Math 1313
Test 2 Supplemental Review

1. It costs a recording company $180,000 to prepare a new CD – recording costs, case design costs, etc. There are other costs such as materials, marketing and royalties that amount to $6 per CD. Suppose the CD is sold to music stores for $12.
a. Write the cost function.
b. Write the revenue function.
c. Write the profit function.
d. Is there a profit or a loss if the company sells 28,000 CDs?
e. What is the profit or loss if the company sells 50,000 CDs?
f. What is the break-even quantity?
g. What is the break-even revenue?
h. What is the break-even point?

2. Gallery of Furniture purchased 10 new delivery vans, to be depreciated linearly. Each van cost $60,000 and was sold for scrap value of $4,000 after four years.
a. Write an expression for the value of one van at time t, ($0 \le t \le 4$).
b. Find the value of the van at the end of 3 years.

3. Write the augmented matrix corresponding to the given system of equations.

$$8x - 4y - 2z = -10$$
$$7y - \frac{1}{2}z = 0$$
$$2x - 8z = -5$$

4. Write the system of equations corresponding to the given augmented matrix.

$$\left(\begin{array}{ccc|c} -9 & 3 & \frac{8}{7} & -1 \\ 5 & 8 & 0 & 0 \\ 5 & 3 & -1 & 4 \end{array}\right)$$

5. Indicate whether the matrix is in row-reduced form.

a. $\left(\begin{array}{cc|c} 1 & -2 & 0 \\ 0 & 0 & 0 \end{array}\right)$

b. $\left(\begin{array}{cc|c} 1 & 1 & -1 \\ 0 & 1 & 10 \end{array}\right)$

c. $\left(\begin{array}{ccc|c} 1 & 0 & 1 & 9 \\ 0 & 1 & 0 & 6 \\ 0 & 0 & 0 & 0 \end{array}\right)$

d. $\left(\begin{array}{ccc|c} 1 & 0 & 0 & 2 \\ 0 & 1 & 0 & 5 \\ 0 & -9 & 1 & 1 \end{array}\right)$

e. $\left(\begin{array}{ccc|c} 1 & 0 & 0 & 2 \\ 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & -4 \end{array}\right)$

f. $\left(\begin{array}{cc|c} 1 & 0 & -5 \\ 0 & 1 & 11 \\ 0 & 0 & 0 \end{array}\right)$

g. $\left(\begin{array}{cccc|c} 1 & 0 & -2 & 0 & 2 \\ 0 & 1 & 1 & 0 & -3 \\ 0 & 0 & 0 & 1 & 4 \\ 0 & 0 & 0 & 0 & 0 \end{array}\right)$

h. $\left(\begin{array}{ccc|c} 1 & 0 & 3 & 9 \\ 0 & 1 & -1 & 8 \\ 0 & 0 & 0 & 0 \end{array}\right)$

6. Solve the system of linear equations using the Gauss-Jordan elimination method.

a. $\begin{aligned} 5x + 3y &= 9 \\ -2x + y &= -8 \end{aligned}$

b. $\begin{aligned} 2x + 3y - 6z &= -11 \\ x - 2y + 3z &= 9 \\ 3x + y &= 7 \end{aligned}$

c. $\begin{aligned} 2x + 3y &= 2 \\ x + 3y &= -2 \\ x - y &= 3 \end{aligned}$

d. $\begin{aligned} 3y + 2z &= 4 \\ 2x - y - 3z &= 3 \\ 2x + 2y - z &= 7 \end{aligned}$

7. The following augmented matrix in row-reduced form is equivalent to the augmented matrix of a certain system of linear equations. Use this result to solve the system of equations.

