

EFRETV E1 EDWARD SAMUEL

15/ENG01/026

CHEMICAL ENGINEERING

Q) $\frac{dy}{dt} + 3y = e^{2t}$ given that at $t=0, y=2$

$$\mathcal{L}\left\{\frac{dy}{dt}\right\} = sY(s) - y(0)$$

$$\mathcal{L}\{3y\} = 3Y(s)$$

$$\mathcal{L}\{e^{2t}\} = \frac{1}{s-2}$$

$$sY(s) - y(0) + 3Y(s) = \frac{1}{s-2}$$

$$sY(s) + 3Y(s) - 2 = \frac{1}{s-2}$$

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

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

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

$$\frac{2s-5}{(s-2)(s+3)} = \frac{A}{s-2} + \frac{B}{s+3}$$

$$2s-5 = A(s+3) + B(s-2)$$

$$2s-5 = As + 3A + Bs - 2B$$

$$A+B = 2 \quad *3$$

$$3A+2B = 5 \quad *1$$

$$3A+3B = 6$$

$$3A+2B = 5$$

$$B = 1$$

From eqn ①

$$\frac{2s+5}{(s+2)(s+3)} = \frac{A}{s+2} + \frac{B}{s+3}$$
$$1 - \frac{1}{s+2} = \frac{A}{s+2} + \frac{B}{s+3}$$

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

From eqn ②

$$sA = 12 - B$$

$$A = -\frac{1}{3}$$

$$3A = 3 - B$$

$$3A = 3 - 9$$

$$A = -\frac{1}{2}$$

$$\frac{2s+5}{(s+2)(s+3)^2} = \frac{-\frac{1}{2}}{s+2} - \frac{\frac{1}{3}}{s+3} + \frac{\frac{13}{6}}{s+3}$$

$$1 - \frac{1}{s+2} = \frac{-\frac{1}{2}}{s+2} - \frac{\frac{1}{3}}{s+3} + \frac{\frac{13}{6}}{s+3}$$

$$y = \frac{1}{2}e^{-2t} - \frac{1}{3}te^{-3t} + \frac{13}{6}e^{-3t}$$

$$y = \frac{1}{2}(e^{-2t} + 4te^{-3t} - 13e^{-3t})$$

2. $\frac{3x}{x^2} - \frac{6y}{x^2} = \frac{3x^2 - 6y}{x^2}$ given that at $(2, 3)$

