Laplace Transforms

	t-domain $f(t) = \mathscr{L}^{-1}\{F(s)\}(t)$	s-domain $F(s) = \mathscr{L}\{f(t)\}(s)$
delayed unit step	$u(t-a)$	$\dfrac{e^{-as}}{s}$
n-th power	t^n	$\dfrac{n!}{s^{n+1}}$
exponential	e^{at}	$\dfrac{1}{s-a}$
sine	$\sin(bt)$	$\dfrac{b}{s^2+b^2}$
cosine	$\cos(bt)$	$\dfrac{s}{s^2+b^2}$
exponential sine	$e^{at}\sin(bt)$	$\dfrac{b}{(s-a)^2+b^2}$
exponential cosine	$e^{at}\cos(bt)$	$\dfrac{s-a}{(s-a)^2+b^2}$
definition	$f(t)$	$\int_0^\infty e^{-st} f(t)\, dt$
linearity	$af(t)+bg(t)$	$aF(s)+bG(s)$
time differentiation	$f'(t)$	$sF(s)-f(0)$
second time differentiation	$f''(t)$	$s^2F(s)-sf(0)-f'(0)$
general time differentiation	$f^{(n)}(t)$	$s^nF(s)-s^{n-1}f(0)-\cdots-f^{(n-1)}(0)$
frequency differentiation	$t^n f(t)$	$(-1)^n F^{(n)}(s)$
frequency shift	$e^{at}f(t)$	$F(s-a)$
time shift	$f(t-a)u(t-a)$	$e^{-as}F(s)$
time scaling	$f(at)$	$\frac{1}{\lvert a\rvert}F\left(\frac{s}{a}\right)$
convolution	$(f*g)(t) := \int_0^t f(\tau)g(t-\tau)\, d\tau$	$F(s)G(s)$
frequency integration	$\dfrac{f(t)}{t}$	$\int_s^\infty F(\sigma)\, d\sigma$
periodic function	$f(t)$ with period T	$\dfrac{\int_0^T e^{-st} f(t)\, dt}{1-e^{-Ts}}$

- $t \in [0,\infty)$ typically represents time.
- a and b are real numbers.
- s represents an "angular frequency".
- n is a nonnegative integer.