**Math 274 In-Class** **Worksheet 12**
Section: 9.1, 9.2, 9.3

1. (a) Write the following second order equation as a system of first order equations: $y''+3y'-y=0$.

(b) Write the following second order equation as a system of first order equations: $y''+3y=e^t$.

(c) Write the following third order equation as a system of first order equations: $y'''+2y''-2y=0$.

(d) Write the coupled system in matrix notation

$$x''+3x-y=0$$
$$y''+2y-2x=0$$

2. Let $M$ be the $3 \times 3$ matrix

$$M = \begin{bmatrix} 0 & 1 & 1 \\ 0 & 2 & 1 \\ 1 & 1 & 1 \end{bmatrix}$$

(a) Compute the determinant of $M$.

(b) Determine the inverse of $M$. Verify $M^{-1}M = I$.

(c) Solve the system of linear equations:

$$\begin{aligned} b + c &= 5 \\ 2b + c &= 6 \\ a + \ b + c &= 7 \end{aligned}$$

3. Find the inverse of the $4 \times 4$ matrix

$$\begin{bmatrix} 0 & 1 & 1 & 0 \\ 1 & 0 & 0 & 1 \\ 2 & 2 & 2 & 1 \\ 1 & 3 & 3 & 3 \end{bmatrix}$$

4. (a) Find the equation of the line passing through the points $(2, 4)$ and $(5, 13)$.

(b) For $t > 0$, write the following function in terms of step functions

$$f(t) = \begin{cases} t, & t < 2 \\ 1/2, & 2 < t < 3 \\ e^{t-2}, & 3 < t \end{cases}$$

(c) Compute $\mathscr{L}\{f(t)\}$, for $f(t)$ as above.

(d) For $t > 0$, let $g(t)$ be the periodic function of period 2 given on a fundamental period by

$$g(t) = 9 - e^t, \ 0 < t < 2.$$

Compute $\mathscr{L}\{g(t)\}$.