Math 141

Test I (Ch. 1 & 2)

Friday, September 15, 1995

Name ________________________________

ID# ___________________________

Seat Number _________

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-- You must show all appropriate work to receive full credit.

-- There are 100 points possible. Point values for each problem are as indicated.

-- You will have 50 minutes to complete this exam. Budget your time accordingly.

-- SCHOLASTIC DISHONESTY WILL NOT BE TOLERATED.

-- If you need more space to work a problem, do so on the back of the page and indicate this on the front of the page.

Good Luck!

Problem 1 -- True/False. Clearly mark your answer. (2 points each)

a) T F If two lines with slopes m_1 and m_2 are perpendicular, then $m_1 m_2 = -1$.

b) T F Every square matrix has an inverse.

c) T F The market equilibrium point is where revenue equals cost.

d) T F If **A** is a 4 *x* 1 matrix and **B** is a 1 *x* 4 matrix, then the product **AB** is a 4 *x* 4 matrix.

Problem 2 -- Find the equation of the line that

a) (3 points) passes through the point (-2, 4) and is parallel to the *y*-axis.

b) (4 points) passes through the point (-1, -1) and is perpendicular to $4x+3y-6=0$. Leave your answer in slope-intercept form.

Problem 3 -- Coors' Field, home of the Colorado Rockies, estimates its fixed costs (i.e.: rent, utilities) per game to be $250, 000. Variable costs (i.e.: security, maintenance) are about $6 per ticket. Each ticket is sold for $16.
a) (4 points) Find the cost equation.
b) (3 points) Find the revenue equation.
c) (4 points) Find the profit equation.
d) (3 points) What is the profit (loss) if 40,000 tickets are sold?
d) (6 points) How many tickets must be sold to break even?

Problem 4 -- Given the following matrices, perform the indicated operations, if possible. If an operation is not possible, tell why. (5 points each)

$$A=\begin{bmatrix} 3 & 0 \\ 2 & -1 \\ 4 & 1 \end{bmatrix} \qquad B=\begin{bmatrix} -2 & 0 & -1 \\ 0 & 3 & 1 \end{bmatrix} \qquad C=\begin{bmatrix} 2 & 1 \\ -3 & 4 \end{bmatrix}$$

$$D=\begin{bmatrix} 1 \\ -2 \\ 3 \end{bmatrix} \qquad E=\begin{bmatrix} 2 & -1 & 0 \end{bmatrix}$$

a) $B^{-1}=$

b) $2A+B^{T}=$

c) $CB=$

d) $E^{2}=$

e) $\frac{1}{2}ED=$

Problem 5 -- For each of the following matrices, determine if the matrix is in row-reduced form.
For those that are row reduced, give the solution to the system.
Use parameters if necessary, and assume that the variables for the systems are (x, y, z) or (x, y, z, w). (5 points each)

a) $\left[\begin{array}{cccc|c} 1 & 0 & 2 & 0 & 2 \\ 0 & 0 & 0 & 1 & -1 \end{array}\right]$

b) $\left[\begin{array}{ccc|c} 1 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{array}\right]$

c) $\left[\begin{array}{cccc|c} 1 & -1 & 0 & 1 & 2 \\ 0 & 0 & 1 & 0 & 1 \\ 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \end{array}\right]$

d) $\left[\begin{array}{ccc|c} 1 & 0 & 0 & -1 \\ 0 & 1 & 0 & 3 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 \end{array}\right]$

e) $\left[\begin{array}{ccc|c} 0 & 0 & 1 & 2 \\ 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 \end{array}\right]$

Problem 6 -- Formulate, but **DO NOT SOLVE** the following problem. (6 points)

A company runs 3 production lines for a total output of 45 parts/hr. Twice the production of the first line is equal to the combined output of the other two lines. The output of the second line is 4 parts/hr. more than that of the third line.

a) Clearly define your variables for this problem.

b) Write the system of equations that will find the production rate of each line.

Problem 7 -- Given $A = \begin{bmatrix} 1 & 1 & -1 \\ 0 & -1 & 0 \\ -1 & 0 & -1 \end{bmatrix}$

a) (5 points) Compute A^{-1}. Show all row operations (e.g.: R2 = R2 - 2R1, etc.).

b) (4 points) Use the result of part (a) to solve $A\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} -1 \\ 0 \\ 2 \end{bmatrix}$

(Note: You must use the result of part (a) to receive full credit.)