Brief Table of Laplace Transforms

(Based on Table 5.1 in Bobrow)

Time Domain	Frequency Domain
Transform Definition:	
$f(t)$	$\mathbf{F}(\mathbf{s}) = \int_0^\infty f(t)e^{-\mathbf{s}t}\,\mathrm{d}t$
Linearity:	
$K_1 f_1(t) + K_2 f_2(t)$	$K_1\mathbf{F}_1(\mathbf{s}) + K_2\mathbf{F}_2(\mathbf{s})$
Differentiation (with zero initial conditions):	
$df(t)/dt$	$\mathbf{s}\mathbf{F}(\mathbf{s})$
Integration (with zero initial conditions):	
$\int_0^t f(t')\mathrm{d}t'$	$\frac{1}{\mathbf{s}}\mathbf{F}(\mathbf{s})$
Complex translation:	
$e^{-at}f(t)$	$\mathbf{F}(\mathbf{s}+a)$
Various functions:	
$\delta(t)$	1
$u(t)$	$1/\mathbf{s}$
$e^{-at}u(t)$	$1/(\mathbf{s}+a)$
$\cos(\beta t)u(t)$	$\mathbf{s}/(\mathbf{s}^2+\beta^2)$
$\sin(\beta t)u(t)$	$\beta/(\mathbf{s}^2+\beta^2)$
$e^{-\alpha t}\cos(\beta t)u(t)$	$(\mathbf{s}+\alpha)/((\mathbf{s}+\alpha)^2+\beta^2)$
$e^{-\alpha t}\sin(\beta t)u(t)$	$\beta/((\mathbf{s}+\alpha)^2+\beta^2)$
$t\,u(t)$	$1/\mathbf{s}^2$
$te^{-at}u(t)$	$1/(\mathbf{s}+a)^2$
$t^n\,u(t)$	$n!/\mathbf{s}^{n+1}$
$(1-e^{-at})u(t)$	$a/s(\mathbf{s}+a)$
Linear circuit element relations (with zero initial conditions): (V = voltage drop across device; I = current through device)	
R: $V_R(t) = R\,I_R(t)$	$\mathbf{V}_R(\mathbf{s}) = R\,\mathbf{I}_R(\mathbf{s})$
L: $V_L(t) = L\,\frac{dI_L(t)}{dt}$	$\mathbf{V}_L(\mathbf{s}) = \mathbf{s}L\,\mathbf{I}_L(\mathbf{s})$
C: $V_C(t) = \frac{1}{C}\int_0^t I_C(t')\mathrm{d}t'$	$\mathbf{V}_C(\mathbf{s}) = \frac{1}{\mathbf{s}C}\,\mathbf{I}_C(\mathbf{s})$