Table of Laplace Transforms

physical variables	**transformed variables**
$f(t)$	$F(s) \equiv \int_0^\infty e^{-st} f(t) dt$)
$af(t) + bg(t)$	$aF(s) + bG(s)$
$f(t) * g(t) \qquad (f, g = 0 \text{ for } t < 0)$	$F(s)G(s)$
$g(t-T) = g(t-T)H(t-T)$	$e^{-sT}G(s)$
$e^{-at}g(t)$	$G(s+a)$
$g(at) \qquad (a > 0)$	$\frac{1}{a}G\left(\frac{s}{a}\right)$
$\frac{dg}{dt}$	$sG(s) - g(0)$
$\frac{d^n}{dt^n}g(t)$	$s^nG(s) - \sum_{k=0}^{n-1} s^{n-1-k} g^{(k)}(0)$
$\int_0^t g(\tau) d\tau$	$s^{-1}G(s)$
$t^n g(t)$	$(-1)^n \frac{d^n}{ds^n} G(s)$
$\delta(t-T) \qquad (T \geq 0)$	e^{-Ts}
$H(t-T) \qquad (T \geq 0)$	$\frac{e^{-Ts}}{s}$
$t^n \qquad (n = 0, 1, 2, \dots)$	$\frac{n!}{s^{n+1}}$
$\exp(at)$	$\frac{1}{s-a}$
$\sin(at)$	$\frac{a}{s^2+a^2}$
$\cos(at)$	$\frac{s}{s^2+a^2}$
$\sinh(at)$	$\frac{a}{s^2-a^2}$
$\cosh(at)$	$\frac{s}{s^2-a^2}$

Definition of the convolution:

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

Definition of Heaviside function:

$$H(x) = \begin{cases} 1 & \text{if } x > 0 \\ 0 & \text{if } x < 0 \end{cases}$$

Formulas related to the Dirac delta function:

$$\int_{-\infty}^t \delta(s) ds = H(t)\ , \qquad \delta(ax) = \frac{1}{|a|}\delta(x)\ , \qquad \int_a^b \delta(x - x_0) f(x) dx = f(x_0) \quad \text{for } a < x_0 < b$$

Mellin's Inverse Formula:

$$f(t) = \frac{1}{2\pi i} \int_{c-i\infty}^{c+i\infty} e^{st} F(s) ds$$

where the contour of integration is taken to the right of all the singularities in the complex s plane.