

HOMEWORK 7 - MATH 111

DUE DATE: Monday, November 15

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Read each problem very carefully before starting to solve it. Each question is worth 1 point. It is necessary to show your work. Correct answers without explanations are worth 0 points.

GOOD LUCK!!

1. Perform the following multiplications:

$$\begin{bmatrix} 3 & 2 & -1 \\ 3 & 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} 0 & 2 \\ -1 & 4 \\ 0 & 2 \end{bmatrix}, \quad \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix} \cdot \begin{bmatrix} -1 & 5 \\ 7 & 0 \\ 1 & 2 \end{bmatrix}$$

2. Check whether the following pairs of matrices are inverses of each other by computing their products.

$$\begin{bmatrix} 1 & 1 \\ \frac{1}{10} & \frac{2}{10} \end{bmatrix} \text{ and } \begin{bmatrix} 2 & -10 \\ -1 & 10 \end{bmatrix}, \quad \begin{bmatrix} 2 & 5 & 4 \\ 1 & 4 & 3 \\ 1 & 3 & 2 \end{bmatrix} \text{ and } \begin{bmatrix} 1 & 2 & 1 \\ -5 & 8 & 2 \\ 7 & -11 & -3 \end{bmatrix}$$

3. Find the inverse of the following 2×2 matrix by using both methods: $\begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$.

4. Find the inverse of the following 3×3 matrix $\begin{bmatrix} 5 & 0 & 2 \\ 2 & 2 & 1 \\ -3 & 1 & -1 \end{bmatrix}$.

5. Use the inverse matrix method to solve the system of equations

$$\begin{cases} x + y - 3z = 4 \\ 2x + 4y - 4z = 8 \\ -x + y + 4z = -3 \end{cases}$$

6. A simplified economy is based on agriculture, manufacturing and transportation. Each unit of agriculture output requires .4 units of its own output, .3 units of manufacturing and .2 units of transportation output. One unit of manufacturing output requires .4 units of its own output, .2 units of agricultural, and .3 units of transportation output. One unit of transportation output requires .4 units of its own output, .1 unit of agricultural and .2 units of manufacturing output. There is demand for 35 units of agricultural, 90 units of manufacturing and 20 units of transportation output. How many units should each segment of the economy produce?

7. Write true or false for the following statements:

- (a) $\emptyset \subseteq \{1, 2, 3, 4, 5\}$
- (b) $\emptyset \in \{1, 2, 3, 4, 5\}$
- (c) $\emptyset \in \{\{\emptyset\}, \{\emptyset, \{\emptyset\}\}$
- (d) $\emptyset \in \{\emptyset, \{\emptyset\}\}$

8. Suppose that the universe $U = \{1, 2, \dots, 10\}$. Let $X = \{2, 3, 4, 5\}$, $Y = \{3, 5, 7, 9\}$ and $Z = \{2, 4, 5, 7, 9\}$. Compute the following sets

$$X \cap Y, Y \cup Z, X' \cap Z, Y \cap (X \cup Z)$$