Laplace Transform of Particular Functions

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

$$\mathcal{L}\left(f^{(n)}(t)\right) = s^n F(s) - s^{n-1} f(0) - s^{n-2} f'(0) - \cdots - f^{(n-1)}(0)$$

$\mathcal{L}\big(f'(t)\big) = sF(s) - f(0)$	$\mathcal{L}\left(f^{(2)}(t)\right) = s^2 F(s) - sf(0) - f'(0)$

$u(t-c) = \begin{cases} 1 & t \geq c \\ 0 & t < c \end{cases}$	$\delta(t-c) = \begin{cases} +\infty & t = c \\ 0. & t \neq c \end{cases}$ and $\int_{-\infty}^{\infty} \delta(t-c) dt = 1$	$\frac{d}{dt} u(t-c) = \delta(t-c)$

$\Gamma(\mathrm{p}) = \int_0^{\infty} t^{p-1} e^{-t} dt$	$\Gamma'(\mathrm{p}) = \int_0^{\infty} t^{p-1} e^{-t} \ln t \, dt$

$f(t) = \mathcal{L}^{-1}\big(F(s)\big)$	$F(s) = \mathcal{L}\big(f(t)\big)$	$f(t) = \mathcal{L}^{-1}\big(F(s)\big)$	$F(s) = \mathcal{L}\big(f(t)\big)$
$\delta(t)$	1	$\delta(t-c)$	e^{-cs}
$u(t)$	$\frac{1}{s}$, $s > 0$	$u(t-c)$	$\frac{e^{-cs}}{s}$
t^n, $n = 1, 2, 3 \ldots$	$\frac{n!}{s^{n+1}}$, $s > 0$	t^p , $p > -1$	$\frac{\Gamma(p+1)}{s^{p+1}}$, $s > 0$
e^{at}	$\frac{1}{s-a}$, $s > a$	$e^{ct} f(t)$	$F(s-c)$
$t^n e^{at}$, $n = 1, 2, 3 \ldots$	$\frac{n!}{(s-a)^{n+1}}$, $s > a$	$\sqrt[n]{t}$	$\frac{\Gamma(\frac{1}{n}+1)}{s^{\frac{1}{n}+1}}$, $p = \frac{1}{n}$
$\sin at$	$\frac{a}{s^2+a^2}$, $s > 0$	$\cos at$	$\frac{s}{s^2+a^2}$, $s > 0$
$\sinh at$	$\frac{a}{s^2-a^2}$, $s > \lvert a \rvert$	$\cosh at$	$\frac{s}{s^2-a^2}$, $s > \lvert a \rvert$
$e^{ct} f(t)$	$F(s-c)$	$f(ct)$	$\frac{1}{c} F\left(\frac{s}{c}\right)$, $c > 0$
$u(t-c) f(t)$	$e^{-cs} F(s)$	$(-1)^n f(t)$	$F^{(n)}(s)$
$e^{at} \sin bt$	$\frac{b}{(s-a)^2+b^2}$, $s > a$	$e^{at} \cos bt$	$\frac{s-a}{(s-a)^2+b^2}$, $s > a$
$\frac{1}{2a} t \sin at$	$\frac{s}{(s^2+a^2)^2}$, $s > 0$	$t \cos at$	$\frac{s^2-a^2}{(s^2+a^2)^2}$
$t^n f(t)$	$(-1)^n F^{(n)}(s)$	$\Gamma'(1) - \ln t$, $\Gamma'(1) \cong -\gamma$	$\frac{1}{s} \ln s$
$\frac{1}{t} f(t)$	$\int_s^{\infty} f(\tau) d\tau$	$(t-c)^n e^{a(t-c)}$	$\frac{n!\, e^{cs}}{(s-a)^{n+1}}$, $c > 0$
$\int_0^t f(t-\tau) g(\tau) d\tau$	$F(s)G(s)$	$\frac{e^t}{n!} \frac{d^n}{dt^n} (t^n e^{-t})$	$\frac{1}{s} \left(\frac{s-1}{s}\right)^n$
$\frac{1}{a-b} (e^{at} - e^{bt}), a \neq b$	$\frac{1}{(s-a)(s-b)}$	$\frac{1}{a-b} (ae^{at} - be^{bt}), a \neq b$	$\frac{s}{(s-a)(s-b)}$
$\frac{1}{\sqrt{\pi t}}$	$\frac{1}{\sqrt{s}}$	$\frac{e^{at}}{\sqrt{\pi t}}$	$\frac{1}{\sqrt{s-a}}$
$\sinh at - \sin at$	$\frac{2a^3}{s^4-a^4}$	$\cosh at - \cos at$	$\frac{2a^2 s}{s^4-a^4}$
$\sin at \cosh at - \cos at \sinh at$	$\frac{4a^3}{s^4+4a^4}$	$\sin at \sinh at$	$\frac{2a^2 s}{s^4+4a^4}$