Laplace Transforms

$\boldsymbol{y(t) = \mathcal{L}^{-1}[Y(s)]}$	$\boldsymbol{Y(s) = \mathcal{L}[y(t)]}$
$\boldsymbol{y(t)}$	$Y(s) = \int_0^\infty y(t)e^{-st}dt$
$\boldsymbol{y(t) = e^{at}}$	$Y(s) = \frac{1}{s-a} \ (s > a)$
$\boldsymbol{y(t) = t^n}$	$Y(s) = \frac{n!}{s^{n+1}} \ (s > 0)$
$\boldsymbol{y(t) = \sin(\omega t)}$	$Y(s) = \frac{\omega}{s^2 + \omega^2}$
$\boldsymbol{y(t) = \cos(\omega t)}$	$Y(s) = \frac{s}{s^2 + \omega^2}$
$\boldsymbol{y(t) = e^{at} \cdot \sin(\omega t)}$	$Y(s) = \frac{\omega}{(s-a)^2 + \omega^2}$
$\boldsymbol{y(t) = e^{at} \cdot \cos(\omega t)}$	$Y(s) = \frac{(s-a)}{(s-a)^2 + \omega^2}$
$\boldsymbol{y(t) = t \cdot sin(\omega t)}$	$Y(s) = \frac{2\omega s}{(s^2 + \omega^2)^2}$
$\boldsymbol{y(t) = t \cdot cos(\omega t)}$	$Y(s) = \frac{s^2 - \omega^2}{(s^2 + \omega^2)^2}$
$\boldsymbol{y(t) = u_a(t)}$	$Y(s) = \frac{e^{-as}}{s} \ (s > 0)$
$\boldsymbol{y(t) = \delta_a(t)}$ Oklahoma City Community College Math Lab	$Y(s) = e^{-as}$

Laplace Transforms

Rules for Laplace	Rules for Inverse Laplace
$\mathcal{L}[y(t)] = Y(s)$	$\mathcal{L}^{-1}[Y(s)] = y(t)$
$\mathcal{L}[w(t)] = W(s)$	$\mathcal{L}^{-1}[W(s)] = w(t)$
$\mathcal{L}\left[\frac{dy}{dt}\right] = s\mathcal{L}[y] - y(0)$	
$\mathcal{L}[y + w] = \mathcal{L}[y] + \mathcal{L}[w]$	$\mathcal{L}^{-1}[Y + W] = \mathcal{L}^{-1}[Y] + \mathcal{L}^{-1}[W]$
$\mathcal{L}[\alpha \cdot y] = \alpha \cdot \mathcal{L}[y] = \alpha \cdot Y(s)$	$\mathcal{L}^{-1}[\alpha \cdot Y] = \alpha \cdot \mathcal{L}^{-1}[Y] = \alpha \cdot y(t)$
$\mathcal{L}[u_a(t) \cdot y(t-a)] = e^{-as}\mathcal{L}[y]$	$\mathcal{L}^{-1}[e^{-as}Y(s)] = u_a(t) \cdot y(t-a)$
$\mathcal{L}[e^{at}y(t)] = Y(s-a)$	$\mathcal{L}^{-1}[Y(s-a)] = e^{at}y(t)$

Convolutions

$$(f * g)(t) = \int_0^t f(t-u) \cdot g(u)du$$

$\mathcal{L}[(f * g)] = \mathcal{L}[f] \cdot \mathcal{L}[g] = F(s) \cdot G(s)$	$\mathcal{L}^{-1}[F(s) \cdot G(s)] = \mathcal{L}^{-1}[F] \cdot \mathcal{L}^{-1}[G]$