

a.)

$$\mathcal{L}^{-1} \left[\frac{4}{s} \right] = 4$$

b.)

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

c.)

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

d.)

$$\mathcal{L}^{-1} \left[\frac{s}{s^2+9} \right] = \cos(3t)$$

e.)

$$\mathcal{L}^{-1} \left[\frac{4}{s^2+16} \right] = \sin(4t)$$

f.)

$$\mathcal{L}^{-1} \left[\frac{s}{s^2-9} \right] = \mathcal{L}^{-1} \left[\frac{s}{(s-3)(s+3)} \right] = \frac{1}{6} \mathcal{L}^{-1} \left[\frac{3}{s+3} + \frac{3}{s-3} \right] = \frac{1}{2} e^{-3t} + \frac{1}{2} e^{3t}$$

g.)

$$\mathcal{L}^{-1} \left[\frac{1}{s^2+4} \right] = \frac{1}{2} \mathcal{L}^{-1} \left[\frac{2}{s^2+4} \right] = \frac{1}{2} \sin(2t)$$

h.)

$$\begin{aligned} \mathcal{L}^{-1} \left[\frac{s-1}{(s^2-9)} \right] &= \mathcal{L}^{-1} \left[\frac{s-1}{(s-3)(s+3)} \right] = \mathcal{L}^{-1} \left[\frac{s}{(s-3)(s+3)} - \frac{1}{(s-3)(s+3)} \right] \\ &= \frac{1}{6} \mathcal{L}^{-1} \left[\frac{3}{s+3} + \frac{3}{s-3} - \frac{1}{s-3} + \frac{1}{s+3} \right] = \frac{1}{6} \mathcal{L}^{-1} \left[\frac{4}{s+3} + \frac{2}{s-3} \right] = \frac{2}{3} e^{-3t} + \frac{1}{3} e^{3t} \end{aligned}$$

a.)

$$\mathcal{L}^{-1} \left[\frac{s+3}{(s+3)^2+16} \right] = e^{-3t} \mathcal{L}^{-1} \left[\frac{s}{s^2+16} \right] = e^{-3t} \cos(4t)$$

b.)

$$\mathcal{L}^{-1} \left[\frac{1}{(s-2)^2+4} \right] = \frac{1}{2} e^{2t} \mathcal{L}^{-1} \left[\frac{2}{s^2+4} \right] = \frac{1}{2} e^{2t} \sin(2t)$$

c.)

$$\mathcal{L}^{-1} \left[\frac{1}{(s-4)^5} \right] = e^{4t} \mathcal{L}^{-1} \left[\frac{1}{s^5} \right] = \frac{1}{24} e^{4t} \mathcal{L}^{-1} \left[\frac{24}{s^5} \right] = \frac{1}{24} e^{4t} t^4$$

d.)

$$\begin{aligned}\mathcal{L}^{-1}\left[\frac{s}{(s-4)^5}\right] &= e^{4t}\mathcal{L}^{-1}\left[\frac{s+4}{s^5}\right] = e^{4t}\mathcal{L}^{-1}\left[\frac{1}{s^4} + \frac{4}{s^5}\right] = \frac{1}{6}e^{4t}\mathcal{L}^{-1}\left[\frac{6}{s^4} + \frac{24}{s^5}\right] \\ &= \frac{1}{6}e^{4t}(t^3 + t^4)\end{aligned}$$

e.)

$$\begin{aligned}\mathcal{L}^{-1}\left[\frac{s^2}{(s-4)^5}\right] &= e^{4t}\mathcal{L}^{-1}\left[\frac{(s+4)^2}{s^5}\right] = e^{4t}\mathcal{L}^{-1}\left[\frac{s^2+8s+16}{s^5}\right] \\ &= e^{4t}\mathcal{L}^{-1}\left[\frac{1}{s^3} + \frac{8}{s^4} + \frac{16}{s^5}\right] = e^{4t}\left(\frac{1}{2}\mathcal{L}^{-1}\left[\frac{2}{s^3}\right] + \frac{4}{3}\mathcal{L}^{-1}\left[\frac{6}{s^4}\right] + \frac{2}{3}\mathcal{L}^{-1}\left[\frac{24}{s^5}\right]\right) \\ &= e^{4t}\left(\frac{1}{2}t^2 + \frac{4}{3}t^3 + \frac{2}{3}t^4\right)\end{aligned}$$

f.)

$$\begin{aligned}\mathcal{L}^{-1}\left[\frac{s+5}{(s+2)^2+16}\right] &= e^{-2t}\mathcal{L}^{-1}\left[\frac{s+3}{s^2+16}\right] = e^{-2t}\mathcal{L}^{-1}\left[\frac{s}{s^2+16} + \frac{3}{s^2+16}\right] \\ &= e^{-2t}\left(\cos(4t) + \frac{4}{3}\sin(4t)\right)\end{aligned}$$

g.)

$$\begin{aligned}\mathcal{L}^{-1}\left[\frac{s+3}{s^2+4s+13}\right] &= \mathcal{L}^{-1}\left[\frac{s+3}{(s+2)^2+9}\right] = e^{-2t}\mathcal{L}^{-1}\left[\frac{s+1}{s^2+9}\right] \\ &= e^{-2t}\mathcal{L}^{-1}\left[\frac{s}{s^2+9} + \frac{1}{s^2+9}\right] = e^{-2t}\left(\cos(3t) + \frac{1}{3}\sin(3t)\right)\end{aligned}$$

h.)

$$\begin{aligned}\mathcal{L}^{-1}\left[\frac{s-4}{s^2-2s+7}\right] &= \mathcal{L}^{-1}\left[\frac{s-4}{(s-1)^2+6}\right] = e^t\mathcal{L}^{-1}\left[\frac{s-3}{s^2+6}\right] \\ &= e^t\left[\cos(\sqrt{6}t) - \frac{3}{\sqrt{6}}\sin(\sqrt{6}t)\right]\end{aligned}$$