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Q3) $L^{-1}\left(\frac{s+2}{s(s+3)}\right)$

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

$$s+2 = A(s+3) + B(s)$$

a) $s=0 . A = \frac{2}{3}$

b) $s = -3$

$\therefore -3+2 = -3B$

$B = 1/3$

$$L^{-1}\left(\frac{s+2}{s(s+3)}\right) = L^{-1}\left(\frac{2}{3s} + \frac{1}{3(s+3)}\right)$$

$$= \frac{2}{3} + \frac{1}{3}e^{-3t}$$

4) $\phi(s) = \frac{4}{s-2} \cdot \frac{4}{s+2}$

$\phi_1 = \frac{4}{s-2}$, $\phi_2 = \frac{4}{s+2}$

$L^{-1}(\phi_1) = 4e^{2t}$, $L^{-1}(\phi_2) = 4e^{-2t}$

$$L^{-1}[\phi(s)] = \int_0^t 4e^{-2t} \cdot e^{2(t-u)} \cdot 4 \, du$$

$$= 16 \int_0^t e^{2t-4u} \, du$$

$$= \frac{16}{-4} \left[e^{2t} \cdot e^{-4u} \right]_0^t$$

$$= -4 \left[e^{2t-4u} \right]_0^t$$

$$= -4 \left[e^{-2t} - e^{2t} \right]$$

$$= \frac{4}{2} \cdot \frac{e^{2t} - e^{-2t}}{2}$$

$$= 8 \sinh 2t$$

Q6 $L^{-1}\left[\frac{1}{2}\log\left(\frac{s^2+4}{s^2+9}\right)\right]$

$$\phi(s) = \frac{1}{2}\log\frac{s^2+4}{s^2+9}$$

$$= \frac{1}{2}\left[\log(s^2+4) - \log(s^2+9)\right]$$

$$\phi'(s) = \frac{1}{2}\left(\frac{2s}{s^2+4} - \frac{2s}{s^2+9}\right)$$

$$= \frac{s}{s^2+4} - \frac{s}{s^2+9}$$

$$L^{-1}(\phi(s)) = \frac{-1}{t} \cdot L^{-1}(\phi'(s))$$

$$= -\frac{1}{t} L^{-1}\left(\frac{s}{s^2+4} - \frac{s}{s^2+9}\right)$$

$$= -\frac{1}{t}(\cos 2t - \cos 3t)$$

$$= \frac{1}{t}(\cos 3t - \cos 2t)$$