Definition and properties of the Laplace transform

1. $\mathscr{L}\{f(t)\} = \displaystyle\int_0^\infty e^{-st} f(t)\,dt \equiv F(s)$
2. $\mathscr{L}\{e^{at} f(t)\} = F(s-a)$
3. $\mathscr{L}\{tf(t)\} = -\dfrac{d}{ds}F(s)$
4. $\mathscr{L}\{f'(t)\} = s\mathscr{L}\{f(t)\} - f(0)$
5. $\mathscr{L}\{f''(t)\} = s^2\mathscr{L}\{f(t)\} - sf(0) - f'(0)$
6. $\mathscr{L}\{u(t-c)f(t-c)\} = e^{-cs}\mathscr{L}\{f(t)\} = e^{-cs}F(s)$

Laplace transforms of a few specific functions

$$\mathscr{L}\{t^n\} = \frac{n!}{s^{n+1}} \qquad \mathscr{L}\{e^{at}\} = \frac{1}{s-a} \qquad \mathscr{L}\{\delta(t-c)\} = e^{-cs}$$

$$\mathscr{L}\{\cos bt\} = \frac{s}{s^2+b^2} \qquad \mathscr{L}\{\sin bt\} = \frac{b}{s^2+b^2}$$