Matrics AssismentQ.4) If A = [1 5 ; 4 6] And B = [8 2 ; 0 4] Then Find BA.

Matrics AssismentQ.4) If A = [1 5 ; 4 6] And B = [8 2 ; 0 4] Then Find BA.

Understanding matrix operations is fundamental in linear algebra, and this question provides an excellent opportunity to explore matrix multiplication, particularly focusing on the product BA where matrices A and B are given. In this article, we will delve into the step-by-step process of matrix multiplication, the properties involved, and the detailed calculation to find BA. Whether you're a student preparing for exams or a professional looking to refresh your knowledge, this comprehensive guide will help you understand and perform matrix multiplication effectively.

Introduction to Matrices and Matrix Multiplication

Matrices are rectangular arrays of numbers arranged in rows and columns, essential in various fields such as engineering, physics, computer science, and mathematics. Matrix multiplication is a core operation that combines two matrices to produce a third matrix, often representing transformations, systems of equations, or data transformations.

Key concepts:

- Matrix Dimensions: The size of a matrix is expressed as rows x columns. For example, A is a 2x2 matrix, as it has 2 rows and 2 columns.
- Multiplication Compatibility: Two matrices can be multiplied only if the number of columns in the first matrix matches the number of rows in the second matrix.
- Product Dimensions: When multiplying an $m \times n$ matrix with an $n \times p$ matrix, the resulting matrix is $m \times p$.

In our case:

- Matrix A is 2×2.
- Matrix B is 2×2.

Since both are square matrices of the same order, their products BA and AB are both defined.

Given Matrices

Let's restate the matrices for clarity:

Matrix A:

$$A = \begin{bmatrix} 1 & 5 \\ 4 & 6 \end{bmatrix}$$

Matrix B:

$$B = \begin{bmatrix} 8 & 2 \\ 0 & 4 \end{bmatrix}$$

Our goal is to find the matrix product BA, which involves multiplying matrix B by matrix A.

Understanding Matrix Multiplication

Before calculating BA, it's crucial to understand how matrix multiplication works at the element level.

Method:

- To compute an element in row i and column j of the product matrix, take the dot product of the ith row of the first matrix with the jth column of the second matrix.

Mathematically,

$$ (BA)_{ij} = \sum_{k=1}^{n} B_{ik} \times A_{kj} $$

where:

- B_{ik} is the element in row i, column k of B.
- A_{kj} is the element in row k, column j of A.

Since both B and A are 2×2 matrices, the calculations are straightforward.

Step-by-Step Calculation of BA

Let's proceed step by step to compute BA.

Step 1: Write matrices B and A

$$ B = \begin{bmatrix} 8 & 2 \\ 0 & 4 \end{bmatrix} $$

$$ A = \begin{bmatrix} 1 & 5 \\ 4 & 6 \end{bmatrix} $$

Step 2: Calculate each element of BA

Element (1,1):

$$ (BA)_{11} = B_{11} \times A_{11} + B_{12} \times A_{21} = 8 \times 1 + 2 \times 4 = 8 + 8 = 16 $$

Element (1,2):

$$ (BA)_{12} = B_{11} \times A_{12} + B_{12} \times A_{22} = 8 \times 5 + 2 \times 6 = 40 + 12 = 52 $$

Element (2,1):

$$ (BA)_{21} = B_{21} \times A_{11} + B_{22} \times A_{21} = 0 \times 1 + 4 \times 4 = 0 + 16 = 16 $$

Element (2,2):

$$ (BA)_{22} = B_{21} \times A_{12} + B_{22} \times A_{22} = 0 \times 5 + 4 \times 6 = 0 + 24 = 24 $$

Step 3: Write the resulting matrix

$$ BA = \begin{bmatrix} 16 & 52 \\ 16 & 24 \end{bmatrix} $$

This is the product of matrices B and A, specifically BA.

Properties and Observations

- Non-commutativity: Matrix multiplication is generally not commutative, meaning that $BA \neq AB$ in most cases. To verify this, one could compute AB separately and compare.
- Symmetry: The resulting matrix BA is not symmetric, indicating the order of multiplication affects the result.
- Applications: Such matrix products are used in transformation matrices, systems of linear equations, and computer graphics.

Verification: Calculating AB for Comparison

To appreciate the non-commutative nature, let's briefly compute AB:

$$ A = \begin{bmatrix} 1 & 5 \\ 4 & 6 \end{bmatrix} $$

$$ B = \begin{bmatrix} 8 & 2 \\ 0 & 4 \end{bmatrix} $$

Calculate AB:

- (1,1): $1 \times 8 + 5 \times 0 = 8 + 0 = 8$
- (1,2): $1 \times 2 + 5 \times 4 = 2 + 20 = 22$
- (2,1): $4 \times 8 + 6 \times 0 = 32 + 0 = 32$
- (2,2): $4 \times 2 + 6 \times 4 = 8 + 24 = 32$

Result:

$$ AB = \begin{bmatrix} 8 & 22 \\ 32 & 32 \end{bmatrix} $$

As seen, $AB \neq BA$, reaffirming the non-commutative property of matrix multiplication.

