

Table of Laplace Transforms

This table summarizes the general properties of Laplace transforms and the Laplace transforms of particular functions derived in Chapter 7.

Function	Transform	Function	Transform
$f(t)$	$F(s)$	e^{at}	$\frac{1}{s-a}$
$af(t) + bg(t)$	$aF(s) + bG(s)$	$t^n e^{at}$	$\frac{n!}{(s-a)^{n+1}}$
$f'(t)$	$sF(s) - f(0)$	$\cos kt$	$\frac{s}{s^2 + k^2}$
$f''(t)$	$s^2 F(s) - sf(0) - f'(0)$	$\sin kt$	$\frac{k}{s^2 + k^2}$
$f^{(n)}(t)$	$s^n F(s) - s^{n-1} f(0) - \dots - f^{(n-1)}(0)$	$\cosh kt$	$\frac{s}{s^2 - k^2}$
$\int_0^t f(\tau) d\tau$	$\frac{F(s)}{s}$	$\sinh kt$	$\frac{k}{s^2 - k^2}$
$e^{at} f(t)$	$F(s-a)$	$e^{at} \cos kt$	$\frac{s-a}{(s-a)^2 + k^2}$
$u(t-a)f(t-a)$	$e^{-as} F(s)$	$e^{at} \sin kt$	$\frac{k}{(s-a)^2 + k^2}$
$\int_0^t f(\tau)g(t-\tau) d\tau$	$F(s)G(s)$	$\frac{1}{2k^3}(\sin kt - kt \cos kt)$	$\frac{1}{(s^2 + k^2)^2}$
$tf(t)$	$-F'(s)$	$\frac{t}{2k} \sin kt$	$\frac{s}{(s^2 + k^2)^2}$
$t^n f(t)$	$(-1)^n F^{(n)}(s)$	$\frac{1}{2k}(\sin kt + kt \cos kt)$	$\frac{s^2}{(s^2 + k^2)^2}$
$\frac{f(t)}{t}$	$\int_s^\infty F(\sigma) d\sigma$	$u(t-a)$	$\frac{e^{-as}}{s}$
$f(t)$, period p	$\frac{1}{1-e^{-ps}} \int_0^p e^{-st} f(t) dt$	$\delta(t-a)$	e^{-as}
1	$\frac{1}{s}$	$(-1)\llbracket t/a \rrbracket$ (square wave)	$\frac{1}{s} \tanh \frac{as}{2}$
t	$\frac{1}{s^2}$	$\left\lceil \frac{t}{a} \right\rceil$ (staircase)	$\frac{e^{-as}}{s(1-e^{-as})}$
t^n	$\frac{n!}{s^{n+1}}$		
$\frac{1}{\sqrt{\pi t}}$	$\frac{1}{\sqrt{s}}$		
t^a	$\frac{\Gamma(a+1)}{s^{a+1}}$		

Table of Integrals

ELEMENTARY FORMS

- $\int u dv = uv - \int v du$
- $\int u^n du = \frac{1}{n+1} u^{n+1} + C$ if $n \neq -1$
- $\int \frac{du}{u} = \ln |u| + C$
- $\int e^u du = e^u + C$
- $\int a^u du = \frac{a^u}{\ln a} + C$
- $\int \sin u du = -\cos u + C$
- $\int \cos u du = \sin u + C$
- $\int \sec^2 u du = \tan u + C$
- $\int \csc^2 u du = -\cot u + C$
- $\int \sec u \tan u du = \sec u + C$
- $\int \csc u \cot u du = -\csc u + C$
- $\int \tan u du = \ln |\sec u| + C$
- $\int \cot u du = \ln |\sin u| + C$
- $\int \sec u du = \ln |\sec u + \tan u| + C$
- $\int \csc u du = \ln |\csc u - \cot u| + C$
- $\int \frac{du}{\sqrt{a^2 - u^2}} = \sin^{-1} \frac{u}{a} + C$
- $\int \frac{du}{a^2 + u^2} = \frac{1}{a} \tan^{-1} \frac{u}{a} + C$
- $\int \frac{du}{a^2 - u^2} = \frac{1}{2a} \ln \left| \frac{u+a}{u-a} \right| + C$

TRIGONOMETRIC FORMS

- $\int \sin^2 u du = \frac{1}{2}u - \frac{1}{4} \sin 2u + C$
- $\int \cos^2 u du = \frac{1}{2}u + \frac{1}{4} \sin 2u + C$
- $\int \tan^2 u du = \tan u - u + C$
- $\int \cot^2 u du = -\cot u - u + C$
- $\int \sec^3 u du = \frac{1}{2} \sec u \tan u + \frac{1}{2} \ln |\sec u + \tan u| + C$
- $\int \csc^3 u du = -\frac{1}{2} \csc u \cot u + \frac{1}{2} \ln |\csc u - \cot u| + C$
- $\int \sin^3 u du = -\frac{1}{3}(2 + \sin^2 u) \cos u + C$
- $\int \cos^3 u du = \frac{1}{3}(2 + \cos^2 u) \sin u + C$
- $\int \tan^3 u du = \frac{1}{2} \tan^2 u + \ln |\cos u| + C$
- $\int \cot^3 u du = -\frac{1}{2} \cot^2 u - \ln |\sin u| + C$
- $\int \sin au \sin bu du = \frac{\sin(a-b)u}{2(a-b)} - \frac{\sin(a+b)u}{2(a+b)} + C$ if $a^2 \neq b^2$

(Continued on B)