

$$3.24 \quad H(s) = \frac{18s+10}{s^2+6s+5}$$

$$\frac{-6 \pm \sqrt{6^2 - 4(1)(5)}}{2}$$

$$H(s) = \frac{18s+10}{(s+1)(s+5)}$$

$$36 - 20 = 16$$

$$\frac{-6 \pm 4}{2} = \frac{-2}{2} = -1$$

$$= \frac{-10}{2} = -5$$

$$Y(s) = H(s) \cdot X(s)$$

$$b.) x(t) = 2t u(t)$$

$$\mathcal{L}\{x(t)\} = \frac{2}{s^2} = \frac{2}{s^2} \cdot \frac{18s+10}{s^2+6s+5}$$

$$\Rightarrow \frac{2(18s+10)}{s^2(s+1)(s+5)} = \frac{36s+20}{s^2(s+1)(s+5)} = \frac{C_1}{s} + \frac{C_2}{s^2} + \frac{C_3}{s+1} + \frac{C_4}{s+5}$$

$$C_1 = \frac{12}{5} \quad C_2 = 4 \quad C_3 = -4 \quad C_4 = \frac{8}{5}$$

$$= \frac{12}{5} \cdot \frac{1}{s} + 4 \cdot \frac{1}{s^2} - 4 \cdot \frac{1}{s+1} + \frac{8}{5} \cdot \frac{1}{s+5}$$

$$y(t) = \frac{12}{5} u(t) + 4t u(t) - 4e^{-t} u(t) + \frac{8}{5} e^{-5t} u(t)$$

$$c.) x(t) = 2e^{-4t} u(t) \quad X(s) = \frac{2}{s+4}$$

$$Y(s) = H(s) \cdot X(s) \Rightarrow \frac{2}{s+4} \cdot \frac{18s+10}{(s+1)(s+5)} \Rightarrow \frac{36s+20}{(s+4)(s+1)(s+5)}$$

$$C_1 = \frac{124}{3} \quad C_2 = -\frac{4}{3} \quad C_3 = -40$$

$$Y(s) = \frac{124}{3} \cdot \frac{1}{s+4} - \frac{4}{3} \cdot \frac{1}{s+1} - 40 \cdot \frac{1}{s+5}$$

$$y(t) = \frac{124}{3} e^{-4t} u(t) - \frac{4}{3} e^{-t} u(t) - 40 e^{-5t} u(t)$$

$$H(s) = \frac{18s+10}{(s+1)(s+5)}$$

$$d.) x(t) = 4\cos(4t)u(t)$$

$$X(s) = \frac{4s}{s^2+4^2}$$

$$Y(s) = H(s) \cdot X(s) \Rightarrow \frac{4s}{s^2+16} \cdot \frac{18s+10}{(s+1)(s+5)} = \frac{72s^2+40s}{(s^2+16)(s+1)(s+5)}$$

$$\Rightarrow \frac{72s+40}{(s+16)(s+1)(s+5)} = \frac{C_1}{s+16} + \frac{C_2}{s+1} + \frac{C_3}{s+5}$$

$$C_1 = -\frac{1112}{165} \quad C_2 = -\frac{8}{15} \quad C_3 = \frac{80}{11}$$

$$Y(s) = -\frac{1112}{165} \cdot \frac{1}{s+16} - \frac{8}{15} \cdot \frac{1}{s+1} + \frac{80}{11} \cdot \frac{1}{s+5}$$

$$y(t) = -\frac{1112}{165} e^{-16t} u(t) - \frac{8}{15} e^{-t} u(t) + \frac{80}{11} e^{-5t} u(t)$$

$$3.25) y(t) = [5 - 10t + 20\sin(2t)]u(t)$$

$$Y(s) = \frac{5}{s} - \frac{10}{s^2} + \frac{20(2)}{s^2+2^2} = \frac{40}{s^2+4}$$

$$H(s) = \frac{Y(s)}{X(s)} = \frac{\frac{5}{s} - \frac{10}{s^2} + \frac{40}{s^2+4}}{\frac{1}{s}} = s\left(\frac{5}{s} - \frac{10}{s^2} + \frac{40}{s^2+4}\right)$$

$$H(s) = 5 - \frac{10}{s} + \frac{40s}{s^2+4}$$

$$h(t) = 5 - 10u(t) + 40\cos(2t)u(t)$$