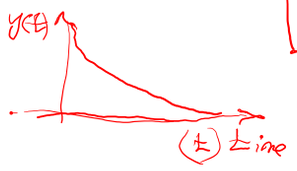
$y(t) = e^{-2t}$

$Y(s) = \mathcal{L}\{e^{-2t}\}$

$= \dfrac{1}{s+2}$

$= \mathcal{L}^{-1}\left\{\dfrac{1}{s+2}\right\} = e^{-2t}$



s-domain $\Rightarrow$ time domain

$$Y(s) = \frac{s+1}{s^2+5s+6} = \frac{s+1}{(s+2)(s+3)}$$

$y(t) = ?$

$$= \frac{A}{s+2} + \frac{B}{s+3}$$

$$y(t) = A e^{-2t} + B e^{-3t}$$

$$= \frac{A(s+3)+B(s+2)}{(s+2)(s+3)}$$

$A = ?$; $B = ?$

$$y(t) = \mathcal{L}^{-1}[Y(s)] = \mathcal{L}^{-1}\left\{\frac{s+1}{(s+2)(s+3)}\right\}$$

$$= \mathcal{L}^{-1}\left[\frac{A}{s+2}\right] + \mathcal{L}^{-1}\left[\frac{B}{s+3}\right]$$

$s = As + Bs$

$1 =$

$3A + 2B = 1$ ——— (1)

$-2[A + B = 1]$ ——— (2)

$3A + 2B = 1$ ——— (1)

$-2A - 2B = -2$ ——— (2)

$A = -1$

$B = 2$

$A + B = 1$

$-1 + B = 1$

$B = 2$

$$y(t) = \mathcal{L}^{-1}\left[\frac{A}{s+2}\right] + \mathcal{L}^{-1}\left[\frac{B}{s+3}\right] = \mathcal{L}^{-1}\left\{\frac{2}{s+3}\right\} - \mathcal{L}^{-1}\left[\frac{1}{s+2}\right]$$

$= 2e^{-3t} - e^{-2t}$

$$Y(s) = \frac{(s+1)}{(s+2)(s+3)} = \frac{A}{s+2} + \frac{B}{s+3}$$

$$A = (s+2)\cdot Y(s) = \frac{(s+2)(s+1)}{(s+2)(s+3)} = \frac{s+1}{s+3}\Big|_{s=-2} = \frac{-2+1}{-2+3} = \frac{-1}{1} = -1$$

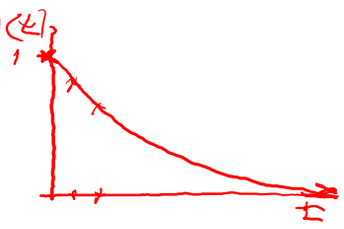
$$B = (s+3)\cdot Y(s) = \frac{(s+3)(s+1)}{(s+3)(s+2)}\Big|_{s=-3}$$

$$= \frac{s+1}{s+2}\Big|_{s=-3} = \frac{-3+1}{-3+2} = \frac{-2}{-1} = 2$$

$A = -1$; $B = 2$

$y(t) = Ae^{-2t} + Be^{-3t}$

$\boxed{y(t) = 2e^{-3t} - e^{-2t}}$



at $t = 0$

$y(0) = 2e^{0} - e^{0} = 1$

$$y(0) = \lim_{s\to\infty} s\cdot Y(s) = \lim_{s\to\infty} s\cdot\frac{(s+1)}{(s+3)(s+2)}\cdot\frac{s^2}{s^2}$$

initial

$$= \lim_{s\to\infty} \frac{[s^2+s]/s^2}{s^2+5s+6} = \frac{1+0}{1+0+0} = 1$$