$$\frac{3x^2 - 6y}{x^2} = 3 \left(\frac{3x^2 - 6y}{x^2} \right)$$

$$\frac{3x^2 - 6y}{x^2} = -6y$$

$$\frac{3x^2 - 6y}{x^2} = \frac{3x^2}{x^2}$$

$$3x^2 - 6y - 3x^2 = \frac{3x^2}{x^2}$$

$$3x^2 - 6y - 3x^2 = \frac{3x^2}{x^2}$$

$$4y(3x-6) = \frac{24x^2(3x-6)}{(3x-6)^2}$$

$$4y = \frac{24x^2(3x-6)}{(3x-6)^2}$$

$$2B(3x-6) = A + B + C$$

$$(3x-6)^2(3x-6) = (3x-6)(3x-6) + B(3x-6) + C(3x-6)$$

$$2B(3x-6)^2 = A(3x-6)(3x-6) + B(3x-6) + C(3x-6)$$

$$2 + 3(2x-5) + 0 = A(3x-6) + B(3x-6) + C(3x-6)$$

$$3A + 3B + 3C = 3 \quad \text{--- (1)}$$

$$3A + 4C = 2 \quad \text{--- (2)}$$

$$-12A - (3 + 4C) = 0 \quad \text{--- (3)}$$

from

$$3A = 3 - C$$

$$A = \frac{3-C}{3}$$

3

$$5B + 0C = 12$$

$$-12 \left(\frac{2C}{3} \right) = 18$$

$$-10 + 4C = 18 + 4C = 19$$

$$-6B + 8C = 28$$

$$-18B - 24C = -92$$

$$-18B + 24C = 84$$

$$48C = 56$$

$$C = 13/12$$

$$812C = A(S-4) + 8B$$

$$3A - 3 = 6 \quad 22B = 22$$

$$3 = 3 \cdot 13/12 \quad -4A = 8$$

$$A = -1/2 \quad A = 2$$

$$3A = B = 21/2 \quad B = 1$$

$$\frac{812S}{5(S-4)} = \frac{2-2}{5(S-4)}$$

$$\frac{812S}{5(S-4)} = \frac{2-2}{5(S-4)}$$

$$L = \frac{4000}{3} = L = \frac{5}{3} + \frac{4}{3} = \frac{5}{3}$$

$$y = -2 + 4e^{2x}$$

3. $\frac{1}{x^2} - \frac{1}{x} - 8$ $\frac{1}{x^2} = \frac{1}{x^2}$ Not to 0 yet

$$\frac{1}{x^2} - \frac{1}{x} - 8 = \frac{1 - x - 8x^2}{x^2}$$

$$\frac{1 - x - 8x^2}{x^2} = -\frac{8x^2 + x - 1}{x^2}$$

$$\frac{1 - x - 8x^2}{x^2} = \frac{8x^2 + x - 1}{x^2}$$

$$\frac{1 - x - 8x^2}{x^2} - \frac{8x^2 + x - 1}{x^2} = \frac{8x^2 + x - 1}{x^2}$$

$$\frac{1 - x - 8x^2 - 8x^2 - x + 1}{x^2} = \frac{8x^2 + x - 1}{x^2}$$

$$\frac{2 - 2x - 16x^2}{x^2} = \frac{8x^2 + x - 1}{x^2}$$

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(ABUAD), The Road to Intel

$$(2x - 1) = 23$$

(2)

$$2x - 1 = 23$$

$$(2x - 1) + 1 = 23 + 1$$

$$2x = 24$$

$$(2x) \div 2 = 24 \div 2$$

2x

$$x = 12$$

$$(2x - 1) = 23$$

$$2x - 1 = 23$$

$$2x - 1 = 23$$

$$2x - 1 = 23$$

$$-1 + 1 = 23 + 1$$

$$2x = 24$$

$$2x = 24$$

$$2x = 24$$

$$x = 12$$

4 $\frac{d^2y}{dt^2} - 2\frac{dy}{dt} + 5y = e^{2t}$ given that at $t=0$, $y=1$, $y' = 0$

$$\mathcal{L}\left\{\frac{d^2y}{dt^2}\right\} = s^2y(s) - sy(0) - y'(0)$$

$$\mathcal{L}\left\{-2\frac{dy}{dt}\right\} = -2sy(s) + 2y(0)$$

$$\mathcal{L}\{5y\} = 5y(s)$$

$$\mathcal{L}\{e^{2t}\} = \frac{1}{s-2}$$

$$s^2y(s) - sy(0) - y'(0) - 2sy(s) + 2y(0) + 5y(s) = \frac{1}{s-2}$$

$$s^2y(s) - 2sy(s) + 5y(s) - 2s + 4 = \frac{1}{s-2}$$

$$y(s)(s^2 - 2s + 5) = \frac{1}{s-2} + 2s - 4$$

$$y(s)(s^2 - 2s + 5) = (2s - 3)(s - 2)$$

$$y(s) = \frac{1 + 2s - 3s}{(s-2)(s^2 - 2s + 5)}$$

$$\frac{s-1}{(s-2)(s-4)} = \frac{-1/2}{s-2} + \frac{3/2}{s-4}$$

$$\frac{2s-5}{(s-3)(s^2-6s+9)} = \frac{-1}{s-3} + \left(\frac{-1/2}{s-2} + \frac{3/2}{s-4}\right)$$

$$\mathcal{L}^{-1}\{y(s)\} = \mathcal{L}^{-1}\left\{-\frac{1}{s-3} - \frac{1/2}{s-2} + \frac{3/2}{s-4}\right\}$$

$$y = -e^{3t} - \frac{1}{2}e^{2t} + \frac{3}{2}e^{4t}$$

$$y = \frac{1}{2}(2e^{4t} + e^{2t} - 3e^{3t})$$