

# DEPARTMENT OF MATHEMATICS

Ma162 FIRST EXAM Spring 2004  
February 16, 2004

**DO NOT TURN THIS PAGE UNTIL YOU ARE INSTRUCTED TO DO SO.**

**Be sure to show all work and justify your answers.**

There are 7 problems and a total of 8 pages including this one. You are allowed the use of calculators.

<b>Problem</b>	<b>Maximum Score</b>	<b>Actual Score</b>
1	15	
2	15	
3	15	
4	15	
5	10	
6	15	
7	15	
Total	100	

NAME: \_\_\_\_\_

SECTION NO: \_\_\_\_\_

STUDENT #: \_\_\_\_\_

1. Answer the following questions.

(a) Find an equation of the straight line that connects  $P(1, 2)$  and  $Q(-2, -4)$ .

(b) Where does the above line cross the x axis? Give both the coordinates of the point.

(c) A line  $K$  is known to be parallel to the line  $2x + 3y = 5$  and it is known that the point  $P(-1, -1)$  is on  $K$ . What is an equation of  $K$ ?

(d) A line  $L$  is known to be perpendicular to the line  $-3x + 2y = 5$  and is known to cross the x axis at  $x = -\frac{5}{2}$ . What is an equation of  $L$ ?

2. A factory has three branches each manufacturing product lines called  $A, B, C$ . The production rate per hour for each branch is given in the following table.

	$A$	$B$	$C$
Branch 1	3	4	1
Branch 2	2	0	5
Branch 3	1	3	4

Create appropriate equations to determine the number of hours each branch must run in order to meet the following conditions.

The factory needs a total of 116 units of product  $A$ , 170 units of product  $B$  and 250 units of product  $C$ .

Be sure to identify the variables used.

Set up the appropriate augmented matrix that you would have to solve for finding the solution of the equations. **Do not solve!**

3. A publisher sells a certain book for \$ 7.00, and he needs to spend 50 cents per book for handling the sales. He also has a fixed production cost of \$ 24000 per month and needs \$ 4.00 per book for printing costs.

Answer the following questions:

- (a) Find the monthly cost function. **Be sure to describe the meaning of the variable that you use.**
- (b) Find the monthly revenue function.
- (c) Find the monthly profit function.
- (d) What is the net profit (loss if negative) if he print and sells 1000 books?
- (e) How many books must be printed and sold to break even? **(Round up the answer to the next integer.)**

4. Precisely list **the three allowable elementary row operations** on an augmented matrix of a system of equations. Be sure to use complete precise sentences and describe the operations in words, not just symbols.

Carry out the indicated elementary row operations on the given matrix  $M$  **in the specified order**.

$$M = \left[ \begin{array}{ccc|c} 0 & 10 & 2 & 3 \\ -2 & 2 & 0 & 4 \\ 2 & 3 & 1 & 5 \end{array} \right]$$

- (a) Swap the first and the third row. ( $R_1 \leftrightarrow R_3$ .)
- (b) Add the first row to the second ( $R_2 + R_1$ .)
- (c) Subtract two times the second row from the third. ( $R_3 - 2R_2$ .)
- (d) Since  $M$  represented a system of three equations in three variables, what more work is needed for finishing the solution process? **Just discuss what might be needed, don't carry out any further operations.**

5. The following matrix is in REF. Convert it to the row reduced form (RREF). **You must indicate the row operations used and show the steps.**

$$A = \left[ \begin{array}{ccc|c} 1 & 0 & 5 & 1 \\ 0 & 1 & 5 & 4 \\ 0 & 0 & 2 & -4 \end{array} \right]$$

The following matrix is already row reduced (RREF). Write out a solution in parametric form.

$$\left[ \begin{array}{cccc|c} 1 & 4 & 0 & 3 & -1 \\ 0 & 0 & 1 & -2 & 5 \end{array} \right]$$

6. (a) Find a value of  $k$  which makes the given system have infinitely many solutions or be inconsistent. *You must show justification; just a yes or no will receive no credit!*

$$3x - 2y = 5, \quad kx + 4y = 7.$$

- (b) Decide whether or not  $(-1, (3 - 3t), t)$  represents a parametric solution to the given system of equations. *You must show justification; just a yes or no will receive no credit!*

$$5x + 2y + 6z = 1, \quad -2x + y + 3z = 5.$$

7. Consider the following matrices.

$$A = \begin{bmatrix} 0 & 10 & 2 \\ -2 & 2 & 0 \\ 2 & 3 & 1 \end{bmatrix}, \quad X = \begin{bmatrix} 2 \\ 1 \\ 3 \end{bmatrix}, \quad B = \begin{bmatrix} 16 \\ 2 \\ 10 \end{bmatrix}, \quad C = \begin{bmatrix} 0 & 1 & 0 \\ -2 & 2 & 0 \\ 2 & 0 & 1 \end{bmatrix}$$

(a) Is  $3A + 2B$  defined? Explain your answer. If it is defined, calculate it.

(b) Is  $3A + 2C$  defined? Explain your answer. If it is defined, calculate it.

(c) Is  $AX$  defined? Explain your answer. If it is defined, calculate it and decide if  $AX = B$ .