Laplace Transforms Formulas and Theorems

$f(t)$	$\mathscr{L}[f(t)] = F(s)$
1	$\frac{1}{s}$
t^n	$\frac{n!}{s^{n+1}}$
e^{at}	$\frac{1}{s-a}$
$\sin kt$	$\frac{k}{s^2+k^2}$
$\cos kt$	$\frac{s}{s^2+k^2}$
$\sinh kt$	$\frac{k}{s^2-k^2}$
$\cosh kt$	$\frac{s}{s^2-k^2}$

Other Results:

1. Laplace transform of derivatives:

$$\begin{aligned}\mathscr{L}[f'(t)] &= s\mathscr{L}[f(t)] - f(0)\\ \mathscr{L}[f''(t)] &= s^2\mathscr{L}[f(t)] - sf(0) - f'(0)\\ \mathscr{L}[f^{(n)}(t)] &= s^n\mathscr{L}[f(t)] - s^{n-1}f(0) - s^{n-2}f'(0) - \ldots - f^{(n-1)}(0)\end{aligned}$$

2. s-shifting theorem:

$$\mathscr{L}[e^{at}f(t)] = F(s-a)$$

3. t-shifting theorem:

$$\begin{aligned}\mathscr{L}[f(t-a)\mathscr{U}(t-a)] &= e^{-sa}F(s)\\ \mathscr{L}[g(t)\mathscr{U}(t-a)] &= e^{-sa}\mathscr{L}[g(t+a)]\end{aligned}$$