

Name: _____

1. The eigenvalues of the coefficient matrix can be found by inspection and factoring for the following system. Apply the eigenvalue method to find a general solution to the system $x'_1 = x_1 + 2x_2 + 2x_3$, $x'_2 = 2x_1 + 7x_2 + x_3$, $x'_3 = 2x_1 + x_2 + 7x_3$.

2. Consider a harmonic oscillator with mass $m = 9$, spring constant $k = 1$, damping coefficient $c = 6$, with initial conditions $y(0) = 1$, $v(0) = 1$. Write the second-order differential equation and the corresponding first-order system, then find the general and specific solutions. Classify the oscillator and, if appropriate state the natural period and frequency. Sketch the phase portrait, including the solution curve for the given initial condition and sketch the $y(t)$ and $v(t)$ graphs of the solution with the given initial condition.