Applications and Importance of Matrix Multiplication

Matrix multiplication is fundamental in numerous fields:

- Computer Graphics: Transforming images and objects using transformation matrices.
- Engineering: Solving systems of linear equations.
- Data Science: Data transformations and operations in machine learning algorithms.
- Physics: Representing and calculating rotations and other transformations.

Understanding how to perform and interpret matrix products like BA is essential for professionals and students working with complex systems.

Summary and Key Takeaways

- The matrices involved are:

$$A = \begin{bmatrix} 1 & 5 \\ 4 & 6 \end{bmatrix} \quad \text{and} \quad B = \begin{bmatrix} 8 & 2 \\ 0 & 4 \end{bmatrix}$$

- To find BA, multiply matrix B by matrix A, respecting the order.
- The calculation involves taking the dot product of rows of B with columns of A.
- The resulting matrix BA is:

$$\boxed{\begin{bmatrix} 16 & 52 \\ 16 & 24 \end{bmatrix}}$$

- Matrix multiplication is non-commutative; AB $\neq$ BA in this case.
- Mastery of matrix operations is essential for many advanced mathematical and engineering applications.

Conclusion

This comprehensive guide has walked you through the process of calculating the product BA given matrices A and B, emphasizing the importance of understanding the mechanics of matrix multiplication. By following the step-by-step process and recognizing the properties involved, you can confidently perform similar operations on matrices in your studies or professional work. Remember, practice is key to mastering matrix algebra, and understanding these foundational concepts will serve as a building block for more advanced topics in linear algebra and related fields.

Keywords: matrix multiplication, matrices A and B, BA calculation, linear algebra, matrix properties, matrix operations, matrix product, matrix algebra tutorial, non-commutativity of matrices, how to multiply matrices

Frequently Asked Questions

What are the matrices A and B given in the problem?

Matrix A is [[1, 5], [4, 6]] and Matrix B is [[8, 2], [0, 4]].

How do you find the product BA of matrices B and A?

To find BA, multiply matrix B by matrix A in that order, performing the matrix multiplication accordingly.

What is the dimension of matrices A and B?

Both A and B are 2x2 matrices, so their dimensions are 2x2.

What is the first step in calculating BA?

First, write matrices B and A and set up the multiplication BA, which involves taking the dot product of rows of B with columns of A.

What is the resulting matrix BA after multiplication?

The resulting matrix BA is [[81 + 24, 85 + 26], [01 + 44, 05 + 46]] which simplifies to [[8 + 8, 40 + 12], [0 + 16, 0 + 24]] = [[16, 52], [16, 24]].

Is matrix multiplication commutative?

No, matrix multiplication is generally not commutative, so BA is not necessarily equal to AB.

What is the final answer for the matrix BA?

The matrix BA is [[16, 52], [16, 24]].

Additional Resources

Matrix Multiplication: An In-Depth Exploration of the Product BA with Matrices A and B

Introduction

In the realm of linear algebra, matrices serve as fundamental building blocks for numerous applications across engineering, computer science, physics, and mathematics. Understanding how matrices interact through operations such as multiplication is essential for solving complex problems – from transformations in graphics programming to solving systems of equations.

One common task involves multiplying matrices in specific orders, which can dramatically change the result and have practical implications. In this article, we will perform an in-depth analysis of the multiplication of two matrices, A and B, specifically focusing on calculating BA given:

$$
A = \begin{bmatrix} 1 & 5 \\ 4 & 6 \end{bmatrix}
$$

$$
B = \begin{bmatrix} 8 & 2 \\ 0 & 4 \end{bmatrix}
$$

Our goal is to understand each step thoroughly, explore the properties involved, and examine the significance of matrix multiplication order.

Understanding the Matrices

Before diving into the multiplication, let's analyze the matrices involved:

Matrix A

$$
A = \begin{bmatrix} 1 & 5 \\ 4 & 6 \end{bmatrix}
$$

- Dimensions: 2 rows × 2 columns
- Elements:
- First row: 1, 5
- Second row: 4, 6

Matrix B

$$
B = \begin{bmatrix} 8 & 2 \\ 0 & 4 \end{bmatrix}
$$

- Dimensions: 2 rows × 2 columns
- Elements:
- First row: 8, 2
- Second row: 0, 4

Both matrices are square matrices of size 2×2, which simplifies their multiplication due to the uniformity of dimensions.

Matrix Multiplication: Theoretical Foundations

What is Matrix Multiplication?

Matrix multiplication combines two matrices to produce a third matrix. For matrices M (of size $m \times n$) and N (of size $n \times p$), their product MN is an $m \times p$ matrix.

The element at position (i, j) in the resulting matrix is computed as:

$$
(MN)_{i,j} = \sum_{k=1}^{n} M_{i,k} \times N_{k,j}
$$

This means for each element, we take the i^{th} row of the first matrix and the j^{th} column of the second, multiply corresponding elements, and sum the products.

