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

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

$$y = A + Bx + \frac{w}{24EI}\left[6L^2x^2 - 4Lx^3 + x^4\right]$$

at $x = 0$, $y = 0$ $\quad \frac{dy}{dx} = 0$

$$0 = A + B(0) + \frac{w}{24EI}\left[6L^2(0)^2 - 4L(0)^3 + (0)^4\right]$$

$$A = 0$$

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

$$0 = B + \frac{w}{24EI}\left[12L^2(0) - 12L(0)^2 + 4(0)^3\right]$$

$$B = 0$$

when $A = B = 0$

$$y = 0 + 0x + \frac{w}{24EI}\left[6L^2x^2 - 4Lx^3 + x^4\right]$$

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

when $x = L$

$$y = \frac{w}{24EI}\left[6L^4 - 4L^4 + L^4\right]$$

$$y = \frac{w}{24EI}\left[3L^4\right]$$

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

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

// Convert equation into an homogeneous equation

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

$EIm^2 = 0$

$m^2 = 0 \Rightarrow m = \sqrt{0} = 0 \quad m_1 = m_2 = 0$

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

$y = A + Bx$ // CF

$y = Ax^2 + Bx^3 + Cx^4$

$\frac{dy}{dx} = 2Ax + 3Bx^2 + 4Cx^3$

$\frac{d^2y}{dx^2} = 2A + 6Bx + 12Cx^2$

$EI[2A + 6Bx + 12Cx^2] = \frac{w}{2}(L-x)^2$

$2AEI + 6BxEI + 12Cx^2EI = \frac{w}{2}[L^2 - 2Lx + x^2]$

// multiply eqn by 2

$4AEI + 12BxEI + 24Cx^2EI = wL^2 - 2wLx + wx^2$

$24CEI = w$

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

$12BEI = -2wL$

$B = \frac{-2wL}{24EI}$

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

B) $y = \frac{3}{4}(\sin t - \cos t)$

for $t = 0$ to $216°$

Considering D.T

$y = \frac{3}{4}(\sin t - \cos t)$

$\frac{dy}{dt} = \frac{3}{4}\sin t - \frac{3}{4}\cos t$

$\frac{dy}{dt} = \frac{3}{4}\cos t + \frac{3}{4}\sin t$

at steady state

$\frac{dy}{dt} = 0$ and $t = \infty$

$0 = \frac{3}{4}(\cos t + \sin t)$

$-\cos t = \sin t$

divide through by $\cos t$

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

$\tan t = -1$

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

$t = -45$

$t = 216°$

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(1) $\frac{d^2y}{d\theta^2} + 4\frac{dy}{d\theta} + 5y = 6\sin\theta$

$\cot 6\sin\theta = 0$

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

$a = 1, b = 4, C = 5$

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

$= \frac{-4 \pm \sqrt{4^2 - 4 \times 1 + 5}}{2 \times 1}$

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

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

$m = -2 \pm j$

$m = \alpha \pm j\beta$

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

$f(x) = 6\sin\theta$

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

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

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

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

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

$= 6\sin\theta$

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

$C\sin\theta$

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

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