C.F

$M^2 - m - 2 = 0$

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

$m = 2$ or $m = -1$

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

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

P.I

$y = C$

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

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

$= 0 - 0 - 2C = 8$

$2C = -8$

$C = -8/2$

$C = -4$

∴ The General solution

G.S = C.F + P.I

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

C.F.

$m^2 - 4 = 0$

$m^2 = 4$

$m = \sqrt{4}$

$m = \pm 2$.

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

P.I.

$y = Ce^{3x}$.

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

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

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

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

Dividing through by e^{3x}.

$9C - 4C = 10$

$5C = 10$

$C = 2$

∴ The General equation becomes

C.F + P.I

$1-e = A\cosh 2x + B\sinh 2x + 2e^{3x}$.

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Q3) $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = e^{-2x}$

C.F

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

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

$m = -1$ twice

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

P.I.

$y = Ce^{-2x}$

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

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

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

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

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

$C = 1$

∴ The general solution will be

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

Q4) $\frac{d^2y}{dx^2} + 25y = 5x^2 + x$

C.F

$m^2 + 25 = 0$

$m^2 = -25$

$m = \sqrt{-25}$

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

$m = j5$

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

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

P.I

$y = Cx^2 + Dx + E$

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

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

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

Comparing coefficients

$25C = 5$

$C = 1/5$

$25D = 1$

$D = 1/25$

$2C + 25E = 0$

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

$25E = -2/5$

$E = -2/125$

Ans

∴ The general solution becomes

C.F + P.I

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

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= $5x^2+x$

$E = 5x^2+x$.

nt =

m becomes

$\frac{25x^2+5x-2}{125}$

(Q5) $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = 4\sin x$.

C.F

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

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

$m = 1$ twice

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

P.I

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

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

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

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

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

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

$+ C\cos x + D\sin x = 4\sin x$.

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

Comparing Coefficients:

$2C = 4$

$C = 4/2 \Rightarrow C = 2$

$2D = 0$

$D = 0$.

P.I $y = 2\cos x + 0\sin x = 2\cos x$

General solution becomes

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

(Q6) $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 5y = 2e^{-3x}$

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

C.F

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

This is a complex solution

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

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

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

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

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

$= -2 \pm j$.

$m_1 = -2+j$ $m_2 = -2-j$.

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

P.I

$y = ce^{-2x}$

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

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

$4ce^{-2x} + 4(-2ce^{-2x}) + 5(ce^{-2x})$

$= 2e^{-2x}$

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

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

$c = 2/1$

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

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$1 = 1(A) + 2$

$1 = A + 2$

$A = 1 - 2$

$A = -1$

$\frac{dy}{dx} = e^{-2x}[-A\sin x + B\cos x] + [A\cos x + B\sin x]$

$-2e^{-2x} + 2e^{-2x}$

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

at $x = 0$ $\quad \frac{dy}{dx} = -2$

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Q3) $\frac{d^2y}{dx^2} + 2\frac{dy}{dx} + y = e^{-2x}$

C.F

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

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

$m = -1$ twice

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

P.I.

$y = Ce^{-2x}$

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

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

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

$C = 1$

∴ The general solution will be

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

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Ans

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C.F + P.I

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

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= $5x^2+x$

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m becomes

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C.F

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

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

$m = 1$ twice

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

P.I

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

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

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

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

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$m_1 = -2+j$ $m_2 = -2-j$.

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

at $x = 0$ $\quad \frac{dy}{dx} = -2$

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