

# Math 1105 – Prelim I

Tuesday, September 30, 2008

Name: .....

Instructor:

## INSTRUCTIONS – READ THIS NOW

- This test has **8** problems worth a total of **100** points.
- Please write your name right now.
- **Show your work.** Unless otherwise specified, no credit will be given for unsupported answers, even if your final answer is correct. To receive full credit, you must show your reasoning and the steps which led you to your final answer, and these must be neatly written. If you need more space, write on the back side of the preceding sheet, but be sure to label your work clearly.
- This is a closed book exam. No electronic device (calculators, cell phones e.t.c.) or any other aid (notes, handouts, book e.t.c.) is allowed.
- The exam is **90 minutes** long. **Good luck!**

Academic integrity is expected of all students of Cornell University at all times, whether in the presence or absence of members of the faculty. Understanding this, I declare I shall not give, use, or receive unauthorized aid in this examination.

Signature of the student: .....

### OFFICIAL USE ONLY:

Problem #	1.	2.	3.	4.	5.	6.	7.	8.	TOTAL
Points earned									

1. (12 points) Joanne Ha sells silk-screened T-shirts at community festivals and craft fairs. Her marginal cost to produce one T-shirt is \$4. Her total cost to produce 60 T-shirts is \$300, and she sells them for \$9 each.

- (a) Find the linear cost function for Joanne's T-shirt production.

- (b) How many T-shirts must she produce and sell in order to break even?

- (c) How many T-shirts must she produce and sell to make a profit of \$500?

2. (12 points) For the following problems calculate the specified matrix

(a)

$$\begin{bmatrix} 2 & -1 & 4 & 1 \\ 0 & 3 & 3 & 2 \end{bmatrix} + \begin{bmatrix} 2 & 6 & -3 & -3 \\ 4 & 1 & 0 & 0 \end{bmatrix}$$

(b)

$$\begin{bmatrix} 1 & -1 & 3 \\ 2 & -3 & 2 \end{bmatrix} \begin{bmatrix} 6 & 0 \\ 2 & -4 \\ 1 & 1 \end{bmatrix}$$

(c)

$$\begin{bmatrix} 6 & 0 \\ 2 & -4 \\ 1 & 1 \end{bmatrix} \begin{bmatrix} 1 & -1 & 3 \\ 2 & -3 & 2 \end{bmatrix}$$

3. (12 points) (a) Use an augmented matrix to find the inverse of  $A = \begin{bmatrix} 3 & -14 \\ -1 & 5 \end{bmatrix}$ .

- (b) Use the inverse of the coefficient matrix from part (a) to solve the system

$$3x - 14y = 4$$

$$-x + 5y = -1$$

4. (12 points) Using the Gauss-Jordan method, solve the system of equations

$$x + 1 = y + z$$

$$y + 3 = x + z$$

$$z + 1 = x + y$$

5. (20 points) Suppose you roll two fair dice. Let  $A$  represent the event “the sum of the results is even”, and let  $B$  represent the event “the sum of the results is divisible by 3”.
- (a) Write out the sample space  $S$  and tell whether the outcomes in  $S$  are equally likely.
- (b) Write out  $A$  and  $B$  and determine whether  $A$  and  $B$  are mutually exclusive.
- (c) Find  $P(A)$ ,  $P(B)$ ,  $P(A \cap B)$  and  $P(A \cup B)$ .

6. (12 points) Suppose we are looking at a weather forecast for tomorrow. The weather report gives the probability of rain  $P(R) = 40\%$  and the probability of lightning  $P(L) = 30\%$ . The probability of both rain and lightning is  $20\%$ .

(a) What is the probability of rain or lightning? Justify your answer.

(b) What is the probability of neither rain nor lightning? Justify your answer.

(c) What is the probability of rain but not lightning? Justify your answer.

7. (12 points) A survey of 50 children yielded the following data with respect to their ice cream preferences:

10 children like chocolate, vanilla, and strawberry ice cream  
13 children like chocolate and strawberry ice cream  
15 children like vanilla and strawberry ice cream  
34 children like chocolate ice cream  
37 children like vanilla ice cream  
20 children like strawberry ice cream  
2 of the children do not like chocolate, vanilla, nor strawberry ice cream.

- (a) Draw a Venn diagram that illustrates the above sets of children, carefully labeling each part of the diagram.

- (b) What is the probability that a child selected at random from the 50 surveyed likes chocolate and vanilla ice cream?

8. (8 points) Applying the Gauss-Jordan method to the matrix

$$\left[ \begin{array}{cc|c} \frac{-a}{2} & \frac{-b}{2} & \frac{-c}{2} \\ a+d & b+e & c+f \end{array} \right]$$

yields the matrix

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

- (a) Find the point(s) where the lines  $ax + by = c$  and  $(a+d)x + (b+e)y = c+f$  intersect. Justify your answer.

- (b) Do the lines  $ax + by = c$  and  $dx + ey = f$  intersect? If so, explain your answer and find the point(s) of intersection. If not, explain your answer.

SCRATCH PAPER