

1. Solve the following differential equations using the Laplace Transform method.

(a) $\ddot{x} + 5\dot{x} + 4x = 0$ $x(0) = 4$ $\dot{x}(0) = -10$

(b) $\ddot{x} + 6\dot{x} + 34x = 68$ $x(0) = 1$ $\dot{x}(0) = 0$

2. Derive the transfer function of each system given below and plot the system poles in the complex plane. What is the damping condition for each system (when applicable)?

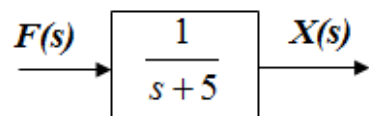
(a) $2\dot{x}(t) + 8x(t) = f(t)$, $x(0) = 0$

(b) $\ddot{x} + 4\dot{x}(t) + 13x(t) = 2f(t)$, $x(0) = \dot{x}(0) = 0$

(c) $2\ddot{x}(t) + 7\dot{x}(t) + 2x(t) = \dot{f}(t) + 3f(t)$, $x(0) = \dot{x}(0) = 0$

3. Find the unit step response, $x(t)$ of the following systems.

(a)



(b)

