

DEPARTMENT OF MATHEMATICS

Ma 162 First Exam February 6, 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	11	
2	11	
3	11	
4	12	
5	11	
6	11	
7	11	
8	11	
9	11	
Total	100	

NAME: _____ Section: _____

Last four digits of Student ID: _____

1. A courier travels from Lexeen's Town to Cooper's Town which is 6 miles east and 8 miles north. The courier must pass through **exactly one of the cities** Bard's Town and Duke's Town along the way. Bard's Town is 3 miles east and 4 miles north of Lexeen's Town, while Duke's Town is 4 miles east and 3 miles north of Lexeen's Town. Assume the courier travels a straight line between cities.

(a) Which city should he pass through (Bard's Town or Duke's Town) in order to minimize his trip distance from Lexeen's Town to Cooper's Town?

He should pass through city on his way to Cooper's Town.

(b) What is the total minimum length of his trip from Lexeen's Town to Cooper's Town, taking into account the stop in the city from part (a)?

Minimum trip length is:

Make sure to show your work. Answers with no work receive no credit.

2. Point A has coordinates $(7, 3)$, and point B has coordinates $(2, 5)$.

(a) What is the distance from A to B and what is the slope of the line joining A to B?

distance: , slope:

(b) Suppose that the point C with coordinates $(x, 9)$ is such that the triangle ABC is a right triangle with right angle at B. Determine the value of x . (Note: The coordinates of $A(7, 3)$ and $B(2, 5)$ were given at the top of the problem.)

$x =$

Make sure to show your work. Answers with no work receive no credit.

4. In a free market, the supply equation for a supplier of corn is $x = 150p + 1082$ where the price p is in dollars and x is in bushels. When the price is \$5 per bushel the demand is 2000 bushels. When the price goes up to \$6 per bushel the demand drops to 1800 bushels. Assuming that the demand equation is also linear, find the equilibrium price and the number of bushels supplied at that equilibrium price.

Demand equation:

$p = \$$

$x =$

bushels

Make sure to write clearly. X=DOG receives no credit.

5. For the following word problem: (a) Write down variables describing the (numerical) business decision to be made, (b) write down equations that constrain your decision, (c) convert the equations to an augmented matrix. **You need not solve the system.**

Mr. Marjoram is renting an automated stuffed animal factory with three machines: a sewing machine, a stuffing machine, and a trimming machine. He has programmed it to make Pandas, Dogs, and Birds, but some of the animals take longer on some of the machines, so he isn't sure how many of each animal to make. He wants the machines to be in constant use (so he feels he got his money's worth; why pay for an idle machine). The production times and available times are given in the table below. How many of each animal should he make?

	Sewing	Stuffing	Trimming
Panda	5 min per	3 min per	4 min per
Dog	2 min per	6 min per	4 min per
Bird	4 min per	2 min per	3 min per
Available	2 hours	2 hours	2 hours

The variables describing the decision are:

The equations to be solved are:

The augmented matrix describing the equations is:

Make sure to show your work. Answers with no work receive no credit.

6. Here is the augmented matrix of a linear system of equations. Take this matrix to RREF. Be sure to label your reduction operations in standard notation. You need not solve for the variables.

$$\left(\begin{array}{cccc|c} x & y & z & w & \text{RHS} \\ \hline 9 & 8 & 7 & 6 & 23 \\ 0 & 2 & 3 & 4 & 5 \\ 0 & 0 & 1 & 2 & 3 \end{array} \right)$$

Make sure to show your work. Answers with no work receive no credit.

7. Here is the augmented matrix of a linear system of equations. As usual, the variables are mentioned for your convenience.

$$\left(\begin{array}{cccc|c} x & y & z & w & \text{RHS} \\ 1 & 0 & 0 & 2 & 3 \\ 0 & 1 & 0 & 4 & 5 \\ 0 & 0 & 1 & 6 & 7 \end{array} \right)$$

- (a) Is this matrix in REF or RREF or both or neither of these?

- (b) Finish the solution process as needed and determine the complete solution of the system by filling in the answers below. If a variable is free, then enter the word “free” as its value. Be sure to show all calculations.

$x =$

$y =$

$z =$

$w =$

Make sure to show your work. Answers with no work receive no credit.

8. Your friend's calculator has never been the same since it went swimming last year. He asked it to solve Mr. Marjoram's problem, or at least bring the matrix to REF. It claims the answer is:

$$\left[\begin{array}{ccc|c} P & D & B & RHS \\ \hline 3 & 9 & 12 & 273 \\ 0 & 4 & 8 & 140 \\ 0 & 0 & 5 & 60 \end{array} \right]$$

- (a) Assume the calculator is right, and solve for P , D , and B .

$(P = \underline{\hspace{1cm}}, D = \underline{\hspace{1cm}}, B = \underline{\hspace{1cm}})$
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- (b) Is your answer in part (a) actually right? Check your constraints in problem #5, and show that the production goals do or do not keep the machines busy.

Your other friend's calculator hasn't been the same since it spent the night in the chemistry lab. It says the REF is:

$$\left[\begin{array}{ccc|c} P & D & B & RHS \\ \hline 5 & 7 & 9 & 235 \\ 0 & 4 & 4 & 92 \\ 0 & 0 & 3 & 36 \end{array} \right]$$

- (c) Assume this calculator is also right, somehow. Solve for P , D , and B .

$(P = \underline{\hspace{1cm}}, D = \underline{\hspace{1cm}}, B = \underline{\hspace{1cm}})$
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Make sure to show your work. Answers with no work receive no credit.

9. A farmer is in the corn and soy business. Every acre of corn will cost him \$42 and every acre of soy will cost him \$30. He has 500 acres and a budget of \$18,600. How much should he plant of each crop in order to use up all the land and all the budget?

He should plant _____ acres of corn and _____ acres of soy.

This will use _____ acres of land and \$ _____ from the budget.