ASSIGNMENT

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

$m^2 - m - 2 = 0$

$a = 1, b = -1, c = -2$

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

$m_1 = 2$ or $m_2 = -1$

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

$P.I = y = c$

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

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

$0 - 0 - 2c = 8$

$-2c = 8$

$c = -4$ and $y = -4$

G.S $y = PI + Cf$

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

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

$m^2 - 4 = 0$

$m = \sqrt{4}$

$m = \pm 2$

$y = ce^{3x}$

$Cf = y = A\cosh 2x + B\sinh 2x$

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

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

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

$9c - 4c = 10$

$5c = 10$

$c = 2$

$y = 2e^{3x}$

G.S = $y = PI + CF$

$y = A\cos 2x + B\sin 2x + 2e^{3x}$

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

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

$a = 1, b = 2, c = 1$

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

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

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

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

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

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

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

$4c - 4c + c = 0$

$c = 1$

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

G.S = $CF + PI$

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

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

$m^2 + 25 = 0$

$m = \sqrt{-25}$

$m = \pm 5j$

C.F = $y = A\cos 5x + B\sin 5x$

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

$\frac{dy}{dx} = 2Cx + D$

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

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

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

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

$25C = 5$ ... (1)

$25D = 1$ ... (2)

$2C + 25E = 0$ ... (3)

$C = \frac{5}{25} = \frac{1}{5}$

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

$25E = -2C$

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

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

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

P.I = $y = \frac{x^2}{5} + \frac{x}{25} - \frac{2}{125}$

G.S = P.I + C.F

$y = A\cos 5x + B\sin 5x + \frac{x^2}{5} + \frac{x}{25} - \frac{2}{125}$

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

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

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

$m_1 = 1 \quad m_2 = 1$

C.F = $y = e^x(A + Bx)$

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

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

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

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

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

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

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

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

$C = 2$

$-D = 0$

P.I = $y = 2\cos x$

G.S $y = CF + PI$

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

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

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

$m = -2 \pm j$

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

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

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

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

$4Ce^{-2x} + 4(-2Ce^{-2x}) + 5(Ce^{-2x}) = 2e^{-2x}$

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

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

$C = 2$

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

G.S = $y = e^{-2x}(A\cos x + B\sin x) + 2e^{-2x}$

given that $x = 0$, $y = 1$ & $\frac{dy}{dx} = -2$

$1 = e^{-2(0)}(A\cos(0) + B\sin(0)) + 2e^{-2(0)}$

$A + 2 = 1$

$A = -1$

$\frac{dy}{dx} = e^{-2x}(-A\sin x + B\cos x) + (A\cos x + B\sin x) - 2e^{-2x} - 4e^{-2x}$

$-2 = e^{-2(0)}(B) + (A) - 2 - 4$

$-2 = B - 2A - 4$

$-2 = B + 1 - 4$

$B = 1$

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

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

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

$m_1 = 1/3$ & $m_2 = -1$

$C.f = y = Ae^{x/3} + Be^{-x}$

$P.I = Cx + D$

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

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

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

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

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

$-Cx = 2x$

$-C = 2$

$C = -2$

$-2C + D = -3$

$D = -3 + 2C$

at $C = -2$

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

$D = -3 - 4$

$D = -7$

$P.I = y = -2x - 7$

$G.S = PI + CF$

$= Ae^{x/3} + Be^{-x} - 2x - 7$,,

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

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

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

$m_1 = 4 \& m_2 = 2$

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

$y = cxe^{4x}$

$\frac{dy}{dx} = c(x\,4e^{4x} + e^{4x}.1)$

$\frac{dy}{dx} = c(4xe^{4x} + e^{4x})$

$\frac{dy}{dx} = 4cxe^{4x} + ce^{4x}$

$\frac{d^2y}{dx^2} = 4c(x.4e^{4x} + e^{4x}.1) + 4ce^{4x}$

$\frac{d^2y}{dx^2} = 4c(4xe^{4x} + e^{4x}) + 4ce^{4x}$

$= 16cxe^{4x} + 4ce^{4x} + 4ce^{4x}$

$16cxe^{4x} + 8ce^{4x} - 6(4cxe^{4x} + ce^{4x}) + 8(cxe^{4x}) = 8e^{4x}$

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

$16cx + 8c - 24cx - 6c + 8cx = 8$

$2c = 8$

$c = 4$

$PI = y = 4xe^{4x}$

$G.S = PI + CF$

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