

NAME: Ekpenyong Ekpenyong Bassery

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DEPARTMENT: Petroleum Engineering

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

$$y'' + 4y' + 5y = 6\sin\theta$$

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

$$k^2 + 4k = -5$$

$$k^2 + 4k + 2^2 = -5 + 2^2$$

$$(k+2)^2 = -1$$

$$(k+2) = \pm\sqrt{-1}$$

$$k+2 = \pm i$$

$$k = \pm i - 2$$

$$k_1 = +i - 2$$

$$k_2 = -i - 2$$

$$y_i = C_1 e^{(-2+i)\theta} + C_2 e^{(-2-i)\theta}$$

$$y_{ii} = C_1 e^{-2\theta+i\theta} + C_2 e^{-2\theta-i\theta}$$

$$y_{iii} = C_1 e^{-2\theta} \cdot e^{i\theta} + C_2 e^{-2\theta} \cdot e^{-i\theta}$$

$$y_{iv} = e^{-2\theta} [C_1 e^{i\theta} + C_2 e^{-i\theta}]$$

$$y_{iv} = e^{-2\theta} [A e^{i\theta} + B e^{-i\theta}]$$

$$y_{iv} = e^{-2\theta} [A \cos\theta + B \sin\theta]$$

$$y = A \cos\theta + B \sin\theta$$

$$y' = -A \sin\theta + B \cos\theta$$

$$y'' = -A \cos\theta - B \sin\theta$$

$$y'' + 4y' + 5y = 6\sin\theta$$

$$-A \cos\theta - B \sin\theta + 4(-A \sin\theta + B \cos\theta) + 5(A \cos\theta + B \sin\theta) = 6\sin\theta$$

$$-A \cos\theta - B \sin\theta + 4A \sin\theta + 4B \cos\theta + 5A \cos\theta + 5B \sin\theta = 6\sin\theta$$

$$(-A \cos\theta + 4B \cos\theta + 5A \cos\theta) + (B \sin\theta - 4A \sin\theta + 5B \sin\theta) = 6\sin\theta$$

$$(-A + 4B + 5A) \cos\theta + (-B - 4A + 5B) \sin\theta = 6\sin\theta$$

$$4A + 4B = 0$$

$$4A + 4B = 6$$

$$8B = 6$$

$$B = \frac{6}{8} = \frac{3}{4}$$

Recall that $4A + 4B = 0$

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

$$4A + 3 = 0$$

$$A = -\frac{3}{4}$$

$$\therefore Y_p = -\frac{3}{4} \cos \theta + \frac{3}{4} \sin \theta$$

$$Y = Y_w + Y_p$$

$$Y = e^{-2\theta} [A \cos \theta + B \sin \theta] + \frac{3}{4} \sin \theta - \frac{3}{4} \cos \theta$$

i) Steady state equation.

$$Y' = 0$$

$$Y_p' = \frac{3}{4} \cos \theta + \frac{3}{4} \sin \theta = 0$$

$$\therefore \frac{3}{4} \cos \theta + \frac{3}{4} \sin \theta = 0$$

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

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

$$1 = -\tan \theta$$

$$\tan \theta = -1$$

Question 2.

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

$$EI m^2 = 0$$

$$m^2 = 0$$

$$m = \pm 0$$

$$m = \pm 0.$$

$$y = e^{0 \cdot x} [A + Bx]$$

$$y = A + Bx$$

$$y_p = y =$$