6. [15 points] Consider a physical system modeled by the differential equation
\[ x'' + \gamma x' + kx = f(t), \]
where \( x(t) \) is the physical quantity being measured and \( \gamma \) and \( k \) are constants.

a. [4 points] If the physical system is underdamped, what can you say about the parameters \( \gamma \) and \( k \)?

b. [5 points] If \( x(0) = x_0, \ x'(0) = v_0 \), and \( \mathcal{L}\{f(t)\} = F(s) \), find the transform \( X(s) = \mathcal{L}\{x(t)\} \).

c. [6 points] If \( f(t) = 0 \), assuming as in (a) that the system is underdamped, invert your transform from (b) to find \( x(t) \). (If you are stuck, assume the equation is \( x'' + \gamma x' + \gamma^2 x = 0 \).)