



ADDIS ABABA UNIVERSITY

DEPARTMENT OF MATHEMATICS

Thursday, January **15, 2008**Time allowed **3** hours

APPLIED MATHEMATICS I (MATH 231B)

MID EXAM

Name:			
ID:			
Instructor'	's Name:		

MAKE SURE THAT THERE ARE 10 PROBLEMS IN PART I, 6 PROBLEMS IN PART II A AND 7 PAGES INCLUDING THIS COVER PAGE.

DO **NOT** USE A CALCULATOR AND **NOT** USE YOUR OWN ROUGH PAPERS, WE WILL PROVIDE ENOUGH PAPERS.

FOR INSTRUCTORS' USE

PARTI		TOTAL					
	1	2	3	4	5	6	

PART I. WRITE YOUR SHORT AND SIMPLIFIED ANSWER ON THE SPACE PROVIDED. (1.5 points each)

1. If A = (1, -2, 3) and B = (3, 1, 2) are vectors in \mathbb{R}^3 , then find scalars x and y such that $\mathbf{C} = x\mathbf{A} + y\mathbf{B}$ is a non-zero vector with $\mathbf{C} \cdot \mathbf{B} = 0$.

- **2.** Suppose the angle between two vectors **A** and **B** in \mathbb{R}^3 be $\frac{\pi}{3}$ and $\|\mathbf{A}\| = 2$, $\|\mathbf{B}\| = 1$. If $\mathbf{C} = \mathbf{A} \times \mathbf{B}$, then $\|\mathbf{A} + \mathbf{B} - \mathbf{C}\| =$
- 3. Let A be an $n \times n$ matrix such that $A^2 = A$ and $A \neq I_n$. Then det(A) =
- **4.** Find the value(s) of λ for which $\mathbf{A} = \begin{pmatrix} \lambda 3 & 0 & 3 \\ 0 & \lambda + 2 & 0 \\ -5 & 0 & \lambda + 5 \end{pmatrix}$ is invertible.
- 5. If $f(x) = \begin{cases} 2 & , & x \le -1 \\ ax + b & , -1 < x < 3 \text{ is continuous on } \mathbf{R}, \text{ then } a = \underline{\hspace{1cm}} \text{ and } b = \underline{\hspace{1cm}}$ 6. $\lim_{x \to \infty} \sqrt{x^2 3x + 2} \sqrt{x^2 + 1} = \underline{\hspace{1cm}}$
- 7. $\lim_{x \to 0^{-}} (\sqrt{9-x} [x+1])$
- 8. Find the distance from the point (3,-2,-1) to the line x=2-3t, y=4+2t, z=3-5t t $\in \mathbb{R}$.
- **9.** Find the area of the triangle with vertices $P_1(2,-2,1)$, $P_2(-1,0,3)$ and $P_3(5,-3,4)$
- **10.** Let $f(x) = \frac{\sqrt{x+c^2}-c}{x}$ for c > 0. Find f(0) so that f is continuous on \mathbf{R} .

PART II. SHOW ALL THE NECESSARY STEPS IN THE FOLLOWING WORKOUT PROBLEMS.

1. Discuss the consistency or inconsistency and if the system is consistent find the solution set.

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

 $2x + 4y - 6z = 8$ (5 points)
 $3x + 6y - 9z = 12$

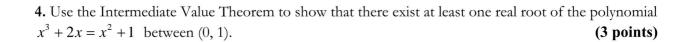
2. Find all the eigenvalues and corresponding eigenvectors of the matrix

$$\mathbf{A} = \begin{pmatrix} 1 & 0 & 1 \\ 6 & -1 & 0 \\ -1 & 0 & -1 \end{pmatrix}$$

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(5 points)

3. Prove Using the $(\varepsilon - \delta)$ definition of limit that $\lim_{x \to 2} 7x + 3 = 17$. (4 points)



5. Find the equation of the plane containing the point P(0,4,-7) and the line with parametric equation x = 1 + t, y = -3 + 2t, z = -2 - t. (4 points)

6. Find the inverse of the matrix
$$\mathbf{A} = \begin{pmatrix} 3 & -2 & 1 \\ 5 & 6 & 2 \\ 1 & 0 & -3 \end{pmatrix}$$
. (4 **points**)