}$

l) e^x

m) e^{-x}

n) $\cos x$

o) $\sin x$

p) $\sin 3x$

q) $\cos 2x$

r) 5

2. You should be able to use the table when variables other than x are involved. Use the table to integrate each of the following functions with respect to t .

a) e^t , b) e^{5t} , c) t^7 , d) $\sqrt{t}$, e) $\cos 5t$, f) e^{-t} .

Answers

1. a) $\frac{x^2}{2} + c$, b) $\frac{x^7}{7} + c$, c) $\frac{x^{-1}}{-1} + c = -x^{-1} + c$, or $-\frac{1}{x} + c$, d) $\frac{x^{-2}}{-2} + c = -\frac{1}{2}x^{-2} + c$, or $-\frac{1}{2x^2} + c$,

e) $\ln|x| + c$, f) $\frac{x^{3/2}}{3/2} + c = \frac{2}{3}x^{3/2} + c$, g) $\frac{x^{1/2}}{1/2} + c = 2x^{1/2} + c$, h) $\frac{1}{3}e^{3x} + c$, i) $\frac{1}{7}e^{7x} + c$,

j) $-\frac{1}{2}e^{-2x} + c$, k) $2e^{0.5x} + c$, l) $e^x + c$ m) $-e^{-x} + c$, n) $\sin x + c$, o) $-\cos x + c$,

p) $-\frac{1}{3}\cos 3x + c$, q) $\frac{1}{2}\sin 2x + c$, r) $5x + c$.

2. a) $e^t + c$, b) $\frac{e^{5t}}{5} + c$, c) $\frac{t^8}{8} + c$, d) $\frac{2t^{3/2}}{3} + c$, e) $\frac{\sin 5t}{5} + c$, f) $-e^{-t} + c$.