

Laplace Transforms Table

for $t \geq 0$

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$f(t) = \mathcal{L}^{-1}\{F(s)\}$	$F(s) = \mathcal{L}\{f(t)\}$	$f(t) = \mathcal{L}^{-1}\{F(s)\}$	$F(s) = \mathcal{L}\{f(t)\}$
1	$\frac{1}{s}$	e^{at}	$\frac{1}{s - a}$
t^n	$\frac{n!}{s^{n+1}}$	$\sin(at)$	$\frac{a}{s^2 + a^2}$
t^a $a > -1$	$\frac{\Gamma(a + 1)}{s^{a+1}}$	$\cos(at)$	$\frac{s}{s^2 + a^2}$
\sqrt{t}	$\frac{\sqrt{\pi}}{2s^{3/2}}$	$t \sin(at)$	$\frac{2as}{(s^2 + a^2)^2}$
$t^{n-\frac{1}{2}}$ $n = 1, 2, 3 \dots$	$\frac{1 \cdot 3 \cdot 5 \cdot \dots \cdot (2n - 1)\sqrt{\pi}}{2^n s^{n+\frac{1}{2}}}$	$t \cos(at)$	$\frac{s^2 - a^2}{(s^2 + a^2)^2}$
$f(ct)$	$\frac{1}{c} F\left(\frac{s}{c}\right)$	$\sin(at + b)$	$\frac{s \sin(b) + a \cos(b)}{s^2 + a^2}$
$u_c(t) = u(t - c)$	$\frac{e^{-cs}}{s}$	$\cos(at + b)$	$\frac{s \cos(b) - a \sin(b)}{s^2 + a^2}$
$\delta(t)$	1	$\sin(at) - at \cos(at)$	$\frac{2a^3}{(s^2 + a^2)^2}$
$\delta(t - c)$	e^{-cs}	$\sin(at) + at \cos(at)$	$\frac{2as^2}{(s^2 + a^2)^2}$
$\delta^{(n)}$	s^n	$\cos(at) - at \sin(at)$	$\frac{s(s^2 - a^2)}{(s^2 + a^2)^2}$
$u_c(t)f(t - c)$	$e^{-cs}F(s)$	$\cos(at) + at \sin(at)$	$\frac{s(s^2 + 3a^2)}{(s^2 + a^2)^2}$
$u_c(t)g(t)$	$e^{-cs}\mathcal{L}\{g(t + c)\}$	$e^{at} \sin(bt)$	$\frac{b}{(s - a)^2 + b^2}$
$tf(t)$	$-\frac{dF(s)}{ds}$	$e^{at} \cos(bt)$	$\frac{s - a}{(s - a)^2 + b^2}$
$t^n f(t)$ $n = 1, 2, 3, \dots$	$\frac{(-1)^n F^{(n)}(s)}{(-1)^n d^n F(s)} = \frac{(-1)^n d^n F(s)}{ds^n}$	$e^{at} f(t)$	$F(s - a)$
$\frac{1}{t} f(t)$	$\int_s^\infty F(u) du$	$t^n e^{at}$ $n = 1, 2, 3, \dots$	$\frac{n!}{(s - a)^{n+1}}$

$\int_0^t f(v)dv$	$\frac{F(s)}{s}$	$\sinh(at)$	$\frac{a}{s^2 - a^2}$
$\int_0^t f(t - \tau)g(\tau)d\tau$	$F(s)G(s)$	$\cosh(at)$	$\frac{s}{s^2 - a^2}$
$f(t + T) = f(t)$	$\frac{\int_0^T e^{-st} f(t)dt}{1 - e^{-sT}}$	$e^{at} \sinh(bt)$	$\frac{b}{(s - a)^2 - b^2}$
$f'(t)$	$sF(s) - f(0)$	$e^{at} \cosh(bt)$	$\frac{s}{(s - a)^2 - b^2}$
$f''(t)$	$s^2F(s) - sf(0) - f'(0)$	$\frac{\sin(at)}{t}$	$\arctan\left(\frac{a}{s}\right)$
$f^{(n)}(t)$	$s^n F(s) - s^{n-1} f(0) - s^{n-2} f'(0) \dots - sf^{(n-2)}(0) - f^{(n-1)}(0)$		
$\frac{1}{\sqrt{\pi t}} e^{-a^2/4t}$	$\frac{e^{-a\sqrt{s}}}{\sqrt{s}}$	$t \sinh(bt)$	$\frac{2bs}{(s^2 - b^2)^2}$
$\frac{a}{2\sqrt{\pi t^3}} e^{-a^2/4t}$	$e^{-a\sqrt{s}}$	$t \cosh(bt)$	$\frac{s^2 + b^2}{(s^2 - b^2)^2}$
$\operatorname{erf}\left(\frac{a}{2\sqrt{t}}\right)$	$\frac{e^{a\sqrt{s}}}{s}$	$\frac{e^{at} - e^{bt}}{a - b}$	$\frac{1}{(s - a)(s - b)}$
te^{at}	$1/(s - a)^2$	$\frac{ae^{at} - be^{bt}}{a - b}$	$\frac{s}{(s - a)(s - b)}$
$\frac{e^{-at}}{(b - a)(c - a)} + \frac{e^{-bt}}{(c - b)(a - b)} + \frac{e^{-ct}}{(a - c)(b - c)}$			$\frac{1}{(s + a)(s + b)(s + c)}$
$\frac{1}{b^2} (1 - \cos(bt))$	$\frac{1}{s(s^2 + b^2)}$	$\frac{1}{a^2} (at - 1 + e^{-at})$	$\frac{1}{(s^2)(s + a)}$
		$\frac{1}{a^2} (1 - e^{-at} - ate^{-at})$	$\frac{1}{s(s + a)^2}$

$$\mathcal{L}\{f(t)\} = \int_0^\infty e^{-st} f(t)dt$$

$$\Gamma(t) = \int_0^\infty e^{-x} x^{t-1} dx, \quad \Gamma(n + 1) = n!, \quad \Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$$

$$\operatorname{erf}(t) = \frac{2}{\sqrt{\pi}} \int_0^t e^{-x^2} dx$$