

Section 9.2 Operations with Matrices

Objective: In this lesson you learned how to add, subtract, and multiply two matrices, and multiply a matrix by a real number.

Course Number

Instructor

Date

Important Vocabulary

Define each term or concept.

Scalar multiple

Zero matrix

Additive identity

Matrix multiplication

Identity matrix of order n

I. Equality of Matrices (Page 645)

Name three ways that a matrix may be represented.

- 1)
- 2)
- 3)

Two matrices are equal if they have the same order and _____ are equal.

What you should learn

How to decide whether two matrices are equal

II. Matrix Addition and Scalar Multiplication

(Pages 646–649)

To add two matrices of the same order, . . .

To multiply a matrix A by a scalar c , . . .

What you should learn

How to add and subtract matrices and multiply matrices by real numbers

Example 1: Let $A = \begin{bmatrix} 2 & 5 \\ -3 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} -1 & 4 \\ 2 & -5 \end{bmatrix}$.

Find (a) $A + B$ and (b) $-2B$

Let A , B , and C be $m \times n$ matrices and let c and d be scalars. Give an example of each of the following properties of matrix addition and scalar multiplication:

- 1) Commutative Property of Matrix Addition: _____
- 2) Associative Property of Matrix Addition: _____
- 3) Associative Property of Scalar Multiplication: _____
- 4) Scalar Identity: _____
- 5) Distributive Property (two forms): _____

If A is an $m \times n$ matrix and O is the $m \times n$ zero matrix, then

$A + O =$ _____.

III. Matrix Multiplication (Pages 650–652)

When multiplying an $m \times n$ matrix A by an $n \times p$ matrix B , to obtain the entry in the i th row and j th column of AB , . . .

What you should learn
How to multiply two matrices

Example 2: If A is a 3×5 matrix and B is a 6×3 matrix, find the order, if possible, of the product (a) AB , and (b) BA .

Example 3: Find the product AB , if

$$A = \begin{bmatrix} 2 & -1 & 7 \\ 0 & 6 & -3 \end{bmatrix} \quad \text{and} \quad B = \begin{bmatrix} 0 \\ -2 \\ 3 \end{bmatrix}$$

List four properties of Matrix Multiplication:

If A is an $n \times n$ matrix, the identity matrix I of order n has the property that _____ and _____.

IV. Applications of Matrix Operations (Pages 653–654)

Matrix multiplication can be used to represent a system of linear equations. The system

$$\begin{cases} a_{11}x_1 + a_{12}x_2 + a_{13}x_3 = b_1 \\ a_{21}x_1 + a_{22}x_2 + a_{23}x_3 = b_2 \\ a_{31}x_1 + a_{32}x_2 + a_{33}x_3 = b_3 \end{cases}$$

can be written as the matrix equation _____, where A is the coefficient matrix of the system and X and B are column matrices.

What you should learn
How to use matrix operations to model and solve real-life problems

Example 4: Consider the following system of linear equations.

$$\begin{cases} 2x_1 - x_2 + 3x_3 = -11 \\ x_1 - 3x_3 = -1 \\ -x_1 + 4x_2 + 2x_3 = 2 \end{cases}$$

Write this system as a matrix equation $AX = B$, and then use Gauss-Jordan elimination on the augmented matrix $[A : B]$ to solve for the matrix X .

Additional notes**Homework Assignment**

Page(s)

Exercises