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ENG 381 Assignment

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

$m^2 - m - 2 = 0$

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

$m = 2, \; m = -1$

$y = Ae^{m_1 x} + Be^{m_2 x}$

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

P-I

$y = C$

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

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

$= 0 - 0 - 2C = 8$

$C = -8/2$

G-S = C-F + P-I

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

(1) $\frac{d^2y}{dx^2} - 4y = 10$

C-F

$m^2 - 4 = 0$

$m^2 = 4$

$m = \sqrt{4}$

$m = \pm 2$

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

P I

$y = Ce^{3x}$

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

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

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

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

Divide through by e^{3x}

$9C - 4C = 10$

$5C = 10$

$C = 2$

G-S = CF + PI

$= A\cosh 2x + B\sinh 2x + 2e^{3x}$

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

C-F

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

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

$m_1 = -1, \; m_2 = -1$ i.e -1 twice

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

P-I

$y = Ce^{-2x}$

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

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

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

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

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

$C = 1$

General Solution

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

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

C.F

$m^2 + 25 = 0$

$m^2 = -25$

$m = \sqrt{-25}$

$m = \sqrt{-1} \times \sqrt{25}$

$m = 5j$

$y = A\cos nx + B\sin nx$

$= A\cos 5x + B\sin 5x$

P.I

$y = Cx^2 + Dx + E$

$dy/dx = 2Cx + D$

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

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

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

Comparing Coefficient

$25C = 5$

$C = 1/5$

$25D = 1$

$D = 1/25$

$2C + 25E = 0$

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

$25E = -2/5$

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

The general solution is

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

No 5

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

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

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

$m = 1$ twice

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

P.I

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

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

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

$-(C\cos x - D\sin x) - 2C(\sin x$

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

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

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

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

Comparing Coefficient

$2C = 4$

$C = 4/2 = 2$

$2D = 0$, $D = 0$

$y = 2\cos x + 0\sin x = 2\cos x$

General Solution =

$e^{3x}(A + Bx) + 2\cos x$

No.6)

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

given that at $x=0$, $y=1$

and $\frac{dy}{dx} = -2$

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

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

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

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

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

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

$= -2 \pm j$

$m = -2+j$ and $m_2 = 2-j$

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

P.I

$y = Ce^{-2x}$

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

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

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

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

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

$C = 2$

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

General solution

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

at $x=0$, $y=1$

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

C.F

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

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

$3m = -1$ or $m = 1$

$m = -1/3$, $m = 1$

$y = Ae^{-1/3x} + Be^{x}$

P.I

$y = Cx + D$

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

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

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

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

Comparing coefficient

$x^0 - C = 2$

$C = -2$

Constants $-2C - D = -3$

$4 - D = -3$

$D = 7$

$y = -2x+7$

General solution

$Ae^{-1/3x} + Be^{x} - 2x + 7$

No 8)

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

C-F

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

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

$m_1 = 4, m_2 = 2$

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

P·I

$y = Cxe^{4x}$

$\frac{dy}{dx} = [x \cdot 4e^{4x} + e^{4x}]c$

$\frac{d^2y}{dx^2} = 4c[x4e^{4x} + e^{4x}] + 4ce^{4x}$

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

$16cxe^{4x} + 8ce^{4x} - 6[4cxe^{4x} + ce^{4x}] + 8cxe^{2x} = 8e^{4x}$

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

$16cx + 4c + 4c - 24cx - 6c + 8cx = 8$

$= -8cx + 2c + 8cx = 8$

$2c = 8$

$c = 8/2$

$c = 4$

$y = 4xe^{4x}$

General Solution

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