

## Laplace Transforms

01.  $\mathcal{L}\{K_1 f_1(t) + K_2 f_2(t)\}(s) = K_1 \mathcal{L}\{f_1(t)\}(s) + K_2 \mathcal{L}\{f_2(t)\}(s)$
02.  $\mathcal{L}\{y^{(n)}(t)\}(s) = s^n \mathcal{L}\{y(t)\}(s) - s^{n-1}y(0) - s^{n-2}y'(0) - \dots - y^{(n-1)}(0) \quad n = 1, 2, 3, \dots$
03.  $\mathcal{L}\{e^{at} f(t)\}(s) = \mathcal{L}\{f(t)\}(s - a)$
04.  $\mathcal{L}\{u_a(t) f(t)\}(s) = \mathcal{L}\{f(t + a)\}(s) e^{-as}$
05.  $\mathcal{L}\{f(t)\}(s) = \frac{1}{1 - e^{-Ts}} \int_0^T f(t) e^{-st} dt, \quad f(t + T) = f(t)$
06.  $\mathcal{L}\{t f(t)\}(s) = -\frac{d}{ds} \left( \mathcal{L}\{f(t)\}(s) \right)$
07.  $\mathcal{L}\left\{\frac{f(t)}{t}\right\}(s) = \int_s^{+\infty} \mathcal{L}\{f(t)\}(r) dr$
08.  $\mathcal{L}\{t^n\}(s) = \frac{n!}{s^{n+1}}, \quad n = 0, 1, 2, \dots$
09.  $\mathcal{L}\{e^{at} t^n\}(s) = \frac{n!}{(s - a)^{n+1}}, \quad n = 0, 1, 2$
10.  $\mathcal{L}\{\cos(bt)\}(s) = \frac{s}{s^2 + b^2}$
11.  $\mathcal{L}\{e^{at} \cos(bt)\}(s) = \frac{s - a}{(s - a)^2 + b^2}$
12.  $\mathcal{L}\{\sin(bt)\}(s) = \frac{b}{s^2 + b^2}$
13.  $\mathcal{L}\{e^{at} \sin(bt)\}(s) = \frac{b}{(s - a)^2 + b^2}$
14.  $\mathcal{L}\{u_a(t)\}(s) = \frac{e^{-as}}{s}$
15.  $\mathcal{L}\{e^{at}\}(s) = \frac{1}{s - a}$
16.  $\mathcal{L}\left\{\frac{1}{\sqrt{t}}\right\}(s) = \sqrt{\frac{\pi}{s}}$

## Inverse Laplace Transforms

01.  $\mathcal{L}^{-1}\{K_1 F_1(s) + K_2 F_2(s)\}(t) = K_1 \mathcal{L}^{-1}\{F_1(s)\}(t) + K_2 \mathcal{L}^{-1}\{F_2(s)\}(t)$
02.  $\mathcal{L}^{-1}\{F(s - a)\}(t) = e^{at} \mathcal{L}^{-1}\{F(s)\}(t) \quad \text{or} \quad \mathcal{L}^{-1}\{F(s + a)\}(t) = e^{-at} \mathcal{L}^{-1}\{F(s)\}(t)$
03.  $\mathcal{L}^{-1}\{F(s) e^{-as}\}(t) = u_a(t) \mathcal{L}^{-1}\{F(s)\}(t - a) \quad \mathcal{L}^{-1}\left\{\frac{e^{-as}}{s}\right\}(t) = u_a(t)$
04.  $\mathcal{L}^{-1}\{F'(s)\}(t) = -t \mathcal{L}^{-1}\{F(s)\}(t)$
05.  $\mathcal{L}^{-1}\left\{\frac{1}{s^{n+1}}\right\}(t) = \frac{t^n}{n!} \quad n = 0, 1, 2, \dots$
06.  $\mathcal{L}^{-1}\left\{\frac{1}{(s - a)^{n+1}}\right\}(t) = e^{at} \frac{t^n}{n!} \quad n = 0, 1, 2$
07.  $\mathcal{L}^{-1}\left\{\frac{s}{s^2 + b^2}\right\}(t) = \cos(bt)$
08.  $\mathcal{L}^{-1}\left\{\frac{s - a}{(s - a)^2 + b^2}\right\}(t) = e^{at} \cos(bt)$
09.  $\mathcal{L}^{-1}\left\{\frac{1}{s^2 + b^2}\right\}(t) = \frac{1}{b} \sin(bt)$
10.  $\mathcal{L}^{-1}\left\{\frac{1}{(s - a)^2 + b^2}\right\}(t) = \frac{1}{b} e^{at} \sin(bt)$

## Trigonometric Identities

1.  $\cos^2(\theta) + \sin^2(\theta) = 1$
2.  $\cos(2\theta) = \cos^2(\theta) - \sin^2(\theta)$
3.  $\sin(2\theta) = 2 \cos(\theta) \sin(\theta)$
4.  $2 \cos^2(\theta) = 1 + \cos(2\theta)$
5.  $2 \sin^2(\theta) = 1 - \cos(2\theta)$
6.  $\cos(\theta \pm \pi) = -\cos(\theta)$
7.  $\sin(\theta \pm \pi) = -\sin(\theta)$
8.  $\cos(\theta \pm 2\pi) = \cos(\theta)$
9.  $\sin(\theta \pm 2\pi) = \sin(\theta)$