c) $EI \frac{d^2y}{dx^2} = \frac{w}{2}(L-x)^2$

C.F

Auxillary Equation

$m^2 = 0$

$m = \sqrt{0}$

$m = \pm 0$ twice

$y = e^0(A + Bx)$

$y = A + Bx$.

Assume PI

$y = Cx^2 + Dx^3 + fx^4$ —— (1)

$dy/dx = 2Cx + 3Dx^2 + 4fx^3$ —— (2)

$d^2y/dx^2 = 2C + 6Dx + 12fx^2$ —— (3).

∴ Cutting eqn 3 into the Original Equation

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

$2CEI + 6DEIx + 12EfIx^2 = w/2 (L-x)^2$

$2CEI + 6DEIx + REIx^2 = w/2 (L-x)(L-x)$

$2CEI + 6DEIx + 12EfIx^2 = w/2 (C^2 - 2(x + x^2))$

$4CEI + 12DEIx + 24EfIx^2 = wC(C^2 - 2(x + x^2))$

$4CEI + 12D)EIx + 24EFIx^2 = w C^2 - 2w(x + wx^2$.

Comparing Co-efficient

$x^2 : 24EfI = 2w$

$f = \frac{w}{24EI}$

$x : 12DEI = -2wl$

$D = \frac{-2wl}{12EI}$.

Constant: $4CEI = wC^2$

$C = \frac{wC^2}{wEI}$

Putting back into the Original equation CPI

$y = \frac{wl^2}{4EI}x^2 + \frac{-2wl}{12EI} + \frac{w}{24EI}x^4$

∴ The general Solution

$y = Cf + P.I$

$= A + Bx + \frac{wl^2}{4EI}x^2 - \frac{2wl}{12EI}x^3 + \frac{w}{24EI}x^4$

$dy/dx = B + \frac{2wl^2x}{4EI} - \frac{6wlx^2}{12EI} + \frac{8w}{24EI}x^3$

at $y = 0$ and $x = 0$

$y = A + Bx + \frac{wl^2}{4EI}x^2 - \frac{2wl}{12EI}x^2 + \frac{2w}{24EI}x^4$

$0 = A$

$A = 0$.

at $dy/dx = 0$ and $x = 0$

$0 = B + \frac{2wl^2x}{4EI} - \frac{6wlx^2}{12EI} + \frac{8^2w}{24EI}x^3$

$0 = B + \frac{wl^2}{2EI} - \frac{wl^2x^2}{2EI} + \frac{w^3}{3EI}$.

$B = 0$.

General equation will be

$y = \frac{wl^2}{4EI}x^2 - \frac{Rwl}{12EI}x^3 + \frac{w}{24EI}x^4$

$y = \frac{wL^2}{4EI}x^2 - \frac{wl}{6EI}x^3 + \frac{w}{24EI}x^4$

at $x = l$

$y = \frac{wl^4}{4EI} - \frac{wl^4}{6EI} + \frac{wl^4}{24EL}$

$y = \frac{6wl^4 - 4wl^4 + wl^4}{24EI}$

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

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

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1.) $d^2y/dt^2 + 4\, dy/dt + 5y = 6\sin\theta$

C.F

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

This is a complex equation

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

$$\frac{-4 \pm \sqrt{4^2-20}}{2(1)}$$

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

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

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

$= -2 \pm j$

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

Assumed P.I.

$y = D\cos\theta + D\sin\theta$

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

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

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

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

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

Comparing Co-efficients

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

$\cos\theta \quad -C + 4D + 5C = 0$

$4D - 4C = 6$ —— ①

$4C + 4D = 0$ —— ②

$4D - 4C = 6$

$4D + 4C = 0$

$-8C = 6$

$C = -6/8$

$C = -3/4$.

from eqn ii

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

$+3 = +4D$

$D = 3/4$

$\therefore$ Assumed P.I

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

$y = 3/4\sin\theta - 3/4\cos\theta$

General Equation

$= C.F + P.I$

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

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

for $\theta = 0$ to 270

Considering P.I

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

$dy/d\theta = 3/4\cos\theta + 3/4\sin\theta$

at Steady State:

$dy/d\theta = 0$ and $\theta =$ infinity as

$0 = 3/4(\cos\theta + \sin\theta)$

$-\cos\theta = \sin\theta$

divide through by $\cos\theta$

$$-\frac{\cos\theta}{\cos\theta} = \frac{\sin\theta}{\cos\theta}$$

$\tan\theta = -1$

$\theta = \tan^{-1}(-1)$

$\theta = -45$

$\theta = 315°$