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ASSIGNMENT 2

NUMBER 1 : (1) AND (2)

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COMP ENG

ENG 381

ASSIGNMENT 2

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

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

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

$$y = (C \cos \theta + D \sin \theta) e^{-2\theta}$$

$$\frac{dy}{d\theta} = -C \sin \theta + D \cos \theta - 2(C \cos \theta + D \sin \theta) e^{-2\theta}$$

$$\frac{d^2y}{d\theta^2} = -C \cos \theta - D \sin \theta - 4(C \cos \theta + D \sin \theta) e^{-2\theta} + 4(-C \sin \theta + D \cos \theta) e^{-2\theta}$$

$$-C \cos \theta - D \sin \theta - 4(C \cos \theta + D \sin \theta) e^{-2\theta} + 4(-C \sin \theta + D \cos \theta) e^{-2\theta} = 6 \sin \theta$$

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

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

$$4C + 4D = 0$$

$$4D - 4C = 6$$

$$4C = -4D$$

$$4D - 4(-D) = 6$$

$$C = -D$$

$$4D + 4D = 6$$

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

$$8D = 6$$

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

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

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

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

GF:

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

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

At steady state $\theta = \infty$; $\frac{dy}{dx} = 0$

$$\frac{dy}{d\theta} = \frac{d}{d\theta}(y)$$

$$u = e^{-2\theta}$$

$$\frac{du}{d\theta} = -2e^{-2\theta}$$

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

$$\frac{dv}{d\theta} = -A \sin \theta + B \cos \theta$$

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

$$\theta = \infty \quad \frac{dy}{d\theta} = 0$$

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

divide through by $\cos \theta$

$$0 = \frac{3}{4} \tan \theta + \frac{3}{4}$$

$$-\frac{3}{4} = \frac{3}{4} \tan \theta \Rightarrow \frac{-3 \times 4}{4} = 3 \tan \theta$$

$$-3 = 3 \tan \theta$$

$$\frac{-3}{3} = \tan \theta$$

$$-1 = \tan \theta$$

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

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

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

#(angle)	y
0	-0.75
10	0.221288
20	0.378647
30	-0.85671
40	1.059038
50	-0.92051
60	0.485702
70	0.105429
80	-0.66263
90	1.006553
100	-1.02651
110	0.716084
120	-0.17518
130	-0.42211
140	0.88354
150	-1.0606
160	0.896291
170	-0.44351
180	-0.15202
190	0.698619
200	-1.02036
210	1.013697
220	-0.68076
230	0.128724
240	0.464748
250	-0.90864
260	1.060075
270	-0.87032

