Math 141 Week in Review
Week 3 Problem Set
Exam 1 Review

Note: Not every topic is covered in this review. Please also take a look at the previous problem sets from Week in Review for more practice.

1. Find the equation of the line that is parallel to the line $2x - 3y = 12$ and passes through the x-intercept of the line $y = -7x + 6$.

2. Find the value of n that makes the following lines perpendicular.

$4x - 9y = -7$
$6x + ny = 10$

3. A keychain company incurs fixed costs of $1500 every month. It costs them $2 to make each keychain. When 300 keychains are sold, the company earns $1800 in revenue.

A. What is the selling price of a keychain?
B. What is the profit function for this company?
C. What is the break-even quantity of keychains?
D. What is the break-even revenue?

4. A sporting goods store finds that when the price of a sleeping bag is $53, 176 people are willing to buy it, but the supplier is only willing to supply 152 sleeping bags. When the price increases by $8, only 112 people are willing to buy sleeping bags, but the supplier is willing to supply 32 more sleeping bags than at the $53 price.

A. Find the supply and demand equations.
B. What is the market equilibrium (equilibrium point)?

5. The following table shows the number of Wal-mart stores nationwide for the given years.

Year	1967	1970	1975	1985	1995
Number of Stores	24	38	125	882	1995

A. Find the least-squares line for this data where x is the number of years since 1967 and y is the number of Wal-mart stores. Round to two decimal places.
B. Estimate the number of Wal-mart stores in 1987. Round to the nearest whole number.
C. In what year would you expect there to be 3000 Wal-mart stores? Round to the nearest year.
D. How well does the line fit the data?

6. For the following augmented matrices, state whether or not the matrix is in row-reduced form. If the matrix IS in row-reduced form, tell how many solutions to the system there are. If it is NOT in row-reduced form, state the next row operation needed to get the matrix in row-reduced form.

A. $\left[\begin{array}{ccc|c} 1 & 0 & 4 & 5 \\ 0 & 1 & -3 & 6 \\ 0 & 0 & 0 & 1 \end{array}\right]$

B. $\left[\begin{array}{ccc|c} 1 & 9 & 0 & 6 \\ 0 & 1 & 0 & 7 \\ 0 & 0 & 0 & 0 \end{array}\right]$

C. $\left[\begin{array}{cc|c} 1 & 0 & -7 \\ 0 & 1 & 8 \\ 0 & 0 & 0 \end{array}\right]$

D. $\left[\begin{array}{cc|c} 1 & 0 & 6 \\ 0 & 1 & 2 \\ 0 & 1 & 5 \end{array}\right]$

E. $\left[\begin{array}{cc|c} 1 & 0 & 4 \\ 0 & 3 & 9 \end{array}\right]$

F. $\left[\begin{array}{ccc|c} 1 & 0 & 1 & 1 \\ 0 & 1 & 3 & 2 \end{array}\right]$

7. Perform Gauss-Jordan elimination by hand on the following matrix to obtain the row-reduced form and the solution to the corresponding system of linear equations.

$$\left[\begin{array}{cc|c} 4 & 8 & 32 \\ -3 & -5 & -18 \end{array}\right]$$

8. Jill drinks both Dr. Pepper and coffee. A 20-oz bottle of Dr. Pepper contains 68 mg of caffeine and 250 calories. 20 oz of coffee with half and half and sugar contains 230 mg of caffeine and 130 calories. In a given week, Jill drinks enough Dr. Pepper and coffee to take in 1830 mg of caffeine and 3150 calories. How many 20-oz Dr. Peppers and coffees did Jill drink that week?

9. Solve the following systems of equations. If there are infinitely many solutions, write the solution in parametric form.

A.
$$\begin{aligned} 10x - 8y &= 6 \\ -15x + 12y &= 20 \end{aligned}$$

B.
$$\begin{aligned} 2x + y + z &= 5 \\ 4x + 6z &= 14 + 2y \\ -6x + 3y - 9z &= -21 \end{aligned}$$

10. Solve for the variables in the following equation.

$$3\begin{bmatrix} 1 & -2 \\ -4 & 9 \end{bmatrix}^{-1} + \begin{bmatrix} -5 & a \\ 2b & 6 \end{bmatrix}^{T} = \begin{bmatrix} -1 & c+1 \\ 9d & 20 \end{bmatrix}\begin{bmatrix} 0 & 2 \\ 1 & 0 \end{bmatrix}$$

11. Steve is throwing a Super Bowl party and wants to order pizzas. He finds that Papa John's charges \$6 for a small pizza, \$9 for a medium pizza, and \$12 for a large pizza. Pizza Hut charges \$5 for a small pizza, \$10 for a medium pizza, and \$13 for a large pizza. This information is summarized in the following matrix.

$$A = \begin{array}{c} \\ \text{S} \\ \text{M} \\ \text{L} \end{array}\begin{array}{c} \begin{array}{cc} \text{J} & \text{H} \end{array} \\ \begin{bmatrix} 6 & 5 \\ 9 & 10 \\ 12 & 13 \end{bmatrix} \end{array}$$

If Steve wants to order 5 small, 3 medium, and 6 large pizzas, find a matrix B so that when multiplied with A will give the total cost of his order if he orders from Papa John's or if he orders from Pizza Hut. Then perform the matrix multiplication.

12. Given the following matrices and their sizes, determine whether the matrix operations are possible or not possible.

$A_{2\times4}$ $B_{3\times2}$ $C_{4\times3}$ $D_{3\times3}$ $E_{2\times3}$

A. $4AC + E$
B. $BA + C$
C. $A^TE - 7C$
D. BED
E. DB^T

13. Suppose there are 3 major airlines that fly out of Houston: Southwest, Delta, and American. A Southwest flight holds 135 people, a Delta flight holds 160 people, and an American flight holds 148 people. On a given day, a total of 88,683 people flew out of Houston. There were 3 times as many Southwest flights as Delta flights, and the number of American flights was half the number of Southwest and Delta flights combined. How many flights out of Houston were there for each airline?

A. Set up this problem.
B. Write the system of equations as a matrix equation $AX = B$.
C. Solve the matrix equation using matrix inverses.

14. (Note: This problem is from 2.7 which not all instructors may cover.) A simple economy consists of 3 industries: Agriculture, Transportation, and Service. The production of 1 unit of agricultural products requires the consumption of 0.2 units of agricultural products, 0.1 units of transportation, and 0.1 units of service goods. The production of 1 unit of transportation requires the consumption of 0.3 units of agricultural products, 0.4 units of transportation, and 0.3 units of service. Finally, the production of 1 unit of service goods requires the consumption of 0.2 units of agricultural products, 0.1 units of transportation, and 0.3 units of service.

A. Find the Input-Output matrix A.

B. Find the gross output of goods needed to satisfy consumer demand for 790 units of agricultural products, 445 units of transportation, and 205 units of service goods.

C. Find the amounts of goods consumed in the internal process of production in order to meet the above gross output.