Problem 1.
The determinant of A where,

$$A = \begin{bmatrix} 3 & -4 & 2 \\ 2 & -3 & -1 \\ 1 & 2 & -4 \end{bmatrix}$$

is closest to:

- ◯ A. 0
- ◯ B. 28
- ◯ C. 1
- ◯ D. 42
- ◯ E. 24

Answer:

Problem 2.
Consider the proposition:

A 2×2 matrix is diagonalizable if and only if its eigenvalues are real.

Which statement is most correct?

- ◯ A. The proposition is True only if the eigenvalues are all greater than zero
- ◯ B. The proposition is False. You also need the algebraic dimension equal to the geometric dimension
- ◯ C. The proposition is False. You also need the matrix to be symetric
- ◯ D. The proposition is False. You also need the matrix to be orthogonal
- ◯ E. The proposition is True for 2×2 matrices but not in general

Answer:

Problem 3.
Let T be the transformation of 2 by 2 real symmetric matrices defined by:

$$\begin{bmatrix} a & b \\ b & c \end{bmatrix} \mapsto \begin{bmatrix} c & -b \\ -b & a \end{bmatrix}$$

Then wich of the following statements is **NOT** true?

- ◯ A. $T^{-1} = T$
- ◯ B. The space of 2 by 2 real symmetric matrices with only zeros in the main diagonal is an eigenspace of T
- ◯ C. $\det(T) = -1$
- ◯ D. $\lambda = 2$ is an eigen value of T
- ◯ E. T is linear

Answer:

Problem 4.
Consider the matrix,

$$A = \begin{bmatrix} 1/8 & -5/8\sqrt{3} \\ -5/8\sqrt{3} & \frac{11}{8} \end{bmatrix}$$

Which of the following transformations of the coordinate axis will make the matrix A diagonal?

- ◯ A. rotation in -60 degrees ccw
- ◯ B. rotation in 60 degrees ccw
- ◯ C. rotation in 30 degrees ccw
- ◯ D. rotation in -30 degrees ccw
- ◯ E. rotation in 45 degrees ccw

Answer:

Problem 5.
Let

$$A = \begin{bmatrix} 2 & 0 & 0 \\ 1 & 0 & 0 \\ 3 & 2 & 1 \end{bmatrix}$$

The eigenvalues of A^{10} are

- ◯ A. 1000, 274, 1
- ◯ B. 0,0,0
- ◯ C. 2,0,1
- ◯ D. 1024, 0, 1
- ◯ E. 30, 20, 10

Answer:

Problem 6.
For what values of x is the determinant of the matrix,

$$\begin{bmatrix} x & -3 & 2 \\ 0 & x & -x \\ x & -9 & 9 \end{bmatrix}$$

equal to one?

- ◯ A. $x = 9$ or $x = -9$
- ◯ B. $x = 2$
- ◯ C. x can be any integer
- ◯ D. $x = 0$
- ◯ E. $x = -1$ or $x = 1$

Answer:

Problem 7.
Consider the matrix,

$$A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 0 & 1 & 1 \end{bmatrix}$$

Which of the following statements is false?

- ◯ A. A is singular
- ◯ B. $(0, -1, 1)$ is an eigenvector of A
- ◯ C. A has three different eigenvalues
- ◯ D. $\lambda = 1$ is an eigenvalue of A
- ◯ E. $(1, -1, 0)$ is an eigenvector of A

Answer:

Problem 8.
Consider the following matrices:

$$\begin{bmatrix} 0 & 0 & 0 & 2 \\ 0 & 0 & 1 & 0 \\ 0 & 4 & 0 & 0 \\ 3 & 0 & 0 & 0 \end{bmatrix} \quad \begin{bmatrix} 0 & 0 & 0 & -3 & 0 \\ 0 & 0 & 0 & 0 & 2 \\ 0 & 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 \\ 0 & 4 & 0 & 0 & 0 \end{bmatrix} \quad \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & -3 & 0 & 0 & 0 & 0 \\ 0 & 0 & 2 & 0 & 0 & 0 \\ 0 & 0 & 0 & 4 & 0 & 0 \\ 0 & 0 & 0 & 0 & 2 & 1 \\ 0 & 0 & 0 & 0 & 3 & 1 \end{bmatrix}$$

Their determinants are:

- ◯ A. -24, 24, -24
- ◯ B. 24, 24, -24
- ◯ C. 24, 24, 24
- ◯ D. 24, -24, 24
- ◯ E. -24, -24, -24

Answer:

Problem 9.
The following matrix A has $\lambda = 2$ and $\lambda = 8$ as its eigenvalues:

$$A = \begin{bmatrix} 4 & 2 & 2 \\ 2 & 4 & 2 \\ 2 & 2 & 4 \end{bmatrix}$$

Let P be the orthogonal matrix that diagonalizes A. In other words $A = PDP^T$. You can check that,

$$P = \begin{bmatrix} -\frac{\sqrt{2}}{2} & -\frac{\sqrt{6}}{6} & \frac{\sqrt{3}}{3} \\ \frac{\sqrt{2}}{2} & -\frac{\sqrt{6}}{6} & \frac{\sqrt{3}}{3} \\ 0 & \frac{\sqrt{6}}{3} & \frac{\sqrt{3}}{3} \end{bmatrix}$$

Then the linear space of eigenvectors associated to the eigenvalue $\lambda = 2$ is generated by:

- ◯ A. the last two rows of the matrix P
- ◯ B. the last column of the matrix P
- ◯ C. the last two columns of the matrix P
- ◯ D. the first two rows of the matrix P
- ◯ E. the first two columns of the matrix P

Answer:

EXAM

FORM 421501
MAT220 Spring 2015. Exam 4

Section # 2150.

May 5, 2015

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Good Luck!