Properties of the Laplace transform

| Function | Laplace transform | Function | Laplace transform |
|---|---|---|---|
| $f(t)$ | $F(s) = \int_0^{+\infty} e^{-st} f(t)dt$ | $1 = u_0(t)$ | $\frac{1}{s}$ |
| $e^{-ct} f(t)$ | $F(s+c)$ | $e^{at}$ | $\frac{1}{s-a}$ |
| $f(t-c),\ c>0$ | $e^{-cs}F(s)$ | $\sin(at)$ | $\frac{a}{s^2+a^2}$ |
| $f'(t)$ | $sF(s) - f(0)$ | $\cos(at)$ | $\frac{s}{s^2+a^2}$ |
| $f''(t)$ | $s^2F(s) - sf(0) - f'(0)$ | $\frac{1}{2a^3}\big(\sin(at) - at\cos(at)\big)$ | $\frac{1}{(s^2+a^2)^2}$ |
| $\int_0^t f(\tau)d\tau$ | $\frac{F(s)}{s}$ | $t^n$ | $\frac{n!}{s^{n+1}}$ |
| $tf(t)$ | $-F'(s)$ | $t^r,\ r>-1$ | $\frac{\Gamma(r+1)}{s^{r+1}}$ |
| $t^n f(t)$ | $(-1)^n F^{(n)}(s)$ | $f(t+T) = f(t),\ T>0$ | $\frac{\int_0^T e^{-st} f(t)dt}{1-e^{-sT}}$ |
| $\frac{f(t)}{t}$ | $\int_s^{+\infty} F(z)dz$ | $\delta(t)$ | $1$ |
| $f(ct),\ c>0$ | $\frac{1}{c}F(s/c)$ | $\int_0^t f(t-\tau)g(\tau)d\tau$ | $F(s)G(s)$ |