1. A system defined by the following differential equation.

\[ \ddot{y} + 2\dot{y} + 5y = x \]

Given the following input and initial conditions, find the output of the system by solving the differential equation.

\[ x = \sin(3t) \quad y(0) = 1 \quad \dot{y}(0) = -1 \]

2. For the following signals, find the final value of the signal as time approaches infinity.

a. \[ X(s) = \frac{10s}{(s+1)(s+2)^2} \]

b. \[ Y(s) = \frac{10s}{s^2 + 2^2} \]

c. \[ Z(s) = \frac{5(s^2 - 2s + 4)}{s(s+1)(s+2)(s+3)} \]

3. Determine the transfer function of the following systems.

a. \[ \ddot{y} + 4\dot{y} + 4y = 2\dot{x} - x \]

b. \[ \dddot{v} + \ddot{v} + 5v = x \]
   \[ \dot{y} + y = 5v \]