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

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

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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) $\mathrm{e}^{0.5x}$

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) $\frac{1}{3}\mathrm{e}^{3x}+c$, i) $\frac{1}{7}\mathrm{e}^{7x}+c$,

j) $-\frac{1}{2}\mathrm{e}^{-2x}+c$, k) $2\mathrm{e}^{0.5x}+c$, l) $\mathrm{e}^{x}+c$ m) $-\mathrm{e}^{-x}+c$, 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) $\mathrm{e}^{t}+c$, b) $\frac{\mathrm{e}^{5t}}{5}+c$, c) $\frac{t^8}{8}+c$, d) $\frac{2t^{3/2}}{3}+c$, e) $\frac{\sin 5t}{5}+c$, f) $-\mathrm{e}^{-t}+c$.

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