

Chapter 9: Matrices and Determinants

Section 9.1: Matrices and Systems of Equations

Key Topics: matrix, augmented matrix, elementary row operations, row echelon forms, Gaussian Elimination, Gauss-Jordan Elimination

Matrix

A **matrix** is a rectangular _____ of numbers.

$$A = \begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & \vdots & \cdots & \vdots \\ a_{m1} & a_{m2} & \cdots & a_{mn} \end{bmatrix} \begin{array}{l} \leftarrow \text{Row 1} \\ \leftarrow \text{Row 2} \\ \leftarrow \text{Row } m \end{array}$$

$$\begin{array}{ccc} \uparrow & \uparrow & \uparrow \\ \text{Column 1} & \text{Column 2} & \text{Column } n \end{array}$$

If a matrix A has m rows and n columns, then we say that A is of _____ (written _____).

Write the augmented matrix of the linear system $\begin{cases} 2x + 6y = 9 \\ 5y - z = -5 \\ 3z + 2x = 6 \end{cases}$

ELEMENTARY ROW OPERATIONS

Row Operation	In Symbols	Description
1. _____ two rows.	_____	Interchange the i th and j th rows.
2. _____ a row by a _____ constant.	_____	Multiply the j th row by c , $c \neq 0$.
3. _____ a multiple of one row to another row.	_____	Replace the j th row by adding c times the i th row to it.

ROW-ECHELON FORM AND REDUCED ROW-ECHELON FORM

An $m \times n$ matrix is in **row-echelon form** if it has the following three properties:

1. The _____ entry of each _____ row is ____.
2. The _____ entry in any row is to the _____ of the leading entry in the row above it.
3. _____ nonzero rows are _____ the rows consisting _____ of zeros.

A matrix in row-echelon form having the following property is in _____
 _____ Each leading 1 is the _____ nonzero entry in its column.

Solving Linear Systems by Using Gaussian Elimination**OBJECTIVE**

Solve a system of linear equations by Gaussian elimination.

List the four steps of Gaussian Elimination.

Step 1 _____

Step 2 _____

Step 3 _____

Step 4 _____

Solve the system of equations
$$\begin{cases} x - y + 2z = 12 & (1) \\ -2x + y + z = -11 & (2) \\ 3x + 2y + z = 11 & (3) \end{cases}$$

Gauss–Jordan Elimination

If we _____ the Gaussian elimination procedure until we have a _____ row-echelon form, the procedure is called **Gauss–Jordan elimination**.

Continue your previous work to Gauss-Jordan form.