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IS/BAC 01/020

ENCA 381

$$1 \quad \frac{d^2y}{dx^2} - \frac{dy}{dx} - 2y = 8$$

$$= m^2 - m - 2 = 0$$

$$m^2 + m - 2m - 2$$

$$m(m+1) - 2(m+1)$$

$$(m+1) \& (m-2) = 0$$

$$m_1 = -1 \quad m_2 = 2$$

$$y = Ae^{-x} + Be^{2x}$$

$$P.I = y = c$$

$$\frac{dy}{dx} = 0 \quad \& \quad \frac{d^2y}{dx^2} = 0$$

$$0 - 0 - 2(c) = 8$$

$$-2c = 8$$

$$c = 8/-2$$

$$c = -4$$

$$= y = Ae^{-x} + Be^{2x}$$

$$2 \quad \frac{dy}{dx} - 4y = 10e^{3x}$$

$$m^2 - 4 = 0$$

$$m^2 - 2^2 = 0$$

$$m = \sqrt{2^2}$$

$$m = \pm 2$$

$$y = [C \cosh 2x + D \sinh 2x]$$

$$P.I = y = Ce^{3x}$$

$$\frac{dy}{dx} = 3Ce^{3x}$$

$$\frac{dy}{dx} = 9Ce^{3x}$$

$$= 9Ce^{3x} - 4(Ce^{3x}) = 10e^{3x}$$

$$9c - 4c = 10$$

$$5c = 10$$

$$c = 2$$

$$y = C \cosh 2x + D \sinh 2x + 2e^{3x}$$

$$\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = e^{-2x}$$

$$m^2 + 2m + 1 = 0$$

$$m^2 + m + m + 1$$

$$m(m+1) + 1(m+1)$$

$$m+1 = 0$$

$$m = -1$$

$$y = e^{-2x}(A+Bx)$$

$$P.I = y = Ce^{-2x}$$

$$\frac{dy}{dx} = -2Ce^{-2x} \quad \& \quad \frac{d^2y}{dx^2} = 4Ce^{-2x}$$

$$4Ce^{-2x} + 2C - 2Ce^{-2x} + Ce^{-2x} = e^{-2x}$$

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

$$4C - 4C + C = 1$$

$$C = 1$$

$$y = e^{-2x}(A+Bx) + e^{-2x}$$

$$\frac{d^2y}{dx^2} + 25y = 5x^2 + x$$

$$m^2 + 25 = 0$$

$$m = \pm 5i$$

$$m = \pm 5j$$

$$y = (C \cos 5x + D \sin 5x)$$

$$P.I = y = Cx^2 + Dx + E$$

$$\frac{dy}{dx} = 2Cx + D \quad \& \quad \frac{d^2y}{dx^2} = 2C$$

$$= 2C + 25Cx^2 + 25Dx + 25E = 5x^2 + x$$

$$= 25C = 5 \quad \text{--- (1)}$$

$$2C + 25E = 0 \quad \text{--- (2)}$$

$$25D = 1 \quad \text{--- (3)}$$

Solving simultaneously

$$C = 1/5$$

$$D = 1/25$$

Sub in equ (2)

$$2(1/5) + 25E = 0$$

$$2/5 = +25E$$

$$E = 2/5 \div 25$$

$$E = -\frac{2}{125}$$

$$y = C \cos 5x + D \sin 5x + \frac{2}{5}x^2 + \frac{1}{25}x - \frac{2}{125} //$$

$$5 \frac{d^2y}{dx^2} - 2 \frac{dy}{dx} + y = 4 \sin x$$

$$m^2 - 2m + 1 = 0$$

$$m^2 - m - m + 1$$

$$m(m-1) - 1(m-1)$$

$$m-1 = 0$$

$$m = 1$$

$$y = e^x (A + Bx)$$

$$P.I = y = C \cos x + D \sin x$$

$$\frac{dy}{dx} = -C \sin x + D \cos x$$

$$\frac{d^2y}{dx^2} = -C \cos x - D \sin x$$

$$= -C \cos x - D \sin x - 2C \sin x - 2D \cos x + C \cos x + D \sin x = 4 \sin x$$

$$\cos x (-C - 2D + C) + \sin x (-D - 2C + D) = 4 \sin x$$

$$(-C - 2D + C) = 0 \quad \text{--- (1)}$$

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

$$= -2D = 0$$

$$= D = 0 //$$

$$= 2C = 4$$

$$C = 4/2$$

$$C = 2$$

$$y = e^x (A + Bx) + 2 \cos x //$$

$$6 \frac{d^2y}{dx^2} + 4 \frac{dy}{dx} + 5y = 2e^{-2x}$$

$$m^2 + 4m + 5 = 0$$

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\frac{4 \pm \sqrt{4^2 - 4 \times 1 \times 5}}{2 \times 1}$$

$$\frac{-4 \pm \sqrt{16-20}}{2}$$

$$\frac{-4 \pm \sqrt{-4}}{2}$$

$$\frac{-4 \pm 2j}{2}$$

$$-2 \pm j$$

$$y = e^{-2x} A \cos x + B \sin x$$

$$P.I = y_2 = C e^{-2x}$$

$$\frac{dy}{dx} = -2C e^{-2x}$$

$$\frac{d^2y}{dx^2} = 4C e^{-2x}$$

$$4C e^{-2x} - 8C e^{-2x} + 5C e^{-2x} = 2e^{-2x}$$

$$4C - 8C + 5C = 2$$

$$C = 2$$

$$y = e^{-2x} A \cos x + B \sin x + 2e^{-2x}$$

$$7) \frac{3d^2y}{dx^2} - 2\frac{dy}{dx} - y = 2x - 3$$

$$3m^2 - 2m - 1 = 0$$

$$3m^2 - 3m + m - 1$$

$$3m(m-1) + 1(m-1)$$

$$3m - 1 = 0 \text{ \& \; } m+1 = 0$$

$$m_1 = -\frac{1}{3} \text{ \& \; } m_2 = 1$$

$$y = A e^{-\frac{1}{3}x} + B e^x$$

$$P.I = y = (x + D)$$

$$\frac{dy}{dx} = C \text{ \& \; } \frac{d^2y}{dx^2} = 0$$

$$0 - 2(C) - (x + D) = 2x - 3$$

$$-2C - (x + D) = 2x - 3$$

$$C = -2$$

$$-2C + D = -3$$

$$-2(-2) + D = -3$$

$$4 + D = -3$$

$$D = -7$$

$$= y = A e^{-\frac{1}{3}x} + B e^x - 2x - 7 //$$

$$8) \frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 8y = 8e^{4x}$$

$$m^2 - 6m + 8 = 0$$

$$m^2 - 2m - 4m + 8$$

$$m(m-2) - 4(m-2)$$

$$(m-4) \text{ \& \; } (m-2) = 0$$

$$m_1 = 2 \text{ \& \; } m_2 = 4$$

$$y = A e^{2x} + B e^{4x}$$

$$P.I = y = C e^{4x}$$

$$\frac{dy}{dx} = 4C x e^{4x} + C e^{4x}$$

$$\frac{d^2y}{dx^2} = 16C x e^{4x} + 8C e^{4x}$$

$$= 16C x e^{4x} + 8C e^{4x} - 24C x e^{4x} - 6C e^{4x} = 8e^{4x}$$

$$16Cx + 8C - 24Cx - 6C + 8Cx = 8$$

$$2C = 8$$

$$C = 8/2$$

$$C = 4$$

$$y = A e^{2x} + B e^{4x} + 4x e^{4x} //$$