a. $\left(\begin{array}{ccc|c} 1 & 0 & 0 & -3 \\ 0 & 1 & -1 & -17 \end{array}\right)$

b. $\left(\begin{array}{cc|c} 1 & -1 & 3 \\ 0 & 3 & 1 \\ 0 & 0 & -\frac{1}{3} \end{array}\right)$

c. $\left(\begin{array}{cccc|c} 0 & 1 & 0 & 1 & 3 \\ 0 & 0 & 1 & -2 & 4 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{array}\right)$

d. $\left(\begin{array}{ccc|c} 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & -8 \\ 0 & 0 & 1 & 7 \end{array}\right)$

8. Solve for the variables in the matrix equation.

a. $\begin{pmatrix} 2x-2 & 3 & 2 \\ 2 & 4 & y-2 \\ 2z & -3 & 2 \end{pmatrix} = \begin{pmatrix} 3 & u & 2 \\ 2 & 4 & 5 \\ 4 & -3 & 2 \end{pmatrix}$

b. $\begin{pmatrix} x & -2 \\ 3 & y \end{pmatrix} + \begin{pmatrix} -2 & z \\ -1 & 2 \end{pmatrix} = \begin{pmatrix} 4 & -2 \\ 2u & 4 \end{pmatrix}$

c. $\begin{pmatrix} 1 & 2 \\ 3 & 4 \\ x & -1 \end{pmatrix} - 3\begin{pmatrix} y-1 & 2 \\ 1 & 2 \\ 4 & 2z+1 \end{pmatrix} = \begin{pmatrix} -4 & -u \\ 0 & -1 \\ 4 & 4 \end{pmatrix}$

d. $-2\begin{pmatrix} x+2 & 3z+1 & 5y \\ 4u & 0 & 3 \end{pmatrix} + \frac{1}{2}\begin{pmatrix} 3x & 2z & 5y \\ 2u & -5 & 6 \end{pmatrix} = -1\begin{pmatrix} 10 & -14 & 80 \\ 10 & 5/2 & 3 \end{pmatrix}$

9. Let $A=\begin{pmatrix} 2 & 7 & -8 \\ 1 & 0 & 11 \\ 15 & -4 & -11 \\ 10 & 7 & 6 \end{pmatrix}$, $B=\begin{pmatrix} 8 & -2 & 1 \\ -13 & 5 & 0 \\ 16 & 20 & 4 \end{pmatrix}$ and $C=\begin{pmatrix} -8 & 10 & 17 \\ 21 & -7 & -4 \\ 9 & -10 & -14 \end{pmatrix}$.

a. What is the size of A, B and C?
b. Find a_{31}? Find b_{22}? Find c_{23}?
c. Identify the square matrix or matrices.
d. What is the transpose of A, B and C?
e. Compute -11A + 3C, if possible.
f. Compute 8B – 3C

10. Perform the indicated operations.

a. $-4\begin{pmatrix} 10 & 6 \\ -3 & 4 \\ 8 & 1 \end{pmatrix}-\begin{pmatrix} -6 & 0 \\ -2 & -1 \\ 10 & 12 \end{pmatrix}$

b. $\begin{pmatrix} 5 & 7 \\ 9 & 5 \end{pmatrix}+\frac{1}{2}\begin{pmatrix} -1 & 5 \\ -3 & 10 \end{pmatrix}-9\begin{pmatrix} -2 & -1 \\ -6 & -15 \end{pmatrix}$

11. Multiply, if possible.

a. $\begin{pmatrix} -1 & 1 & 3 & 0 \\ -4 & 8 & 3 & 2 \\ 2 & -3 & 0 & 1 \end{pmatrix}\begin{pmatrix} 2 & 3 \\ -2 & -10 \\ 1 & 5 \\ 6 & 7 \end{pmatrix}$

b. $\begin{pmatrix} -2 & 3 & 2 \\ 2 & 4 & -2 \\ 2 & -3 & 2 \end{pmatrix}\begin{pmatrix} 3 & -7 & 2 \\ 2 & 4 & 5 \\ 4 & -3 & 2 \end{pmatrix}$

