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16/ENG04/005
Elect/Elect

ENG 387

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

~~$m^2 - m - 2y = 0$~~

C.F.; $m^2 - m - 2 = 0$

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

$m = -1$ or 2

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

P.I.; let $y = c$

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

$0 - 0 - 2c = 8$

$-2c = 8$; $c = -4 = y$

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

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

C.F.; $m^2 - 4 = 0$

$m = \pm 2$

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

P.I.; let $y = ce^{3x}$

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

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

$5ce^{3x} = 10e^{3x}$

$c = 2$; $y = 2e^{3x}$

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

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

C.F.; $m^2 + 2m + 1 = 0$

$m = -1$; $y = e^{-x}(A + Bx)$

P.I.; let $y = ce^{-2x}$; $\frac{dy}{dx} = -2ce^{-2x}$; $\frac{d^2y}{dx^2} = 4ce^{-2x}$

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

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

$c = 1$; $y = e^{-2x}$

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

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

C.F.; $m^2 = -25$; $m = \pm 5j$

$y = C\cos 5x + B\sin 5x$

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

$\frac{dy}{dx} = 2Cx + D$; $\frac{d^2y}{dx^2} = 2C$

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

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

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

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

$(2x + E) = 0$

~~$\frac{2}{5} + E = 0 \; ; E = -\frac{2}{5}$~~

$\frac{2}{5} + 25E = 0 \; ; E = -\frac{2}{5} \times \frac{1}{25}$

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

$y = \frac{x^2}{5} + \frac{x}{25} - \frac{2}{125} = \frac{1}{125}(25x^2 + 5x - 2)$

G.S.; $y = C\cos 5x + D\sin 5x + \frac{1}{125}(25x^2 + 5x - 2)$

So;

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

$D\sin x = 4\sin x$

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

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

$2C = 4 \; ; C = 2$

$-2D = 0 \; ; D = 0$

$y = 2\cos x + 0$

G.S.;

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

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

C.F.; $m^2 - 2m + 1 = 0$

$m = 1 = m_1 = m_2$

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

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

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

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

6.) $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 5y = 2e^{-2x}$; $x = 0, y = 1$

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

C.F.; $m^2 + 4m + 5 = 0$

$m = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-4 \pm \sqrt{16 - 20}}{2}$

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

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

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

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

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

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

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

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

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

if $y = 1$ when $x = 0$

$1 = A + 2$

$A = -1$

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

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

$-2 = B - 2A - 4$

$2 = B - 2A$ $A = -1$

$2 = B + 2$

$B = 0$

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

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

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

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C.F.)

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

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

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

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

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

P.I., let $y = cx + D$

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

So; $3(0) - 2c - (0x + D) = 2x - 3$

$-2c - 0x - D = 2x - 3$

$-0x - 2c - D = 2x - 3$

$c = -2$

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

$-4 + D = 3$

$D = 7$

$y = -2x + 7$

G.S; $y = Ae^{x} + Be^{-x/3} - 2x + 7$

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

C.F.)

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

$(m-4)(m-2)$

$m = 4$ or 2

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

P.I., let $y = ce^{4x}$

$\frac{dy}{dx} = 4ce^{4x}$; $\frac{d^2y}{dx^2} = 16ce^{4x}$

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

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

$c = 0$

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

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