

- A scantron is provided with this test. Fill in your ID information on the scantron now. Do not fold, staple or tear, etc., the scantron.
- This test consists of multiple-choice problems. Fill in the answers to the problems on the scantron. Return only the scantron. You may keep the test.
- Depending on your solution methods your answers may appear in a different form from the ones provided on the test. You are expected to be able to provide the appropriate manipulations to identify the correct answer.
- You may use one 8.5 × 11 inch note sheet prepared in advance. Note sheets may not be shared. If you do not bring a note sheet you will have to do without any help notes. You may not use any books, notebooks, additional note sheets nor note cards.
- You may use a simple scientific calculator or a modest graphics calculator on this test and you are expected to have one available. An overly elaborate calculator, laptop, handheld or notebook computer, or any device capable of extensive symbolic manipulation (other than your own brain) will not be allowed. Calculators and other equipment may not be shared.
- During the test be sure to check the board occasionally for corrections. Note $\log(x)$, $\ln(x)$ or $\log_e(x)$ means the natural logarithm of x . I will use $\log_{10}(x)$ to denote the logarithm base 10 of x .
- There are 9 multiple-choice problems worth 12 points each. The total number of points is 108 points.

Problem 1. Simplify

$$(1 + 8i) \frac{3 + 2i}{-1 + 2i}$$

- A.)** $-13 + 26i$ **B.)** $(1 - 8i)/3$
C.) $-(39 + 53i)$ **D.)** 13 **E.)** None of the foregoing.

←Mark your answer here and on the scantron.

(Problem 1).

Problem 2. Find all values of t for which the matrix

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

is invertible?

- A.)** $t \neq 2$ **B.)** $t \neq -3$
C.) all t **D.)** no t **E.)** None of the foregoing.

←Mark your answer here and on the scantron.

(Problem 2).

Problem 3. Find all values of t for which the matrix

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

is invertible?

- A.)** $t \neq 2$ **B.)** $t \neq -3$
C.) all t **D.)** no t **E.)** None of the foregoing.

←Mark your answer here and on the scantron.

(Problem 3).

Problem 4. The system of linear equations

$$\begin{bmatrix} -3 & 1 & -1 \\ 2 & 2 & 1 \\ 1 & 5 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 3 \\ 2 \\ -1 \end{bmatrix}$$

has

- A.)** no solutions **B.)** exactly one solution
C.) exactly a one parameter solution space **D.)** exactly a two parameter solution space
E.) None of the foregoing.

←Mark your answer here and on the scantron.

(Problem 4).

Problem 5. The system of linear equations

$$\begin{bmatrix} -3 & 1 & -1 \\ 2 & 2 & 1 \\ 1 & 5 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 3 \\ 2 \\ 7 \end{bmatrix}$$

has

- A.)** no solutions **B.)** exactly one solution
C.) exactly a one parameter solution space **D.)** exactly a two parameter solution space
E.) None of the foregoing.

←Mark your answer here and on the scantron.

(Problem 5).

Problem 6. Let

$$A = \begin{bmatrix} 2 & 1 & 0 \\ -1 & 1 & 1 \\ 1 & 2 & 2 \end{bmatrix}, \quad B = \begin{bmatrix} -1 & 1 & 1 \\ -1 & 1 & 1 \\ 1 & 2 & 1 \end{bmatrix}, \quad C = AB - BA.$$

Compute the trace of C , $\text{tr}(C) = c_{11} + c_{22} + c_{33}$.

- A.)** 0 **B.)** 1
C.) 3 **D.)** 5 **E.)** None of the foregoing.

←Mark your answer here and on the scantron.

(Problem 6).

Problem 7. Let

$$B = \begin{bmatrix} 0 & 1 & 1 \\ 1 & -1 & 1 \\ 1 & 1 & 0 \end{bmatrix}.$$

Solve the equation $A(I + B^2) = 8B$ for A . If the entries in A are a_{ij} as usual, then $a_{22} =$

- A.)** -1 **B.)** -2
C.) -3 **D.)** -4 **E.)** None of the foregoing.

←Mark your answer here and on the scantron.

(Problem 7).

Problem 8. Let $T : \mathbb{R}^3 \rightarrow \mathbb{R}^3$ be the linear transformation defined by

$$T \left(\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} \right) = \begin{bmatrix} x_1 + x_2 \\ x_2 + x_3 \\ x_3 + x_1 \end{bmatrix}$$

and let A be the matrix of T . Compute the determinant $\det(A)$ of A .

- A.)** -2 **B.)** -1
C.) 1 **D.)** 2 **E.)** None of the foregoing.

←Mark your answer here and on the scantron.

(Problem 8).

Problem 9. Any four vectors in \mathbb{R}^3

- A.)** span \mathbb{R}^3 **B.)** do not span \mathbb{R}^3
C.) are linearly dependent **D.)** are linearly independent **E.)** None of the foregoing.

←Mark your answer here and on the scantron.

(Problem 9).

Use the backs of the test pages for scratch work.