

Math 141                      **NEATLY PRINT NAME:** \_\_\_\_\_

Exam 1                                      **STUDENT ID:** \_\_\_\_\_

Fall 2008                                      **DATE:** \_\_\_\_\_

Scarborough

FORM F                                      **SECTION:**    503 (10:20am)    521 (11:30am)    523 (1:50pm)

"On my honor, as an Aggie, I have neither given nor received unauthorized aid on this academic work."

\_\_\_\_\_  
Signature of student

Academic Integrity Task Force, 2004  
<http://www.tamu.edu/aggiehonor/FinalTaskForceReport.pdf>

My signature in this blank allows my instructor to pass back my graded exam in class or allows me to pick up my graded exam in class on the day the exams are returned. If I do not sign the blank or if I am absent from class on the day the exams are returned, I know I must show my Texas A&M student ID during my instructor's office hours to pick up my exam.

Signature of student \_\_\_\_\_

**MULTIPLE-CHOICE: There is no partial credit on the multiple-choice questions. You must circle the correct answer(s) on each to receive credit on the multiple-choice questions.**

**Work Out: Write all solutions in the space provided as full credit will not be given without complete, correct accompanying work, even if the final answer is correct. Fully simplify all your answers, and give exact answers unless otherwise stated. Justify your answers algebraically whenever possible; state any special features or programs you use on your calculator. Put your final answer in the blank provided. Remember your units!**

**You must clear your calculator. MEM (2<sup>nd</sup> +), Reset, ALL, Reset  
To turn on the correlation coefficient: Catalog (2<sup>nd</sup> 0), DiagnosticOn, Enter, Enter.**

"The mathematician's patterns, like the painter's or the poet's, must be beautiful; the ideas like the colours or the words, must fit together in a harmonious way. Beauty is the first test: there is no permanent place in the world for ugly mathematics."

- G. H. Hardy

**For the next two problems:** The data represents the relationship between the surface temperature in the Bay of Bengal and the number of cholera outbreaks in India.

Degrees Fahrenheit in Bay of Bengal	76	80	82	86	90
Thousands of Cholera Outbreaks	90	96	104	112	120

- (5 pts) If the surface temperature in the Bay of Bengal is 85 degrees Fahrenheit, use the linear regression line for the data to estimate the number of cholera outbreaks in India.
  - 109,267
  - 108,370
  - 109,286
  - 109,000
  - None of these
- (5 pts) If there are 133,000 cholera outbreaks in India, use the linear regression line to estimate the surface temperature in the Bay of Bengal to the nearest degree.
  - 97 °F
  - None of these
  - 94 °F
  - 92 °F
  - 96 °F
- (5 pts) If the supply and demand equations are  $8.2x + 4000p = 468,000$  and  $81.25x - 25,000p = -937,500$ , not necessarily respectively. What is the market equilibrium price?
  - None of these
  - \$86.25
  - \$150.00
  - \$117.00
  - \$37.50

4. (5 pts) Find the value of  $a$  if the line through points  $(a - 5, -4)$  and  $(2, 4)$  is perpendicular to the line through points  $(0, 2a)$  and  $(-6, 8)$ .

- a.  $\frac{-3}{5}$
- b. None of these
- c. 5
- d.  $\frac{83}{11}$
- e.  $\frac{11}{5}$

**For the next two problems:** The matrix  $\left[ \begin{array}{ccc|c} -8 & 30 & 2 & -150 \\ 1 & -5 & 1 & 25 \\ 0 & -10 & 10 & 50 \end{array} \right]$  represents a system of

equations.

5. (7 pts) After performing the row operation  $R_1 \leftrightarrow R_2$  on the given matrix, what is the next Gauss-Jordan row operation needed along the path to put the matrix into row-reduced form? Give the row operation notation and not the calculator notation. Perform this second row operation and give the resulting matrix.

\_\_\_\_\_ is the row operation.

The resulting matrix is:

6. (5 pts) Solve the system of equations represented by the given matrix by using any method shown in class.

- a. No solution
- b.  $(4t, t - 5, t)$  where  $t$  is any real number
- c. None of these
- d.  $(-4t, -t - 5, t)$  where  $t$  is any real number
- e.  $(0, -5, 0)$

**For the next two problems:** A computer printer manufacturer has fixed monthly costs of \$48,000. If 500 computer printers are sold, there is a loss of \$39,500. If 800 computer printers are produced, the total cost is \$100,000.

