

A Table of Laplace Transforms

$f(t) = \mathcal{L}^{-1}\{F(s)\}$	$F(s) = \mathcal{L}\{f(t)\} = \int_0^\infty e^{-st} f(t) dt$
1	$\frac{1}{s} \quad s > 0$
$t^n \quad n = 1, 2, \dots$	$\frac{n!}{s^{n+1}} \quad s > 0$
$t^r \quad r > -1$	$\frac{\Gamma(r+1)}{s^{r+1}} \quad s > 0$
e^{at}	$\frac{1}{s-a} \quad s > a$
$\sin(kt) \quad k \neq 0$	$\frac{k}{s^2+k^2} \quad s > 0$
$\cos(kt)$	$\frac{s}{s^2+k^2} \quad s > 0$
$e^{at} f(t)$	$F(s-a)$
$\mathcal{U}(t-a) \quad a > 0$	$\frac{e^{-as}}{s} \quad s > 0$
$\mathcal{U}(t-a)f(t-a) \quad a > 0$	$e^{-as} F(s)$
$\mathcal{U}(t-a)g(t) \quad a > 0$	$e^{-as} \mathcal{L}\{g(t+a)\}$
$\delta(t-a) \quad a \geq 0$	e^{-as}
$(f * g)(t)$	$F(s)G(s)$
$f'(t)$	$sF(s) - f(0)$
$f^{(n)}(t)$	$s^n F(s) - s^{n-1} f(0) - s^{n-2} f'(0) - \dots - f^{(n-1)}(0)$
$tf(t)$	$-\frac{d}{ds} F(s)$
$t^n f(t) \quad n = 1, 2, \dots$	$(-1)^n \frac{d^n}{ds^n} F(s)$
$\alpha f(t) + \beta g(t)$	$\alpha F(s) + \beta G(s)$

Gamma Function:¹ $\Gamma(n+1) = n!$ **for** $n = 0, 1, 2, \dots$, **and for** $x > 0$,

$$\Gamma(x) = \int_0^\infty e^{-t} t^{x-1} dt.$$

Convolution: **For** f **and** g **piecewise continuous on** $[0, \infty)$,

$$(f * g)(t) = \int_0^t f(\tau)g(t-\tau) d\tau.$$

¹The entry for t^r reduces to that for t^n if r is a positive integer but is also valid for noninteger powers, e.g. \sqrt{t} .