c. $\begin{pmatrix} -4 & -11 & 10 \\ 6 & -7 & 3 \end{pmatrix}\begin{pmatrix} 9 & -7 & 6 & -4 & 11 \\ 15 & -3 & -6 & -20 & 1 \end{pmatrix}$

d. $\begin{pmatrix} 8 & -9 \\ 11 & -1 \\ -4 & 3 \\ 20 & 6 \end{pmatrix}\begin{pmatrix} 6 & 7 \\ -4 & -7 \end{pmatrix}$

e. $\begin{pmatrix} -7 & 8 & -9 \\ 11 & 12 & 3 \\ 5 & 16 & -7 \end{pmatrix}\begin{pmatrix} 4 & 6 & 5 & 4 & 7 \\ 1 & -5 & -3 & -7 & -2 \\ 3 & 4 & -7 & -5 & -10 \end{pmatrix}$

12. Show that the two matrices are inverses of each other.

a. $\begin{pmatrix} 1 & -3 \\ 1 & -2 \end{pmatrix}$ and $\begin{pmatrix} -2 & 3 \\ -1 & 1 \end{pmatrix}$

b. $\begin{pmatrix} 2 & 4 & -2 \\ -4 & -6 & 1 \\ 3 & 5 & -1 \end{pmatrix}$ and $\begin{pmatrix} 1/2 & -3 & -4 \\ -1/2 & 2 & 3 \\ -1 & 1 & 2 \end{pmatrix}$

13. Find the inverse of the given matrix, if it exists.

a. $A = \begin{pmatrix} 2 & -5 \\ 1 & -3 \end{pmatrix}$

b. $B = \begin{pmatrix} 10 & 2 \\ 1 & 5 \end{pmatrix}$

c. $C = \begin{pmatrix} 3 & -3 \\ 2 & -2 \end{pmatrix}$

d. $D = \begin{pmatrix} 1 & -1 & 3 \\ 2 & 1 & 2 \\ -2 & -2 & 1 \end{pmatrix}$

14. Solve the system of linear equations using the inverse of the coefficient matrix.

a. $\begin{aligned} 2x + 3y &= 5 \\ 3x + 5y &= 8 \end{aligned}$

b. $\begin{aligned} 8x + 5y &= 70 \\ -x - 5y &= 35 \end{aligned}$

15. Use the method of corners to solve this LPP:

Maximize $Z = 5x + 7y$

subject to $6x + 3y \le 24$

$3x + 6y \le 30$

$x \ge 0$

$y \ge 0$

16. Use the method of corners to solve this LPP

Minimize $R = 200x + 35y$

subject to $4x + 3y \le 24$

$3x + 4y \ge 8$

$x \ge 0$

$y \ge 0$

17. You can use two types of fertilizer in your orange grove, Best Food and Natural Nutri. Each bag of Best Food contains 8 pounds of nitrogen, 4 pounds of phosphoric acid, and 2 pounds of chlorine. Each bag of Natural Nutri contains 3 pounds of nitrogen, 4 pounds of phosphoric acid and 1 pound of chlorine. You know that the grove needs at least 1,000 pounds of phosphoric acid and at most 400 pounds of chlorine. If you want to minimize the amount of nitrogen added to the grove, how many bags of each type of fertilizer should be used? How much nitrogen will be added?

18. Set up and solve the LPP: A manufacturing plant makes two types of inflatable boats, a two-person boat and a four-person boat. Each two-person boat requires 0.9 labor-hours from the cutting department and 0.8 labor hours from the assembly department. Each four-person boat requires 1.2 labor-hours from the cutting department and 1.8 labor-hours from the assembly department. The maximum labor-hours available per month for the cutting department and the assembly department are 780 and 950, respectively. The company makes a profit of $25 on each two-person boat and $50 on each four-person boat. How many of each type of boat should be manufactured in order to maximize profit? (Assume all boats manufactured are sold.)