

# DEPARTMENT OF MATHEMATICS

Ma 162 First Exam September 28, 2009

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

**Instructions:** Be sure that your name, section number, and student ID are filled in below. Cell phones must be OFF and put away before you open this exam. You may use calculators (including graphing calculators, but no laptops or cellphone calculators) for checking numerical calculations, but you must show your work to receive credit.

Put your answers in the answer boxes provided, and show your work.

**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	12	
2	12	
3	15	
4	15	
5	12	
6	6	
7	16	
8	12	
Total	100	

Please fill in the information below.

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

Last four digits of Student ID: \_\_\_\_\_

1. The citizens of Heissland created a new temperature scale so that they would see the zero degree temperature sometimes and their high temperatures would not be too high. They called their scale New, or  $N$  for short, with the conversion formula:  $N = \frac{6}{5}(F - 40)$  where  $F$  is the Fahrenheit temperature.

a) When is the Fahrenheit temperature equal to 5 times the New temperature?

Answer: When  $F =$

b) Can 6 times the Fahrenheit temperature be equal to 75 more than 5 times the New temperature? (  $6F = 5N + 75$  ) Why or why not?

Answer:

2. A courier travels from city  $A$  with coordinates  $(0, 0)$  to city  $C$  with coordinates  $(15, 12)$ . He must pass through **exactly one of the cities**  $B(8, 5)$  or  $D(5, 8)$  along the way. Assume he travels the straight line between cities.

(a) Which city should he pass through (B or D) in order to minimize his trip distance from A to C?

He should pass through city  on his way to C.

(b) What is the total minimum length of his trip from A to C?

Minimum trip length is:

3. Point A has coordinates (5, 1), and point B has coordinates (0, 7).

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

distance: , slope:

b) Find the number  $y$  so that the point C with coordinates (8,  $y$ ) lies in the first quadrant and triangle ABC is a right triangle with right angle at A. (Note: The coordinates of A and B were given at the top of the problem.)

$y =$

4. The Fixit company makes testing units for electrical circuits. The cost function for their manufacturing line is  $C = 5x + 7800$ , where  $x$  is the number of units produced per month and  $C$  is measured in dollars. The units generate a revenue of \$12 per unit.

a) Determine the linear profit function for the Fixit company in the usual form:  $P = mx + b$ , assuming he can sell all the units he manufactures.

$P =$    $x +$

b) Determine the break-even value for  $x$  and the break-even cost  $C$  at that value for  $x$ .

$x =$    $C =$

5. In a free market, the supply equation for a supplier of corn is  $x = 30p + 200$  where the price  $p$  is in dollars and  $x$  is in bushels. When the price is \$1 per bushel the demand is 480 bushels. When the price goes up to \$10 per bushel the demand is 0 bushels. Assuming that the demand function is also linear, find the equilibrium price and the number of bushels supplied at that equilibrium price.

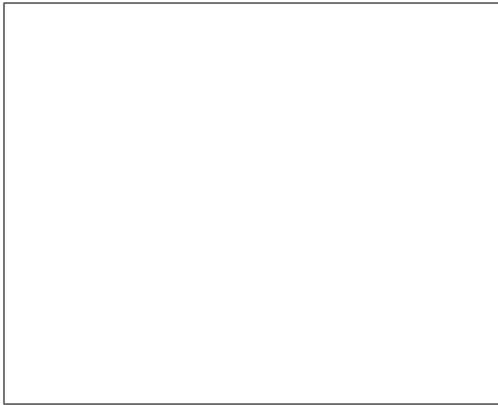
$$p = \boxed{\phantom{000000}} \quad x = \boxed{\phantom{000000}}$$

6. For what value of  $k$  is the system 
$$\begin{cases} x - 3y + 5z = 1 \\ y + kz = 0 \\ 2x + y + 3z = 0 \end{cases}$$
 inconsistent (i.e. has no solution)?

Answer:  $k = \boxed{\phantom{000000}}$

7. Given the system of equations 
$$\begin{cases} 2x - y + 5z = 2 \\ 2x - 2y + 7z = 0 \\ -x + y - 3z = 0 \end{cases}$$

a) Write the augmented matrix for the system.



b) Carry out standard row reductions to convert the augmented matrix to REF (row echelon form). Be sure to describe your reductions in standard notation. Just giving the final form will receive no credit.

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

$$\left[ \begin{array}{cccc|c} x & y & z & w & RHS \\ 1 & 0 & 5 & 0 & 2 \\ 0 & 1 & -4 & 0 & 7 \\ 0 & 0 & 0 & 1 & 5 \end{array} \right]$$

- (a) Is this matrix in REF or RREF 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.

$x =$

$y =$

$z =$

$w =$

# 1 Answer Key for exam1vv4

1.  $\diamond F = 48$  or  $F = 48.0$   
 $\diamond$  No, because 'the system is inconsistent' or 'the graphs do not cross'
2.  $\diamond B$   
 $\diamond \sqrt{89} + 7\sqrt{2} = 19.33$
3.  $\diamond AB = 7.810249676$   
 $\diamond m = -1.2000000000$   
 $\diamond y = 3.5000000000$
4.  $\diamond P = 7x - 7800$   
 $\diamond x = \frac{7800}{7}$  and  $C = \frac{93600}{7}$
5.  $\diamond p = 4$   
 $\diamond 320$
6.  $\diamond k = -1$
7.  $\diamond \begin{pmatrix} -1 & 1 & -3 & 0 \\ 2 & -1 & 5 & 2 \\ 2 & -2 & 7 & 0 \end{pmatrix}$   
 $\diamond \begin{pmatrix} -1 & 1 & -3 & 0 \\ 0 & 1 & -1 & 2 \\ 0 & 0 & 1 & 0 \end{pmatrix}$
8.  $\diamond$  (a) RREF (b)  $2 - 5z = 7 + 4z$  free  $z = 5$