IYAGBA THELMA
15/ENG04/033
ELECT/ELECT ENG

-2+1

Maths Assignment

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

$m^2 - m - 2 = 0$

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

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

$m+1 = 0 \quad m-2 = 0$

$m = -1 \quad m = 2$

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

Particular Integral

$y = C$

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

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

$0 - 0 - 2C = 8$

$-2C = 8$

$y = C = -4$

G.E = C.F + P.I

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

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

solution

$m^2 - 2^2 = 0$

$m^2 = 2^2$

$m = \pm 2$

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

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

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

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

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

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

$\frac{e^{3x}(5C)}{e^{3x}} = \frac{10e^{3x}}{e^{3x}}$

$5C = 10$

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

G.E = $C\cosh 2x + D\sinh 2x + 2e^{3x}$

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

solution

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

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

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

$m+1 = 0 \qquad m+1 = 0$

$m = -1 \qquad m = -1$

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

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

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

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

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

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

$e^{-2x}(C) = e^{-2x}$

$C = 1$

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

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

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

$m^2 + 5^2 = 0$

$m^2 = -5^2$

$m = \pm\sqrt{-5^2}$

$m = \pm\sqrt{-1} \cdot \sqrt{5^2}$

$m = \pm j5$

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

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

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

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

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

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

$25C = 5$

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

$25D = 1$

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

$25E + 2C = 0$

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

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

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

$$P.I = y = \frac{1}{5}x^2 + \frac{1}{25}x + \frac{2}{125}$$

$$G.E = C\cos 5x + D\sin 5x + \frac{1}{5}x^2 + \frac{1}{25}x - \frac{2}{125}$$

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

solution

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

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

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

$m - 1 = 0$

$m = 1$

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

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

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

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

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

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

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

$2D = 0$

$D = 0$

$-2C = 4$

$C = -2$

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

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

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

Solution

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

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

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

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

$m = -2 \pm j$

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

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

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

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

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

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

$e^{-2x}(C) = 2e^{-2x}$

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

$G.E = e^{-2x}(C\cos x + D\sin x) + 2e^{-2x}$

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

$1 = C + 2$

$1 - 2 = C$

$C = -1$

$-2 = e^{-2(0)}(-C\sin(0) + D\cos(0)) + (C\cos(0) + D\sin(0)) - (2e^{2(0)}) + 2e^{2(0)}$

$-2 = D - 2C + 2$

$-4 = D - 2C$

$-4 = D - 2(-1)$

$-4 = D + 2$

$D = -6$

$P.S = y = e^{-2x}(-C\cos x - 6\sin x) + 2e^{-2x}$

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

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

$m^2 - \frac{2}{3}m - \frac{1}{3} = 0$

$m^2 - m + \frac{1}{3}m - \frac{1}{3} = 0$

$m(m-1) + \frac{1}{3}(m-1) = 0$

$m - 1 = 0 \qquad m + \frac{1}{3} = 0$

$m = 1 \qquad m = \frac{-1}{3} = -0.33$

$C.F = y = Ae^{x} + Be^{-0.33x}$

$P.I = y = Cx + D$

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

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

$0 - 2C - Cx - D = 2x - 3$

~~$C(2-x) - D = 2$~~

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

$-Cx = 2x$

$C = -2$

$-2C - D = -3$

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

$4 - D = -3$

$D = 7$

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

$G.S = y = Ae^{x} + Be^{0.33x} - 2x + 7$

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

solution

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

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

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

$m - 4 = 0 \qquad m - 2 = 0$

$m = 4 \qquad m = 2$

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

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

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

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

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

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

$Ce^{4x}(\cdot 2) = 8e^{4x}$

$\cdot 2C = 8$

$C = -4$

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

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