Laplace Transforms

©Alan H. Stein
The University of Connecticut at Waterbury
stein@math.uconn.edu http://www.math.uconn.edu/∼stein

$f(t) = \mathcal{L}^{-1}\{F(s)\}$	$F(s) = \mathcal{L}\{f(t)\} = \int_0^\infty e^{-st} f(t)\, dt$
1	$\frac{1}{s},\ s > 0$
e^{at}	$\frac{1}{s-a},\ s > a$
t^n, n = positive integer	$\frac{n!}{s^{n+1}},\ s > 0$
$t^p,\ p > 1$	$\frac{\Gamma(p+1)}{s^{p+1}},\ s > 0$
$\sin at$	$\frac{a}{s^2+a^2},\ s > 0$
$\cos at$	$\frac{s}{s^2+a^2},\ s > 0$
$\sinh at$	$\frac{a}{s^2-a^2},\ s > \lvert a\rvert$
$\cosh at$	$\frac{s}{s^2-a^2},\ s > \lvert a\rvert$
$e^{at}\sin bt$	$\frac{b}{(s-a)^2+b^2},\ s > a$
$e^{at}\cos bt$	$\frac{s-a}{(s-a)^2+b^2},\ s > a$
$t^n e^{at}$, n = positive integer	$\frac{n!}{(s-a)^{n+1}},\ s > a$
$u_c(t)$	$\frac{e^{-cs}}{s},\ s > 0$
$u_c(t)f(t-c)$	$e^{-cs}F(s)$
$e^{ct}f(t)$	$F(s-c)$
$f(ct)$	$\frac{1}{c}F(\frac{s}{c}),\ c > 0$
$\int_0^t f(t-\tau)g(\tau)\, d\tau$	$F(s)G(s)$
$\delta(t-c)$	e^{-cs}
$f'(t)$	$sF(t) - f'(0)$
$f''(t)$	$s^2F(t) - sf(0) - f'(0)$
$f^{(n)}(t)$	$s^nF(s) - s^{n-1}f(0) - \cdots - f^{(n-1)}(0)$
$(-t)^n f(t)$	$F^{(n)}(s)$