Name (Please Print) ______________________

Finite Applications of Math - MATH 312
Exam 1
Spring 1999

Show <u>all</u> work. No notes, books, reference material are allowed. Correct answers without supporting work will receive no credit.

(10) 1. Show that the inverse of the matrix $\begin{bmatrix} 4 & -2 & 3 \\ 8 & -3 & 5 \\ 7 & -2 & 4 \end{bmatrix}$ is $\begin{bmatrix} -2 & 2 & -1 \\ 3 & -5 & 4 \\ 5 & -6 & 4 \end{bmatrix}$

.

(10) (b) Use part (a) to solve the system: $\begin{aligned} 4x - 2y + 3z &= -2 \\ 8x - 3y + 5x &= 5 \\ 7x - 2y + 4x &= 10 \end{aligned}$.

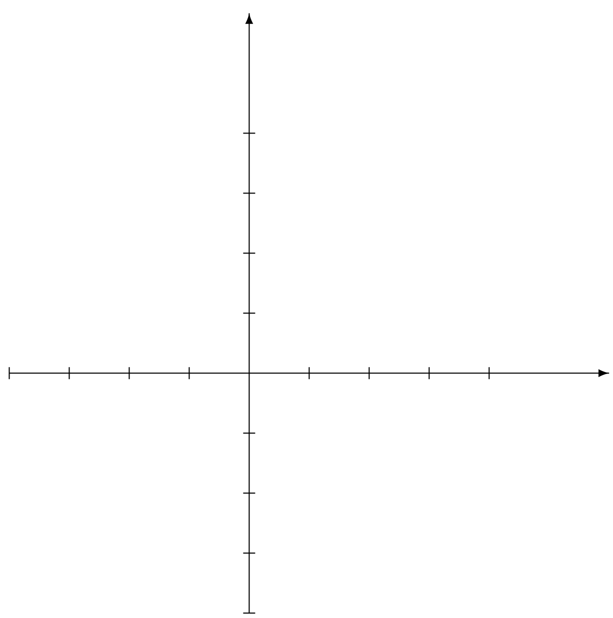
You <u>must</u> use part (a), not some other method.

(12) (c) Use Gaussian elimination to solve the system in part (b). You <u>must</u> use Gaussian elimination, not some other method.

2. Here is a linear programming problem: Maximize $3x + 4y$ with respect to the contstraints

$$\begin{aligned} x \geq 0,\ y &\geq 0 \\ 3x + 2y &\leq 6 \\ -x + y &\leq 1 \\ 2x - y &\leq 1 \end{aligned}$$

(15) (a) Solve the problem geometrically by finding the region of feasibility. You must draw a diagram.



(15) (b) Solve the problem by using the simplex algorithm.

(10) 3. Write the initial simplex table for the following: Minimize $x+2y-z$ with respect to the constraints

$$\begin{aligned} x \geq 0, y \geq 0, z &\geq 0 \\ x - 2y + z &\leq 1 \\ 2x + 3y - 4z &\geq 6 \\ -x - 5y + 6z &\geq 2 \end{aligned}$$

(10) 4. In the following input-output problem, an economy has on input-output matrix

$$A = \begin{bmatrix} .1 & .2 & .3 \\ .3 & .2 & .1 \\ .2 & .1 & .3 \end{bmatrix}, \qquad \text{and}$$

a final demand matrix

$$D = \begin{bmatrix} 10,000 \\ 40,000 \\ 80,000 \end{bmatrix}.$$

Write a matrix equation for X, the matrix that gives the demand levels of production. Don't compute any inverses.

(6) 5(a). Find the inverse of the matrix: $\begin{bmatrix} 2 & -3 \\ 7 & 5 \end{bmatrix}$

(6) (b) Multiply the matrices: $\begin{bmatrix} 2 & -3 & 5 \\ -1 & 4 & 6 \end{bmatrix} \times \begin{bmatrix} 8 & -2 \\ 4 & 5 \\ 6 & -3 \end{bmatrix}$

(6) (c) What is the least-squares error E when the line $y = 2x + 1$ is used to fit the data points $(1, 2), (3, 10)$ and $(-3, -6)$?