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1) $d^2y/dx^2 - dy/dx - 2y = 8$

$m^2 - m - 2 = 0$

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

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

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

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

$m_1 = -1$ & $m_2 = 2$

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

P.I: $y = C$

$dy/dx = 0$

$d^2y/dx = 0$

$+2c = 8$

$c = -4$

P.I: $y = -4$

G.S: $y = Ae^{-x} + Be^{2x} - 4$

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

$m^2 - 4 = 0$

$m^2 = 4$

$m = \pm 2$

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

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

$dy/dx = 3Ce^{3x}$

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

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

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

$9c - 4c = 10$

$5c = 10$

$c = 2$

$P.I = y = 2e^{3x}$

$G.S: Ae^{2x} + Be^{-2x} + 2e^{3x}$

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

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

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

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

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

$m = -1$

$C.F: y = e^{-x}(A + Bx)$

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

$dy/dx = -2Ce^{-2x}$

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

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

$4C - 4C + C = 1$

$C = 1$

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

$G.S = e^{-x}(A + Bx) + e^{-2x}$

4) $d^2y/dx^2 + 25y = 5x^2 + x$

$m^2 + 25 = 0$

$m^2 = -25$

$m = \pm j5$

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

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

$dy/dx = 2Cx + D + f$

$d^2y/dx^2 = 2C$

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

$25Cx^2 + (25D + 25F)x + (2C + 25E + 25G) = 5x^2 + x$

$25C = 5$

$C = 5$

$25D + 25F = 1$ ---- (1)

$D+F = 1/25$

$2c + 25E + 25G = 0$

$10 + 25E + 25G = 0$

$E+G = -2/5$

P.I : $y = 5x^2 + 1/25\,x + -2/5$

G.S : $A\cos 5x + B\sin 5x + 5x^2 + 1/25\,x - 2/5$

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

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

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

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

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

$m = 1$

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

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

$dy/dx = -C\sin x + D\cos x$

$d^2y/dx^2 = -C\cos x - D\sin x$

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

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

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

$-2D = 0$

$D = 0$

$2C = 4$

$C = 2$

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

G.S : $y = e^x(A + Bx) + 2\cos x$

6) $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 5y = 2e^{-2x}$ given that at $x=0, y=1$ and $dy/dx = -3$

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

$a=1, b=4, c=5$

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

$= \frac{-4 \pm \sqrt{16-4(1)(5)}}{2}$

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

$= \frac{-4 \pm \sqrt{-1}\sqrt{4}}{2}$

$= \frac{-4 \pm \sqrt{1}\ 2}{2}$

$= -2 \pm j$

$\alpha = -2, \beta = 1$

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

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

$dy/dx = -2Ce^{-2x}$

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

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

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

$C = 2$

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

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

at $x=0, y=1$ and $dy/dx = -2$

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

$1 = A + 2$

$A = -1$

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

$-2 = e^{-2(0)}\cdot(-A\sin 0 + B\cos 0) - 2e^{-2(0)}(A\cos 0 + B\sin 0) - 4e^{-2(0)}$

$-2 = 1(B) - A - 4$

$-2 = B - A - 4$

$2 = B - A$

$2 = B + 1$

$B = 1$

$y = e^{-2x}(-1\cos x + \sin x) + 2e^{-2x}$

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

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

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

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

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

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

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

P.I: $y = Cx + D - E$

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

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

$-2C - Cx + 1 - D + E = 2x - 3$

$-Cx - 1(C + D - E) = 2x - 3$

$2 = -C$

$C = -2$

$C + D - E = -3$

$-2 + D - E = -3$

$D - E = -1$

P.I. $y = -2x - 1$

G.S: $y = Ae^{x} + Be^{-3/5} - 2x - 1$

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

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

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

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

$m_1 = 4 \quad m_2 = 2$

C.F: $y = Ae^{4x} + Be^{2x}$

P.I $y = Cxe^{4x}$

$dy/dx = Cx(4e^{4x}) + Ce^{4x}$

$dy^2/dx^2 = Cx(16e^{4x}) + C(4e^{4x}) + C4e^{4x}$

$Cx(16e^{4x}) + C(4e^{4x}) + C4e^{4x} - 6Cx(4e^{4x}) - 6Ce^{4x} + 8Cxe^{4x}$

$= 8e^{4x}$

$16Cx + 4C + 4C - 24Cx - 6C + 8Cx = 8$

$16Cx + 2C - 24Cx + 8Cx = 8$

$2C = 8$

$C = 4$

P.I $y = 4xe^{4x}$

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