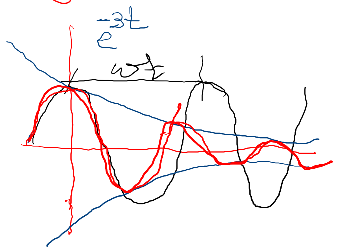
$\mathcal{L}(A) = \frac{A}{s}$ —— (1)

$\mathcal{L}(at) = \frac{a}{s^2}$ —— (2)

$\mathcal{L}[e^{at}] = \frac{1}{s-a}$

$\mathcal{L}[e^{-at}] = \frac{1}{s+5}$

$a=5$



$\mathcal{L}[4\delta(t)] = 4$

$\mathcal{L}[\cos(\omega t)] = \frac{s}{s^2+\omega^2}$

$\mathcal{L}[\cos(4t)] = \frac{s}{s^2+16}$

Find Laplace of $f(t) = \cos(3t)$?

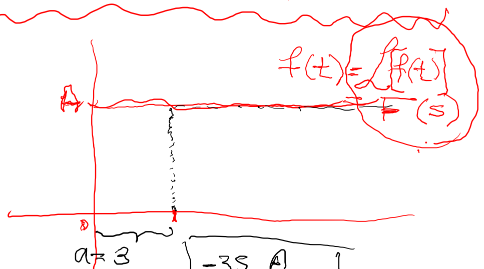
$F(s) = \mathcal{L}[\cos(3t)] = \frac{s}{s^2+(3)^2}$

$\boxed{\text{Find Laplace of } f(t) = e^{-2t}\cos(3t)}$

$F(s) = \mathcal{L}[e^{-2t}\cos(3t)]$

$s \Rightarrow s+2$

$F(s) = \frac{(s+2)}{(s+2)^2+9}$



$= \boxed{e^{-3s}\frac{A}{s}}$

$$\boxed{\begin{aligned} f(t) &= A \\ F(s) &= \frac{A}{s} \end{aligned}}$$

$$\boxed{\begin{aligned} f(t) &= A \\ F(s) &= \mathcal{L}[A] = \frac{A}{s} \end{aligned}}$$

$f(t) = \int A\,dt$

$F(s) = \frac{1}{s}[A/s] = \frac{A}{s^2}$

$\mathcal{L}[\int A\,dt] = \mathcal{L}[At] = \frac{A}{s^2}$

$= \frac{1}{s}F(s) = \frac{1}{s}\left[\frac{A}{s}\right]$

$\mathcal{L}[\int e^{-at}\,dt] =$

$$\boxed{\mathcal{L}[e^{-at}] = \frac{1}{s+a}}$$

$= \frac{1}{s}\cdot\frac{1}{s+a} = \frac{1}{s(s+a)}$

Find $y(0)$?

$t=0$

$\frac{d^2y}{dt^2} + 3\frac{dy}{dt} + 7y(t) = 3$

$\mathcal{L}\left[\frac{d^2y}{dt^2}\right] = s^2Y(s)$; $\mathcal{L}\left[3\frac{dy}{dt}\right] = 3sY(s)$

$\mathcal{L}[7y(t)] = 7Y(s)$

$\mathcal{L}[3] = \frac{3}{s}$

$[s^2+3s+7]Y(s) = \frac{3}{s}$

$Y(s) = \frac{3}{s[s^2+3s+7]}$

$y(t=0) = \lim_{s\to\infty} s.Y(s)$

$t \to \infty$

$= \lim_{s\to\infty} \cancel{s}.\frac{3}{\cancel{s}(s^2+3s+7)}$

∞

$y(t=0) = \text{Zero}$

$$\boxed{\begin{aligned} y(t=\infty) &= \lim_{s\to 0} s.Y(s) \\ &= \lim_{s\to 0} \cancel{s}.\frac{3}{\cancel{s}(s^2+3s+7)} \\ y(t=\infty) &= 3/7 \end{aligned}}$$

$$F(s) = \frac{8}{s^2+3s+5}$$

$$\boxed{\frac{d^2y}{dt^2} + 3\frac{dy}{dt} + 5y = 8}$$

$$\mathcal{L}\left[\frac{d^2y}{dt^2}\right] = s^2 Y(s)$$

$$\mathcal{L}\left[3\frac{dy}{dt}\right] = 3sY(s)$$

$$\mathcal{L}[5Y] = 5Y(s)$$

$$\mathcal{L}[8] = \frac{8}{s}$$

$$(s^2+3s+5)Y(s) = \frac{8}{s}$$

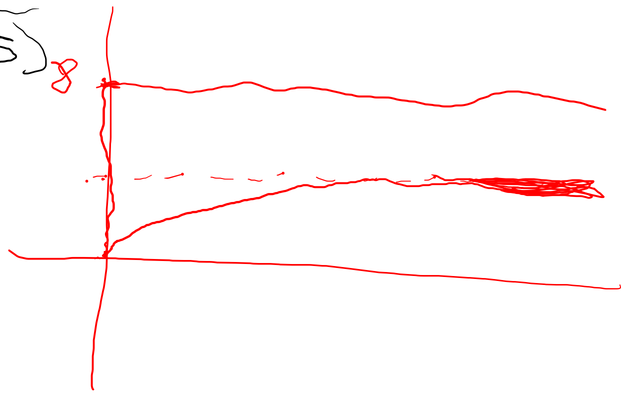
$$Y(s) = \frac{8}{s(s^2+3s+5)}$$

$$y(t=\infty) = \lim_{s\to 0} s.Y(s)$$

$$= \lim_{s\to 0} s.\frac{8}{s(s^2+3s+5)}$$

$$y(t=\infty) = \frac{8}{5}$$

$$5\overline{)8}\ \ 1.6$$
$$5$$
$$\overline{40}$$



Initial Value Theorem:

$$y(0) = \lim_{s\to\infty} sY(s) = \lim_{t\to 0} Y(t)$$

$$= \lim_{s\to\infty} s.\frac{8}{s(s^2+3s+5)}$$