7. (7 pts) What is the linear cost function?

8. (6 pts) What would be the revenue from selling 200 computer printers?

9. (8 pts) A video game manufacturer will supply 100 video games if the unit price is \$41.95. For each \$9 increase in price, they will supply an additional 50 games. What is the supply equation?

10. *Formulate but do not solve:* A small toy fire truck has 4 wheels and 2 ounces of metal, a medium one has 6 wheels and 5 ounces of metal, and a large one has 8 wheels and 8 ounces of metal. Due to the demand, the toy manufacturer will produce twice as many small fire trucks as medium and large ones together. How many fire trucks should the manufacturer produce to use up all 5780 wheels and 3790 ounces of metal in their inventory?

a. (3 pts) Define your variables.

b. (6 pts) Set up a system of equations you would use to solve this problem. Do not solve.

11. (7 pts) A simple economy consists of hunters of meat (M), gatherers of fruit (F) and sewers of hide (H). The input-output matrix is given below. Find the number of units of meat, fruit and hide *consumed internally* to meet an outside demand of 513 units of meat, 627 units of fruit, and 342 units of hide.

$$\begin{array}{c} \text{M} \quad \text{F} \quad \text{H} \\ \text{M} \begin{bmatrix} 0.4 & 0.2 & 0.1 \end{bmatrix} \\ \text{F} \begin{bmatrix} 0.3 & 0.5 & 0.2 \end{bmatrix} \\ \text{H} \begin{bmatrix} 0.1 & 0.2 & 0.6 \end{bmatrix} \end{array}$$

\_\_\_\_\_ units of meat      \_\_\_\_\_ units of fruit      \_\_\_\_\_ units of hide

12. (6 pts) Matrix  $P$  shows the number of adults and children that live in town or in the surrounding rural area. Matrix  $Q$  shows the average number of annual medical and dental visits per adult and per child.

$$P = \begin{array}{c} \text{adult} \\ \text{child} \end{array} \begin{array}{cc} \text{town} & \text{rural} \\ \begin{bmatrix} 18,500 & 1200 \\ 6400 & 500 \end{bmatrix} \end{array} \qquad Q = \begin{array}{c} \text{medical} \\ \text{dental} \end{array} \begin{array}{c} \text{adult} \text{ child} \\ \begin{bmatrix} 3 & 5 \\ 2 & 3 \end{bmatrix} \end{array}$$

Find the product matrix  $B = QP$ , and discuss the meaning of entry  $b_{12}$ , if it has meaning.

13. (7 pts) Solve the matrix equation  $2AX = X + B$  for  $X$ . Assume all matrix algebra is defined.

14. (8 pts) If  $\begin{bmatrix} a & 2 \\ -b & -3 \end{bmatrix}^T - 5 \begin{bmatrix} 1 & 4 \\ 2 & c \end{bmatrix} = \begin{bmatrix} 8 & 10 \\ d & -15 \end{bmatrix}$ , find the value of  $a$ ,  $b$ ,  $c$ , and  $d$ .

$a =$  \_\_\_\_\_,  $b =$  \_\_\_\_\_,  $c =$  \_\_\_\_\_,  $d =$  \_\_\_\_\_

15. (5 pts) Given the matrix  $\begin{bmatrix} 1 & 0 & 0 & a \\ 0 & 1 & 1 & b \\ 0 & 0 & n & c \end{bmatrix}$  that represents a system of equations, **mark all**

**true** statements.

- If  $n$  and  $c$  are both zero, the matrix is in row-reduced form, and there are an infinite number of solutions.
- If  $n = 1$ , then the matrix is in row-reduced form, and there is a unique solution.
- If  $n = 0$  and  $c \neq 0$ , the matrix is in row-reduced form, and there is no solution.
- If  $n = 0$ , and  $a$ ,  $b$ , and  $c$  are any real numbers, the matrix is in row-reduced form, and there are an infinite number of solutions.
- None of these

16. (5 pts) Solve the system of equations.

$$10x - 6y = -44$$

$$-6x + 5y = 32$$

$$3x - 2y = -14$$