Formulas for the Laplace Transform

$\mathcal{L}(t^n) = \dfrac{n!}{s^{n+1}}$, $\mathcal{L}^{-1}\left(\dfrac{n!}{s^{n+1}}\right) = \dfrac{t^{n-1}}{(n-1)!}$

$\mathcal{L}(t^\alpha) = \dfrac{\Gamma(\alpha+1)}{s^{\alpha+1}}$, where $\Gamma(x) = \displaystyle\int_0^\infty e^{-t}t^{x-1}\,dt$

$\mathcal{L}(e^{at}) = \dfrac{1}{s-a}$

$\mathcal{L}(\cos(at)) = \dfrac{s}{s^2+a^2}$

$\mathcal{L}(\sin(at)) = \dfrac{a}{s^2+a^2}$

$\mathcal{L}(\cosh(at)) = \dfrac{s}{s^2-a^2}$

$\mathcal{L}(\sinh(at)) = \dfrac{a}{s^2-a^2}$

$\mathcal{L}\left(\dfrac{1}{2a}\,t\sin(at)\right) = \dfrac{s}{(s^2+a^2)^2}$

$\mathcal{L}\left(\dfrac{1}{2a^3}\,(\sin(at) - at\cos(at))\right) = \dfrac{1}{(s^2+a^2)^2}$

$\mathcal{L}(u_a(t)) = \dfrac{e^{-as}}{s}$, where $u_a(r) = 0$ for $r < a$ and $u_a(r) = 1$ for $r > a$

$\mathcal{L}(f^{(n)}(t)) = s^n\mathcal{L}(f(t)) - s^{n-1}f(0) - s^{n-2}f'(0) - s^{n-3}f''(0) - \cdots - sf^{(n-2)}(0) - f^{(n-1)}(0)$

$\mathcal{L}\left(\displaystyle\int_0^t f(\tau)\,d\tau\right) = \dfrac{1}{s}\,\mathcal{L}(f(t))$

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

$\mathcal{L}(t^n f(t)) = (-1)^n\,\dfrac{d^n}{ds^n}\,F(s)$, in particular $f(t) = -\dfrac{1}{t}\,\mathcal{L}^{-1}(F'(s))$

$\mathcal{L}\left(\dfrac{f(t)}{t}\right) = \displaystyle\int_s^\infty F(\sigma)\,d\sigma$

$\mathcal{L}((f*g)(t)) = F(s)\,G(s)$, where $(f*g)(t) = \displaystyle\int_0^t f(\sigma)g(t-\sigma)\,d\sigma$

$\mathcal{L}(f(t)) = \dfrac{1}{1-e^{-ps}}\displaystyle\int_0^p e^{-st}f(t)\,dt$, if $f(t+p) = f(t)$ for all t

$\mathcal{L}(u_a(t)f(t-a)) = e^{-as}F(s)$, where $u_a(t) = 0$ for $t < a$ and $u_a(t) = 1$ for $t > a$ (this is often written using $u(t-a)$ to mean $u_a(t)$)

$\mathcal{L}(\delta_a(t)) = e^{-as}$, where $\delta_a(t)$ is the Dirac δ-function (this is often written using $\delta(t-a)$ to mean $\delta_a(t)$)