

$$\frac{1.1}{1) \mathcal{L}^{-1} \{ 6e^{-0.7t} + 0.5e^{-5t} \}}$$

$$= 6 \cdot \frac{1}{s+0.7} + 0.5 \frac{1}{s+5}$$

$$2) \mathcal{L} \{ 170 \sin(60t) \}$$

$$= 170 \frac{60}{s^2 + 60^2}$$

$$3) \mathcal{L} \{ 170 (60t + \pi/4) \}$$

$$= 170 \cdot \frac{s \sin(\pi/4) + 60 \cos(\pi/4)}{s^2 + 170^2}$$

Identity

$$4) \mathcal{L}^{-1} \{ (10s^3 - 14s^2 + 4s + 127)X(s) \}$$

$$= 10 \frac{d^3}{dt^3} x - 14 \frac{d^2}{dt^2} x + 4 \frac{d}{dt} x + 127 x$$

1.2

1) Claude.ari Said:

$$H(s) = \frac{2}{s+2} + \frac{48/25 + 4j/25}{s+7+5j} + \frac{48/25 - 4j/25}{s+7-5j}$$

2) By hand

$$\boxed{20} \cdot \left(\frac{s+5}{(s+2)(s+7+5j)(s+7-5j)} \right) = H(s)$$

Remember to put this back in

$$\frac{s+5}{(s+2)(s+7+5j)(s+7-5j)} = \frac{A}{s+2} + \frac{B}{s+7+5j} + \frac{C}{s+7-5j}$$

$$A = \frac{(s+5)}{(s+2+5j)(s+2-5j)} \bigg|_{s=2} = \frac{3}{(2+7+5j)(2+7-5j)}$$

$$= \frac{3}{(s+5j)(s-5j)}$$

$$A = \frac{3}{50} = \boxed{\frac{3}{50}}$$

$$B = \frac{s+5}{(s+2)(s+7-5j)} \bigg|_{s=-7-5j} = \frac{-7-5j+5}{(-7-5j+2)(-7-5j+7-5j)}$$

$$= \frac{-2 - 5j}{(-5 - 5j)(-10j)} = \frac{-2 - 5j}{50j - 50} = \boxed{-0.03 + 0.07j}$$

B

$$C = \frac{s+9}{(s+2)(s+7+5j)} \bigg|_{s=-7+5j} = \frac{-7+5j+9}{(-7+5j+2)(-7+5j+7+5j)}$$

$$= \frac{-2+5j}{(-5+5j)(10j)} = \boxed{-0.03 - 0.07j} = C$$

$$H(s) = 20 \left(\frac{\frac{3}{s_0}}{s+2} + \frac{-0.03+0.07i}{(s+7+5j)} + \frac{-0.03-0.07i}{(s+7-5j)} \right)$$

3 Python

$$n = [20, 100]$$

$$d = \text{numpy polynomial} : [x^3 + 16x^2 + 102x + 148]$$

I get:

$$H(s) = \frac{1.2}{(s+2)} + \frac{-6.6-1.4j}{(s+7-5j)} + \frac{-6.6+1.4j}{(s+7+5j)}$$

which is the same as my original by hand answer
(with 20 distributed)

The LLM answer is totally different and I do
not trust it

Two out of 3 agree!!! (Python and by hand)

1.3.1

$$f(x) = \frac{1}{4}x^2 + 10x + 25$$

$$f_1(x) = \frac{1}{4}x^2 \text{ and } f_2(x) = \underline{10x} + \underline{25}$$

$$\hat{f}(x) = \hat{f}_1(x) + f_2(x)$$

$$\hat{f}_1(x) = f_1(x_0) + \left. \frac{d}{dx} f(x) \right|_{x=x_0} \cdot (x - x_0)$$

$$f_1(x_0) = \frac{1}{4}x_0^2 \quad \frac{d}{dx} f(x) = \frac{1}{2}x$$

$$\hat{f}_1(x) = \frac{1}{4}x_0^2 + \frac{1}{2}x \Big|_{x_0} (x - x_0)$$

$$\hat{f}_1(x) = \frac{1}{4}x_0^2 + \frac{1}{2}x_0 \cdot x - \frac{1}{2}x_0^2$$

$$\hat{f}(x) = \left(10 + \frac{1}{2}x_0\right)x + \left(25 + \frac{1}{4}x_0^2 - \frac{1}{2}x_0^2\right)$$