

Problem 1

To solve this problem it is easiest if you use the initial and final value theorems. Final Value theorem:

$$\lim_{t \rightarrow \infty} f(t) = \lim_{s \rightarrow 0} sF(s)$$

Initial Value theorem:

$$f(0^+) = \lim_{s \rightarrow \infty} sF(s)$$

1, c, j

2, h, o

3, f, i

4, d, k

5, a, m

6, g, p

7, e, l

8, b, n

Problem 2

$\cup_2$

1. $v_1(0^-) = 1, \cancel{v_1}(0^-) = 1, x(0^-) = 1 \text{ m}$

2. $x(0^+) = 1 \text{ m}, \dot{x}(0^+) = -1 \text{ m/s}$

3.

$$\dot{x} + \frac{k}{b_2}x = 0$$

4.

$$x(t) = e^{-\frac{k}{b_2}t}$$

Problem - 3

1.

$$C(s) = \frac{-a(s)(CR_2s + 1)}{Cs(R_1 + R_2) + 1 + a(s)CR_1s} \approx -\frac{R_2}{R_1} - \frac{1}{CR_1s}$$

2. Proportional and Integral, $K_p = R_2/R_1$, $K_i = 1/(CR_1)$

3.

$$C(s) = \frac{10^6(CR_2s + 1)}{s(C(R_1 + R_2)s + 1 + 10^6CR_1)}$$

