

DEPARTMENT OF MATHEMATICS

Ma 162 First Exam September 24, 2012

Instructions: No cell phones or network-capable devices are allowed during the exam. You may use calculators, but you must show your work to receive credit. If your answer is not in the box or if you have no work to support your answer, you will receive no credit. The test has been carefully checked and its notation is consistent with the homework problems. No additional details will be provided during the exam.

Problem	Maximum Score	Actual Score
1	5	
2	5	
3	10	
4	5	
5	5	
6	5	
7	15	
8	15	
9	15	
10	20	
Total	100	

NAME: _____ Section: _____

Last four digits of Student ID: _____

1. Producing 20 items costs \$300, but producing 25 items costs \$310. Assuming a linear model of production costs, how much would producing 23 items cost?

2. Where do the lines given by the following equations intersect?
 $2x + 3y = 22$ and $3x + 2y = 23$

3. Matrix arithmetic. Do the following calculations if possible. If impossible, explain why.

(a) Add $[1 \ 2 \ 3] + [40 \ 50 \ 60]$

(b) Multiply $[1 \ 2 \ 3] \times [40 \ 50 \ 60]$

(c) Add $[1 \ 2 \ 3] + \begin{bmatrix} 40 \\ 50 \\ 60 \end{bmatrix}$

(d) Multiply $[1 \ 2 \ 3] \times \begin{bmatrix} 40 \\ 50 \\ 60 \end{bmatrix}$

4. Write the following equations in matrix form:

$$\begin{aligned}x + z &= y + 2 \\2x + 3 &= y + z \\3x + 4y + 5z &= 10\end{aligned}$$

5. A system of equations is represented by the matrix

$$\left[\begin{array}{cccc|c} x & y & z & t & RHS \\ \hline 1 & 0 & 0 & 0 & 3 \\ 0 & 1 & 0 & 0 & 4 \\ 0 & 0 & 1 & 0 & 5 \\ 0 & 0 & 0 & 2 & 12 \end{array} \right]$$

(a) Write out the system of equations

(b) Solve it: $x =$ _____, $y =$ _____, $z =$ _____, $t =$ _____

6. A system of equations is represented by the matrix

$$\left[\begin{array}{cccc|c} x & y & z & t & RHS \\ \hline 1 & 2 & 0 & 0 & 3 \\ 0 & 0 & 1 & 4 & 5 \end{array} \right]$$

(a) Write out the system of equations

(b) Solve it: $x =$ _____, $y =$ _____, $z =$ _____, $t =$ _____

7. Panda-money-em specializes in production of panda bear themed financial calculators. The fixed costs of production total to \$2800, while the marginal costs are only \$10 per calculator. If the calculators sell for \$14 per calculator (and boy do they sell!), what is the break-even production and the break-even cost? Make sure to show your work clearly! Exhibit the cost function and the revenue function, and describe how they are related to solving this problem.



8. Hill Street Ooze specializes in the production of food like products from various chemical substances. It has 4 main ingredients: X-Ray, Yellow, Zebra-Striped, and Twitchy oozes. It has 3 main products: Mutant Mango, Neon Nectarine, and OMG Orange. Additionally it has two main dispenser machines: the Front Machine and the Side Machine. Describe how much of each ingredient is used at each of the machines given the following ingredients list and sales records. Show your work. It is a good idea to write this out in terms of matrices.



	Ingredients per order				Sales record		
	X-Ray	Yellow	Zebra	Twitchy	Front Machine	Side Machine	
Mutant Mango	2 oz	4 oz	0 oz	1 oz	300 orders	40 orders	Mutant Mango
Neon Nectarine	3 oz	3 oz	0 oz	2 oz	200 orders	50 orders	Neon Nectarine
OMG Orange	2 oz	0 oz	3 oz	3 oz	100 orders	60 orders	OMG Orange

9. The data analysts have done a best-linear-model-fit to the data on the suppliers and found that supply X is currently governed by $X = 35P + 205$ as long as the price P remains between \$5 and \$10 per unit. The demand is handled by another department, and they appear to be on vacation. You know that at \$5 per unit, 500 will be demanded, and at \$10 per unit only 175 will be demanded.

(a) What is the demand equation if one uses a linear model for demand?

(b) What is the equilibrium price and equilibrium demand?

10. Before recent adjustments to accounting practices, departments were required to spend all the money on each budget line each fiscal year. At the end of one year, the department discovered it had over \$2000 unspent, but the money was divided into three budget lines: Labor, Materials, and Storage. It had three ongoing projects: the Old project, the New project, and the previously Forgotten project. Each project spends a certain amount of each budget per day, and the department needs to tell each project how many days of work it needs to do before the year is up.

	Resource usage			Budget
	Old	New	Forgotten	
Labor	\$5	\$8	\$9	\$445
Materials	\$5	\$12	\$21	\$805
Storage	\$10	\$16	\$21	\$965

(a) Describe the variables for the problem. If a variable is “ x ” make sure your description explains clearly what “ $x = 4$ ” means.

(b) Write down the equations for the problem in terms of your variables.

(c) Solve the equations (preferably using matrices)

(d) What are the department’s orders for the projects in plain English?