**MATH 238 – SPRING 2020**
**Exam 1 – In Class: Feb. 4, Take Home: Feb. 5 Due Feb. 7, Team In Class: Feb. 7**
**Sections 1.1-1.6**

**p. 15-17: 1,5,9,11,15-25 odd; p.26-27: 1-17 EOO,19,21,25-31 ODD;**
**p.36: 1,2,5,7,9,10,11,15,18,19,20a,21**
**p. 41-42: 1,4,7,11,15,19; p. 50: 1-6, 7-13 odd; p. 57: 1,3,7,9**

1. Solve the following SLE. Indicate how many solutions there are. Write the solutions as a sum of the solution to the corresponding homogeneous problem and a solution to the non-homogeneous problem.

(a) $\begin{matrix} 2x-4y=10 \\ x+2y=-3 \end{matrix}$ (b) $\begin{matrix} 2x-4y=1 \\ -x+2y=3 \end{matrix}$ (c) $x+y-z=1$ (d) $\begin{matrix} 2x+4y-3z=1 \\ -x+2y=1 \end{matrix}$ (e) $\begin{matrix} 2u_1+3u_2-u_3+u_4=2 \\ 3u_1-2u_2+u_3-u_4=2 \\ u_1+u_2-2u_3+2u_4=1 \end{matrix}$

(f) $\begin{matrix} 3v_1+v_2-v_3+v_4-v_5=3 \\ 6v_1+2v_2-2v_3+v_4-v_5=6 \\ v_1-v_2+v_3-v_4+v_5=1 \end{matrix}$ (g) $\begin{pmatrix} 3 & -2 & 4 & 1 \\ 1 & 2 & 3 & 4 \\ 4 & 0 & 7 & 5 \\ 2 & -4 & 1 & -3 \end{pmatrix} \bar{x} = \begin{pmatrix} a \\ b \\ c \\ d \end{pmatrix}$

2. Determine which of the following matrices have inverses.

(a) $A = \begin{pmatrix} 4 & 3 \\ -1 & 2 \end{pmatrix}$ (b) $A = \begin{pmatrix} 2 & -4 \\ -1 & 2 \end{pmatrix}$ (c) $A = \begin{pmatrix} 4 & -2 & 3 \\ 0 & 0 & 9 \\ 0 & 0 & 6 \end{pmatrix}$ (d) $A = \begin{pmatrix} 8 & 15 & -21 \\ 0 & -20 & 36 \\ -16 & -40 & 60 \end{pmatrix}$

3. Give the inverse of the following matrix and give all the elementary matrices that were used to find the inverse.

$$F = \begin{pmatrix} 2 & 4 & -1 & 2 \\ 1 & 2 & -1 & 3 \\ -1 & -3 & 0 & 3 \\ -3 & -6 & -3 & -1 \end{pmatrix}$$

4. Give the determinant of the following matrices and their transposes

$$A = \begin{pmatrix} 1 & 2 & 3 \\ 7 & 8 & 9 \\ 4 & 5 & 6 \end{pmatrix} \quad B = \begin{pmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 8 \end{pmatrix} \quad C = \begin{pmatrix} -1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{pmatrix} \quad F = \begin{pmatrix} 1 & 2 & -1 & 2 \\ 2 & 4 & 1 & 3 \\ -1 & 2 & 0 & 3 \\ -2 & 0 & 2 & -1 \end{pmatrix}$$

5. Put A,B,C and F in upper triangular form and give the determinants of these matrices. Which of these matrices have inverses?

6. Show that the inverse of $A^T$ is $\left(A^T\right)^{-1}$ and $\left(A^{-1}\right)^T$.

7. What is the inverse of $A^2$, $A^3$?