NAME : EKANEM EFFIONG   MAT NO: 15/ENG07/017

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

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

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

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

$m(m+1) + (m+1) = 0$

$\Rightarrow (m+1)(m+1)$

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

$y = Ce^{-2x}$

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

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

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

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

Divide both sides by e^{-2x}

$\frac{Ce^{-2x}}{e^{-2x}} = \frac{e^{-2x}}{e^{-2x}}$

$C = 1$

$C = e^{-2x}$ {particular integral}

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

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

$$\frac{d^2y}{dx^2} - 4y = 0$$

$$m^2 - 4 = 0$$

$$m^2 = 4$$

$$m = \pm 2$$

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

$$y = Ce^{3x}$$

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

$$\frac{d^2y}{dx^2} = 9Ce^{3x}$$

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

$$5Ce^{3x} = 10e^{3x}$$

Divide both sides by e^{3x}

$$\frac{5C}{5} = \frac{10}{5}$$

$$C = 2$$

$C = 2e^{3x}$ (particular integral)

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

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y381

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

Convert eqn into a homogenous eqn

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

$m^2 - m - 2 = 0$

$(m^2 + m)(-2m - 2) = 0$

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

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

$m_1 = 1 \ , \ m_2 = 2$

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

$y = C$

$\frac{dy}{dx} = 0$

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

$0 - 0 - 2C = 8$

$-2C = 8$

$C = \frac{8}{-2} \Rightarrow -4$

$C = -4$

General Solution $= Ae^{-x} + Be^{2x} - 4$

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

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

$m^2 - 2m - 4m + 8 = 0$

$m(m-2) - 4(m-2) = 0$

$(m-2)(m-4) = 0$

$m = 2$ or 4

$y = Ae^{2x} + Be^{4x}$

$y = Cxe^{4x}$

$\frac{dy}{dx} = 4Cxe^{4x} + Ce^{4x}$

$\frac{d^2y}{dx^2} = 16Cxe^{4x} + 4Ce^{4x} + 4Ce^{4x}$

$16Cxe^{4x} + 4Ce^{4x} + 4Ce^{4x} - 6(4Cxe^{4x} + Ce^{4x}) + 8(Cxe^{4x}) = 8e^{4x}$

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

$2Ce^{4x} = 8e^{4x}$

$2C = 8$

$C = 4$

$y = 4xe^{4x}$

$G.S = Ae^{2x} + Be^{4x} + 4xe^{4x}$

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

$3m^2 - 2m - 1$

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

$3m(m-1) + 1(m-1) = 0$

$(m-1)(3m+1) = 0$

$m_1 = 1 \quad m_2 = \frac{-1}{3}$

$Ae^{x} + Be^{-\frac{1}{3}x}$

$P.I = Cx + D$

$\frac{dy}{dx} = C$

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

$-2C - Cx - D = 2x - 3$

$-C = 2$

$C = -2$

$-2C - D = -3$

$2C + D = 3$

$-4 + D = 3$

$D = 3 + 4$

$D = 7$

$Ae^{x} + Be^{-\frac{1}{3}x} - 2x + 7 = y$

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6) $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 5y$ ...

that $x=0, y=1$ & $\frac{\delta y}{dx} = 2$

$$\frac{d^2y}{dx^2} + \frac{4dy}{dx} + 5y = 0$$

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

$a=1 \quad b=4 \quad c=5$

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

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

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

$$m = \frac{-4 \pm j2}{2}$$

$m = -2 \pm j$

$m_1 = -2 + j \quad m_2 = -2 - j$

$y = e^{-2x}(c\cos x + D\sin x)$

$y = Ce^{-2x}$

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

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

$4Ce^{-2x} + 4[-2Ce^{-2x}] + 5[Ce^{-2x}] = 2e^{-2x}$

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

y

$y =$

Gen

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JG 381

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

convert equation to an homogeneous eqn

$$\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = 0$$

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

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

$m(m-1) - 1(m-1) = 0$

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

$m = 1$

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

$y = C\cos x + D\sin x$

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

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

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

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

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

$-C - 2D + C = 0$

$-D + 2C + D = 4$

$2C = 4 \quad C = 2$

$y = 2\cos x + D\sin x = 2\cos x$

General Solution $= e^x(A + Bx) + 2\cos x$

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

Convert eqn into a homogenous equation

$\frac{d^2y}{dx^2} + 25y = 0$

$m^2 + 25 = 0$

$m^2 = -25$

$m = \pm j5$

$y = C\cos 5x + D\sin 5x$ {complementary function}

$y = Cx^2 + Dx + E \quad \frac{\delta y}{\delta x} = 2Cx + D \quad \frac{d^2y}{dx^2} = 2C$

$2C + 25\left[Cx^2 + Dx + E\right] = 5x^2 + x$

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

$\frac{25C}{25} = \frac{5}{25}$

$C = \frac{1}{5}$

$\frac{25D}{25} = \frac{1}{25}$

$D = \frac{1}{25}$

$2C + 2E = 0$

$2\left[\frac{1}{5}\right] + 25E = 0$

$\frac{2}{5} + 25E = 0$

$25E = \frac{-2}{5}$

$E = \frac{-2}{5} \times \frac{1}{25} = \frac{-2}{125}$

$y = \frac{1}{5}x^2 + \frac{1}{25}x - \frac{2}{125}$ {particular integral}

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