Math 2550 Matrix Algebra Exam 3 **Form D**
Dec. 4, 2014

[18] 1.) Find the characteristic equation and diagonalize $A = \begin{bmatrix} -2 & 6 \\ 6 & -18 \end{bmatrix}$

Characteristic equation of $A =$ ____________________________________.

$P =$ ______________________ $D =$ ______________________ $P^{-1} =$ ______________________.

[16] 2.) Use Gram-Schmidt to find the QR factorization of $M = \begin{bmatrix} 6 & 3 \\ 6 & 0 \\ 3 & 3 \end{bmatrix}$.

$Q =$ ________________________ $R =$ ________________________

Part 2: Multiple Choice (multiple choice problems are worth 6 points each).

Problem 1. The eigenspace corresponding to a particular eigenvalue of A contains an infinite number of vectors.

- A. True
- B. False

Problem 2. Let $A = \begin{bmatrix} -1 & -7 & -6 \\ 0 & 7 & -8 \\ 0 & 0 & -1 \end{bmatrix}$. Is A = diagonalizable?

- A. yes
- B. no
- C. none of the above

Problem 3. Suppose $A \begin{bmatrix} 4 \\ -2 \\ -1 \end{bmatrix} = \begin{bmatrix} -16 \\ 8 \\ 4 \end{bmatrix}$. Then an eigenvalue of A is

- A. -4
- B. -3
- C. -2
- D. -1
- E. 0
- F. 1
- G. 2
- H. 3
- I. 4
- J. none of the above

Problem 4. 0 is an eigenvalue of A if and only if $\det(A) = 0$

- A. True
- B. False

Problem 5. If the characteristic polynomial of $A = (\lambda+1)^9(\lambda-5)^2(\lambda+2)^3$, then the algebraic multiplicity of $\lambda = 5$ is

- A. 0
- B. 1
- C. 2
- D. 3
- E. 0 or 1
- F. 0 or 2
- G. 1 or 2
- H. 0, 1, or 2
- I. 0, 1, 2, or 3
- J. none of the above

Problem 6. Suppose $A = PDP^{-1}$ where D is a diagonal matrix. Suppose also the d_{ii} are the diagonal entries of D. If $P = [\ \vec{p}_1\ \vec{p}_2\ \vec{p}_3\ ]$ and $d_{11} = d_{22}$, then $4\vec{p}_1 + 3\vec{p}_2$ is an eigenvector of A

- A. True
- B. False

Problem 7. Let $A = \begin{bmatrix} 3 & -1 & -6 \\ 0 & 5 & 12 \\ 0 & 0 & 3 \end{bmatrix}$. Is A = diagonalizable?

- A. yes
- B. no
- C. none of the above

Problem 8.
If the characteristic polynomial of $A = (\lambda-8)^3(\lambda+8)(\lambda+1)^3$, then the geometric multiplicity of $\lambda = -8$ is

- A. -4
- B. -3
- C. -2
- D. -1
- E. 0
- F. 1
- G. 2
- H. 3
- I. 4
- J. none of the above

Problem 9. If x is not in a subspace W, then $x - \text{proj}_W(x)$ is not zero.

- A. True
- B. False

Problem 10. If A is symmetric, then A is diagonalizable.

- A. True
- B. False

Problem 11. Suppose the orthogonal projection of $\begin{bmatrix} -147 \\ 3 \\ 9 \end{bmatrix}$ onto $\begin{bmatrix} 1 \\ -5 \\ 4 \end{bmatrix}$ is (z_1, z_2, z_3). Then z_1 =

- A. -4
- B. -3
- C. -2
- D. -1
- E. 0
- F. 1
- G. 2
- H. 3
- I. 4
- J. none of the above