

ORUABUNWA RESOILE

15/06/2027

CIVIL ENGINEERING

ENR 281

$$1 \frac{d^2y}{dt^2} + 4\frac{dy}{dt} + 5y = 6\sin t$$

$$at \quad 6\sin t = 0$$

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

$$a = 1 \quad b = 4 \quad c = 5$$

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

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

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

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

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

$$m = -2 \pm j$$

$$m = \alpha \pm j\beta$$

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

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

$$P-I \quad y = C \cos t + D \sin t$$

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

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

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

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

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

$$4L \cos \theta + 4D \sin \theta - 4s \sin \theta + 4D \cos \theta = 6 \sin \theta$$

$$4L \cos \theta + 4D \sin \theta + 4D \sin \theta - 4L \cos \theta = 6 \sin \theta$$

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

$$4L + 4D = 0 \quad \dots (i)$$

$$-4L + 4D = 6 \quad \dots (ii)$$

$$8D = 6$$

$$D = \frac{3}{4}$$

from eqn (i)

$$4L + 4\left(\frac{3}{4}\right) = 0$$

$$4L + 3 = 0$$

$$4L = -3$$

$$L = -3/4$$

$$P.I = y = \frac{-3}{4} \cos \theta + \frac{3}{4} \sin \theta$$

$$G.S = C_1 e^{\lambda t} + P.I$$

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

Steady state Equation

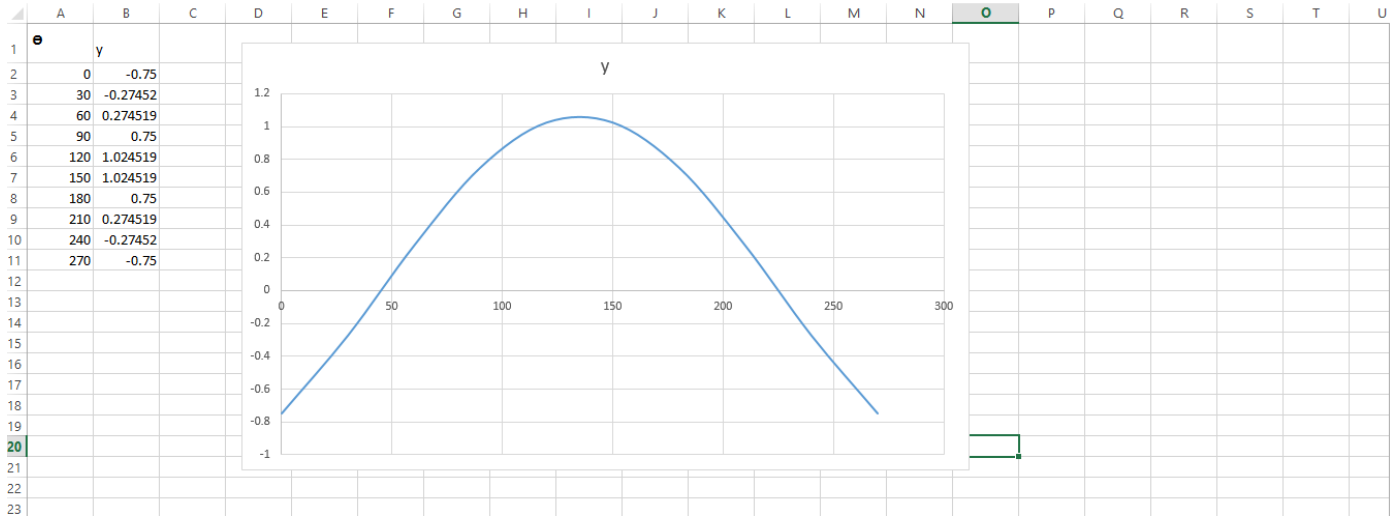
$$y' = \frac{3}{4} \sin \theta + \frac{3}{4} \cos \theta$$

$$\frac{3/4 \sin \theta}{3/4 \cos \theta} = \frac{-3/4 \cos \theta}{3/4 \sin \theta}$$

$$\tan \theta = -1$$

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

$$\theta = -45^\circ$$





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

$$EI m^2 = 0$$

$$m^2 = 0$$

$$m = \pm \sqrt{0}$$

$$m = \pm 0$$

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

$$C.F. \neq y = A + Bx$$

$$P.D = y = Fx^2 + Gx^3 + Hx^4$$

$$\frac{dy}{dx} = 2Fx + 3Gx^2 + 4Hx^3$$

$$\frac{d^2 y}{dx^2} = 2F + 6Gx + 12Hx^2$$

$$EI (2F + 6Gx + 12Hx^2) = \frac{W}{2} (L-x)^2$$

$$2FEI + 6GEI x + 12HEI x^2 = \frac{W}{2} (L-x)^2$$

$$4FEI + 12GEI x + 24HEI x^2 = W(L^2 - 2Lx + x^2)$$

$$24HEI = W$$

$$H = \frac{W}{24EI} \quad \dots (1)$$

$$12GEI = -2WL$$

$$G = \frac{-2WL}{12EI} = \frac{-WL}{6EI} \quad \dots (2)$$

$$4FEI = WL^2$$

$$F = \frac{WL^2}{4EI}$$

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

$$= \frac{WL^2 x^2}{4EI} - \frac{WL x^3}{6EI} + \frac{W x^4}{24EI}$$

$$y = \frac{6WL^2 x^2 - 4WL x^3 + W x^4}{24EI}$$

$$G.S = y = A + Bx + \frac{W}{24EI} [6L^2 x^2 - 4L x^3 + x^4]$$

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

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

$$A = 0$$

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

$$0 = B + \frac{W}{24EI} \left[ 12(0) - 12(0) + 4(0) \right]$$

$$B = 0$$

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

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

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

When  $x = L$

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

$$y = \frac{WL^2}{24EI} \left[ 3L^2 \right]$$

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