

Laplace Transforms for Math 221

Functions		Rules	
$f(t)$	$\mathcal{L}[f](s)$	$f(t)$	$\mathcal{L}[f](s)$
e^{at}	$\frac{1}{s-a}, \quad (s > a)$	$f + g$	$\mathcal{L}[f] + \mathcal{L}[g]$
t^n	$\frac{n!}{s^{n+1}}, \quad (s > 0)$	αf	$\alpha \mathcal{L}[f], \quad (\alpha \text{ real})$
$\sin(bt)$	$\frac{b}{s^2 + b^2}$	$\frac{df}{dt}$	$s\mathcal{L}[f] - f(0)$
$\cos(bt)$	$\frac{s}{s^2 + b^2}$	$\frac{d^2f}{dt^2}$	$s^2\mathcal{L}[f] - sf(0) - f'(0)$
$e^{at} \sin(bt)$	$\frac{b}{(s-a)^2 + b^2}$	$e^{at} f(t)$	$\mathcal{L}[f](s-a)$
$e^{at} \cos(bt)$	$\frac{s-a}{(s-a)^2 + b^2}$	$tf(t)$	$-\frac{d}{ds}\mathcal{L}[f](s)$
$\sinh(bt)$	$\frac{b}{s^2 - b^2}$	$t^n f(t)$	$(-1)^n \frac{d^n}{ds^n} \mathcal{L}[f](s)$
$\cosh(bt)$	$\frac{s}{s^2 - b^2}$	$f(ct)$	$\frac{1}{c} \mathcal{L}[f]\left(\frac{s}{c}\right)$
$u_a(t)$	$\frac{e^{-as}}{s}, \quad (s > 0)$	$u_a(t)f(t)$	$e^{-as} \mathcal{L}[f(t+a)]$
$\delta_a(t)$	e^{-as}	$u_a(t)f(t-a)$	$e^{-as} \mathcal{L}[f]$

Extra Functions	
$f(t)$	$\mathcal{L}[f](s)$
$\frac{1}{2k^3}(\sin kt - kt \cos kt)$	$\frac{1}{(s^2 + k^2)^2}$
$\frac{t}{2k} \sin kt$	$\frac{s}{(s^2 + k^2)^2}$
$\frac{1}{2k}(\sin kt + kt \cos kt)$	$\frac{s^2}{(s^2 + k^2)^2}$