AXERERA

ADDIS ABABA UNIVERSITY
SCIENCE FACULTY
DEPARTMENT OF MATHEMATICS
MATH 231: Applied Mathematics I
<u>Mid-Semester Examination</u>

Date: December 25,2005
Time: $2\frac{1}{2}$ hrs.

Name: ______________________________ I.D. No. _________________

Department: __________________________

Instructions: This examination has two parts, Part I and Part II.

Part I has 15 short answer questions worth two points each to be answered in the blank spaces following each question.

Part II, worth a total of 20 points, has four workout problems; each problem allotted the points shown against it. Show all necessary steps and write clearly in the spaces provided for each problem.

Make sure that your examination paper has **six** pages.

For Instructor's Use only

Part I	Part II				Total
	1	2	3	4	

Part I: Short Answer questions

1. If u = (1, 2, 3) and v = (4, 5, 6) then

   a) U + V = ___________ b) U – V = _____________

2. The unit vector in the direction of

   V = (-2, 1, 2) is ________________________

3. The cosine of the angle between u = i + 2j + 2k and

   v = -2i + j + 2k is ______________________

4. If u = (0, 5, 6) and v = (1, 2, 3) then proj_v^u = ___________________

5. If u = (x, -3, 1) is orthogonal to v = (1, x, 2) then x = _______________

6. If u and v are any two parallel vectors in R^3 then u × v = ____________

7. The area of the parallelogram having u = (2, -3, 4) and v = (3, 1,2) as its adjacent sides is ________________________

8. The distance of the point P(4, 2, 3) from the plane

   π: 2x + 2y – z = 3 is __________________________

9. The distance of the point P(1, 2, 3) from the line

   L : (0, 2, 1) + t(1, 2, 2), t ∈R is _____________________________

10. The coordinates of v = (4, 3) relative to the basis {(2, 1), (-1, 0)}

    are ______________________________________

11. If A and B are matrices such that det A = 8, det B = 4 and the product A^tB^{-1} is defined then det (A^tB^{-1}) = _____________________________

12. If $A = \begin{bmatrix} 1 & 9 & 1 \\ 1 & 2 & 3 \\ 0 & -1 & 1 \end{bmatrix}$ then rank A = __________________________

13. If $A = \begin{bmatrix} 4 & 2 \\ 3 & 2 \end{bmatrix}$ then A^{-1} = ______________________________

14. If $A = \begin{bmatrix} 3x & 1 & -2 \\ 3 & -2 & 1 \\ -x & -3 & 3 \end{bmatrix}$ then A is not invertible if

x = ____________________

15. If $A = 2I_3$, $B = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 2 & 4 \\ 0 & 0 & 1 \end{bmatrix}$ and $C = \begin{bmatrix} 2 & 0 & 0 \\ 5 & 1 & 0 \\ 6 & 8 & 1 \end{bmatrix}$ then

det (ABC) = ____________________________

Part II: Workout Problems

1. a) Find the distance between π_1: $2x - 2y - z = 4$ and

π_2: $-6x + 6y + 3z = 0$ (3 pts)

b) Find the point of intersection of the line L whose parametric equations are: $x = 1-2t$, $y = 3 + t$ and $z = 5 + t$, $t \in R$, with the plane π: $2x + 3y - z - 1 = 0$.

(3 pts)

2. a) If $V = \{f \backslash f: R \rightarrow R \text{ and } f(x) \leq 0 \ \forall x \in R\}$ show that V is not a vector space.

(3 pts)

b) If $V = R^2$ and $W = \{(x, y) \in V \backslash\ x + y = 0\}$ show that W is a subspace of V.

(3 pts)

3. Solve the following system of linear equations using Gaussian elimination method.

$$x + 2y - z = 6$$
$$2x - y + 4z = 2$$
$$4x + 3y - 2z = 14$$

(3 pts)

4. Solve the following system of linear equations using the method of matrix algebra

$$2x_1 + x_2 - 3x_3 = 1$$

$$3x_1 - x_2 - 4x_3 = 7$$

$$5x_1 + 2x_2 - 6x_3 = 5$$

(5 pts)