MATH 302 -01 (Term 061)

Major Exam I

Monday 09 October, 2006

Time Allowed: 75 minutes

Instructor: Dr. A. Boucherif

Name: .......................................................... ID #............................
Serial #: ............

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• Write clearly.
• Show all your steps.
• No credit will be given to wrong steps.
• Do not do messy work
• Calculators are not allowed in this exam.

Mark: ______

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Q1. Let $S$ consist of all vectors parallel to the plane $2x - y + z = 0$.
   (i) Is $S$ a subspace in $\mathbb{R}^3$?
   (ii) Find a basis for $S$. 
Q2. Let $S$ consist of all vectors $(x, 0, 0, 1, 0, y) \in \mathbb{R}^6$. Is $S$ a subspace of $\mathbb{R}^6$?
Q3. Use row operations to solve the system $AX = B$, with $A = \begin{pmatrix} -6 & 1 & -4 \\ 2 & -1 & -1 \\ 1 & 6 & -1 \end{pmatrix}$

$$B = \begin{pmatrix} 1 \\ 8 \\ -3 \end{pmatrix} \quad \text{and} \quad X = \begin{pmatrix} x \\ y \\ z \end{pmatrix}$$.
Q4. Find the eigenvalues and eigenvectors of the matrix

\[ A = \begin{pmatrix} 4 & -2 \\ -2 & 1 \end{pmatrix} \]

Find an orthogonal matrix \( Q \) that diagonalizes \( A \).