Laplace Transforms

If $y(t)$ is a function defined for $t \geq 0$, the Laplace transform $\overline{y}(s)$ is defined by the equation

$$\overline{y}(s) = \mathcal{L}\{y(t)\} = \int_0^\infty \mathrm{e}^{-st} y(t)\,\mathrm{d}t$$

Function $y(t)$ $(t > 0)$	Transform $\overline{y}(s)$	
$\delta(t)$	1	Delta function
$\theta(t)$	$\frac{1}{s}$	Unit step function
t^n	$\frac{n!}{s^{n+1}}$	
$t^{1/2}$	$\frac{1}{2}\sqrt{\frac{\pi}{s^3}}$	
$t^{-1/2}$	$\sqrt{\frac{\pi}{s}}$	
e^{-at}	$\frac{1}{(s+a)}$	
$\sin \omega t$	$\frac{\omega}{(s^2+\omega^2}$	
$\cos \omega t$	$\frac{s}{(s^2+\omega^2)}$	
$\sinh \omega t$	$\frac{\omega}{(s^2-\omega^2)}$	
$\cosh \omega t$	$\frac{s}{(s^2-\omega^2)}$	
$\mathrm{e}^{-at} y(t)$	$\overline{y}(s+a)$	
$y(t-\tau)\,\theta(t-\tau)$	$\mathrm{e}^{-s\tau}\,\overline{y}(s)$	
$t y(t)$	$-\frac{\mathrm{d}\overline{y}}{\mathrm{d}s}$	
$\frac{\mathrm{d}y}{\mathrm{d}t}$	$s\overline{y}(s) - y(0)$	
$\frac{\mathrm{d}^n y}{\mathrm{d}t^n}$	$s^n\overline{y}(s) - s^{n-1}y(0) - s^{n-2}\left[\frac{\mathrm{d}y}{\mathrm{d}t}\right]_0 \cdots - \left[\frac{\mathrm{d}^{n-1}y}{\mathrm{d}t^{n-1}}\right]_0$	
$\int_0^t y(\tau)\,\mathrm{d}\tau$	$\frac{\overline{y}(s)}{s}$	
$\left.\begin{array}{l}\int_0^t x(\tau)\,y(t-\tau)\,\mathrm{d}\tau \\ \int_0^t x(t-\tau)\,y(\tau)\,\mathrm{d}\tau\end{array}\right\}$	$\overline{x}(s)\,\overline{y}(s)$	Convolution theorem

[Note that if $y(t) = 0$ for $t < 0$ then the Fourier transform of $y(t)$ is $\widehat{y}(\omega) = \overline{y}(\mathrm{i}\omega)$.]

The online version of the full Mathematical handbook can be found at
http://homepage.ntu.edu.tw/~wttsai/MathModel/Mathematical%20Formula%20Handbook.pdf