ASSIGNMENT.

a) $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 5y = 6\sin\theta$.

$\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 5y = 0$

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

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

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

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

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

$m = -2 \pm j$.

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

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

$\frac{dy}{d\theta} = -C\sin\theta + D\cos\theta$

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

$-C\cos\theta - D\sin\theta + 4(-C\sin\theta + D\sin\theta) + 5(C\cos\theta$
$+ D\sin\theta) = 6\sin\theta$.

$-C\cos\theta - D\sin\theta - 4C\sin\theta + 4D\cos\theta + 5C\cos\theta +$
$5D\sin\theta = 6\sin\theta$

$-C\cos\theta + 4D\cos\theta + 5C\cos\theta - D\sin\theta - 4C\sin\theta$
$+ 5D\sin\theta = 6\sin\theta$.

$\cos\theta(-C + 4D + 5C) + \sin\theta(-D - 4C + 5D) = 6\sin\theta$

$\therefore$ Comparing Coefficients

$-C + 4D + 5C = 0$

$-D - 4C + 5D = 6$

$\therefore -4D + 4C = 0$ ---- (i)

$-4C + 4D = 6$ --- (ii)

$4D + 4C = 0$

$\underline{4D - 4C = 6}$

$0 \quad 8C = -6$

$\frac{8C}{8} = \frac{-6}{8}$

$C = -3/4$

$4D + 4(-3/4) = 0$

$4D + (-3) = 0$

$4D = 3$

$D = 3/4$

P.I. $y = -3/4\cos\theta + 3/4\sin\theta$

$y = 3/4(-\cos\theta + \sin\theta)$

G.S = C.F + P.I

$y = e^{-2\theta}(A\cos\theta + B\sin\theta) + 3/4(-\cos\theta + \sin\theta)$

$y = e^{-2\theta}(A\cos\theta + B\sin\theta) + 0.75(-\cos\theta + \sin\theta)$

(b) Neglecting the C.f

where the model:

$y = 0.75(-\cos\theta + \sin\theta) = -0.75(\cos\theta - \sin\theta)$

from $0°$ to $270°$

(c) Steady state value.

(2)

$EI \frac{d^2y}{dx^2} = \frac{w}{2}(l-x)^2 \quad \text{--- (1)}$

$EIm^2 = 0$

$m^2 = 0$

$m = 0$ twice.

$y = e^{0x}(A + Bx)$

$P.I = y = Cx^2 + Dx^3 + Ex^4$

$dy/dx = 2Cx + 3Dx^2 + 4Ex^3$

$d^2y/dx^2 = 2C + 6Dx + 12Ex^2.$

Substituting into eqn (1)

$EI(2C + 6Dx + 12Ex^2) = w/2(l-x)^2$

$EI(2C + 6Dx + 12Ex^2 = w/2(l^2 - 2lx + x^2)$

. Equating both sides.

$EI2C = wl^2/2$

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$C = wL^2/2 \cancel{f} EI\, 2$

$C = wL^2/4EI$

$EI\, 6d = -2L\, w/2$

$d = -\cancel{2}L\, w/\cancel{2}EI\, 6 = -wL/6EI$

$EI\, 12e = w/2$

$e = w/24EI$

$$P.I = y = \left(\frac{wL^2}{4EI}\right)x^2 + \left(\frac{-wL}{6EI}\right)x^3 + \left(\frac{w}{24EI}\right)x^4$$

$$y = \frac{wL^2x^2 \cdot 6 - 4wLx^3 + wx^4}{24EI}$$

when $y = 0$ & $x = 0$

$0 = A + B(0) + w/24EI(0)$

$A = 0$

$$dy/dx = B + \frac{w}{24EI}\left(12L^2x - 12Lx^2 + 4x^3\right)$$

when $dy/dx = 0 \quad x = 0$

$$0 = B + \frac{w}{24EI}(0)$$

$B = 0$

$$G.S = y = 0 + 0 + \frac{w}{24EI}\left(6L^2x^2 - 4Lx^3 + x^4\right)$$

$$y = \frac{w}{24EI}\left(6L^2x^2 - 4Lx^3 + x^4\right)$$

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when $x = l$

$$y = \frac{w}{24EI}\left(6l^2(L)^2 - 4L(L)^3 + (L)^4\right)$$

$$y = \frac{w}{24EI}\left(6l^4 - 4L^4 + L^4\right)$$

$$y = \frac{w}{24 \cdot EI} 3L^4$$

$$y = \frac{\cancel{3}wL^4}{\cancel{24}EI}$$

$$y = \frac{wL^4}{8EI}.$$