

Addition, Multiplication and Scalar Multiplication of Matrices

Exercises

1. Give an example of two matrices A and B for which AB is defined but not BA .
2. Suppose $A \in \mathbb{R}^{m \times n}$ and $B \in \mathbb{R}^{p \times q}$. We know that AB is defined if and only if $n = p$. Suppose also this is the case, what are the dimensions of AB ?
3. Find B if $2A - 3B + C = 0$, where

$$A = \begin{bmatrix} -1 & 3 \\ 0 & 0 \end{bmatrix} \quad \text{and} \quad C = \begin{bmatrix} -2 & -1 \\ -1 & 1 \end{bmatrix}.$$

4. Show that $AB \neq BA$, where

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

Addition, Multiplication and Scalar Multiplication of Matrices

Problems (not for submission)

1. Suppose $A \in \mathbb{R}^{m \times n}$ is such that $A + B = B$ for every $B \in \mathbb{R}^{m \times n}$. Find A .
2. A matrix $A \in \mathbb{R}^{m \times n}$ is said to be a *zero matrix* if all of its entries are zero. If $B \in \mathbb{R}^{m \times n}$, what is $A + B$? $B + A$?
3. Recall that if $x, y \in \mathbb{R}$ are such that $xy = 0$, then either $x = 0$ or $y = 0$. However, matrix multiplication does not have this property. Give an example of two nonzero matrices A and B such that AB is a zero matrix.
4. Textbook problems: 3.2.43 to 3.2.46.
5. Read about the *identity matrix* on p.233 of the textbook.
6. Show what $AB \neq BA$, where

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

7. Solve for x, y, z and w :

$$\begin{bmatrix} x & 4 \\ 4y & w \end{bmatrix} - \begin{bmatrix} 4x & 2z \\ -3 & -2w \end{bmatrix} = \begin{bmatrix} 12 & 8 \\ y & 6 \end{bmatrix}.$$

8. Rewrite the matrix equation the following matrix equation as a linear system of linear equations:

$$\begin{bmatrix} 3 & 1 & 0 \\ 2 & -2 & 1 \\ 1 & 1 & 2 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 4 \\ 9 \\ 2 \end{bmatrix}.$$

Solve the system in matrix notation.

9. Textbook problems: 3.3.3 to 3.3.10, 3.3.22, 3.3.26, 3.3.38, and 3.3.45.