

# Laplace transforms

Below is the Laplace transform of some elementary functions:

- $\mathcal{L}\{t^n\}(s) = \frac{n!}{s^{n+1}}$
- $\mathcal{L}\{e^{ct}\}(s) = \frac{1}{s - c}$
- $\mathcal{L}\{\cos(bt)\}(s) = \frac{s}{s^2 + b^2}$
- $\mathcal{L}\{\sin(bt)\}(s) = \frac{b}{s^2 + b^2}$
- $\mathcal{L}\{u_c(t)\}(s) = \frac{e^{-cs}}{s}$
- $\mathcal{L}\{\delta(t - c)\}(s) = e^{-cs}$

Below is a list of some of the properties of the Laplace transform:

- $\mathcal{L}\{e^{ct}f(t)\}(s) = \mathcal{L}\{f\}(s - c)$
- $\mathcal{L}\{t^n f(t)\}(s) = (-1)^n \frac{d^n}{ds^n} (\mathcal{L}\{f\}(s))$
- $\mathcal{L}\{u_c(t)f(t - c)\}(s) = e^{-cs} \mathcal{L}\{f\}(s)$
- $\mathcal{L}\{f^{(n)}(t)\}(s) = s^n \mathcal{L}\{f\}(s) - s^{n-1}f(0) - \dots - f^{(n-1)}(0)$