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11:00

Dynamic control and instrumentation

Question 1

Question 2

a) time when velocity of B = 3(A)

$$7t^3 + 4t^2 + 4 = 3t^2 + 10 - 8$$

$$a \text{ velocity} = 3t + 2$$

$$b \text{ velocity} = 21t + 8$$

$$21t + 8 = 3(3t + 2)$$

$$8 = 3t$$

$$t = 2.6 \text{ seconds}$$

$$c) a - s = 3t^2 + 10t - 8 = 3^{(2)} (4) + 10(4) - 8 = 36 + 40 - 8$$

$$b - s = 7t^3 + 4t - 4 = 7^{(3)} (4) + 4(4) - 4 = 1372 + 16 - 4$$

$$c - s = 10t^3 - 30t + 2 = 10^{(3)} (4) - 30(4) + 2 = 4000 - 120 + 2$$

$$a = 68 \text{ m/s}$$

$$b = 1368 \text{ m/s}$$

$$c = 3882 \text{ m/s}$$

Question 3

Question 4

$$\begin{aligned}
 a) \quad F(t) &= K_1 x(t) - K_2 x(t) - K_3 x(t) - C_1 \dot{x}(t) - C_2 \dot{x}(t) = M \\
 F(t) &= K_1 x(t) - K_2 x(t) - K_3 x(t) - C_1 \frac{dx}{dt} - C_2 \frac{dx}{dt} = M \frac{d^2x}{dt^2} \\
 F(t) &= 2x(t) - 2x(t) - 2x(t) - 2\frac{dx}{dt} - 2\frac{dx}{dt} = 6\frac{d^2x}{dt^2} \\
 F(t) &= 6x(t) - 4\frac{dx}{dt} = 6\frac{d^2x}{dt^2} \\
 F(t) &= 6\frac{d^2x}{dt^2} + 4\frac{dx}{dt} + 6x(t)
 \end{aligned}$$

$$b) \quad \frac{4}{6} \zeta = \frac{4}{6} \zeta \omega \zeta$$

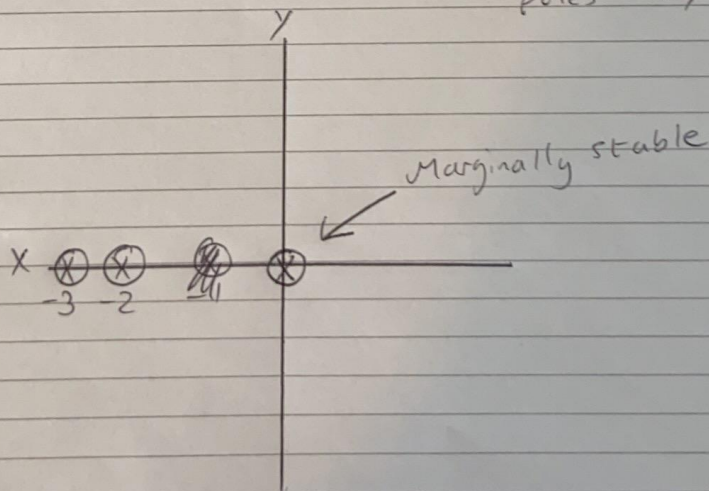
$\zeta \omega = 1$ - critically damped

Question 5

$$a) \quad G(s) = \frac{4(s+1)}{(s+2)(s+3)}$$

Zeros - -4, -1
poles - 0, -2, -3

Zero = -1
pole = -2, -3



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$$b) 0.8 = \frac{4(0.8+1)}{(0.8+2)(0.8+3)}$$

$$0.8 = \frac{7.2}{(2.8)(3.8)}$$

$$0.8 = 0.67669$$

$$0.8 = 0.677$$

The system output after 0.8 seconds would be 0.677.

Question 6