Non-commutativity of Matrix Multiplication

An important property of matrices is that multiplication is generally not commutative:

$$
AB \neq BA
$$

The order of multiplication affects the result, which is crucial for understanding the significance of computing BA specifically.

Calculating BA: Step-by-Step Breakdown

Given matrices B and A, both 2×2, we will calculate:

$$
BA = B \times A
$$

\]

Step 1: Confirm Compatibility

Since both are 2×2 matrices, the multiplication BA is valid, and the resulting matrix will also be 2×2.

Step 2: Apply the Matrix Multiplication Formula

The resulting matrix BA will have elements:

$$
(BA)_{i,j} = \sum_{k=1}^{2} B_{i,k} \times A_{k,j}
$$

for $i, j \in \{1, 2\}$.

Step 3: Calculate Each Element of BA

Let's compute each element explicitly.

Element at (1,1):

$$
(BA)_{1,1} = B_{1,1} \times A_{1,1} + B_{1,2} \times A_{2,1}
$$

$$
= 8 \times 1 + 2 \times 4 = 8 + 8 = 16
$$

Element at (1,2):

$$
(BA)_{1,2} = B_{1,1} \times A_{1,2} + B_{1,2} \times A_{2,2}
$$

$$
= 8 \times 5 + 2 \times 6 = 40 + 12 = 52
$$

Element at (2,1):

$$
(BA)_{2,1} = B_{2,1} \times A_{1,1} + B_{2,2} \times A_{2,1}
$$

$$
= 0 \times 1 + 4 \times 4 = 0 + 16 = 16
$$

Element at (2,2):

$$
(BA)_{2,2} = B_{2,1} \times A_{1,2} + B_{2,2} \times A_{2,2}
$$

$$
= 0 \times 5 + 4 \times 6 = 0 + 24 = 24
$$

Step 4: Assemble the Resulting Matrix

Combining the computed elements, we get:

$$
BA = \begin{bmatrix}
16 & 52 \\
16 & 24
\end{bmatrix}
$$

Significance of the Result

Structural Insights

The product matrix:

$$
BA = \begin{bmatrix} 16 & 52 \\ 16 & 24 \end{bmatrix}
$$

inherits specific properties from matrices B and A:

- Non-symmetric: The matrix is not symmetric, highlighting the importance of multiplication order.
- Element-wise analysis:
- The top row combines the first row of B with the columns of A.
- The bottom row combines the second row of B with the columns of A.

Practical Implications

In applications, such as transformations in graphics or systems modeling:

- Order matters: The difference between AB and BA can lead to very different transformations.

- Matrix properties: Understanding how the entries interact helps in optimizing computations, especially in large-scale problems.

Additional Considerations

Computing AB

For completeness, it's instructive to compute AB as well, to compare with BA.

$$
AB = A \times B
$$

Calculations:

- $(AB)_{1,1} = 1 \times 8 + 5 \times 0 = 8 + 0 = 8$
- $(AB)_{1,2} = 1 \times 2 + 5 \times 4 = 2 + 20 = 22$
- $(AB)_{2,1} = 4 \times 8 + 6 \times 0 = 32 + 0 = 32$
- $(AB)_{2,2} = 4 \times 2 + 6 \times 4 = 8 + 24 = 32$

Result:

$$
AB = \begin{bmatrix}
8 & 22 \\
32 & 32
\end{bmatrix}
$$

This comparison:

$$
AB \neq BA
$$

illustrates the non-commutative nature vividly.

Practical Applications of Matrix Multiplication

Matrix operations like these are foundational in various fields:

- Computer Graphics: Transformation matrices for scaling, rotating, and translating objects.
- Engineering: Modeling systems of linear equations.
- Data Science: Manipulating datasets and transforming features.
- Physics: Describing state changes and coordinate transformations.

Understanding how to compute and interpret matrix products enables professionals to develop more effective algorithms and models.

Final Thoughts

The calculation of BA from matrices A and B exemplifies the elegance and complexity of linear algebra. By systematically applying the matrix multiplication rules, we uncovered not only the numerical result but also the deeper properties and implications of such operations.

This detailed exploration underscores the importance of comprehending the foundational principles behind matrix multiplication – a skill that unlocks advanced problem-solving capabilities across scientific disciplines.

Summary

- Matrices A and B are both 2×2 matrices.
- The product BA is computed by taking each row of B and multiplying it with each column of A.
- The resulting matrix is:

$$
BA = \begin{bmatrix}
16 & 52 \\
16 & 24
\end{bmatrix}
$$

- Matrix multiplication's non-commutative nature means AB and BA differ significantly.
- Understanding these operations is vital for practical applications in various technological and scientific fields.

By mastering such calculations, learners and professionals can harness the power of matrices to model, analyze, and solve complex real-world problems effectively.

Matrics Assismentq 4 If A 1 5 4 6 And B 8 2 0 4 Then Find Ba

Matrics Assismentq 4 If A 1 5 4 6 And B 8 2 0 4 Then Find Ba

Related Articles

- Karl Marx Believed That The Driving Force In Human Behavior And History Is
- Dwayne Graphed The Equation Y=10+. Which Point Does The Graph Not Pass Through?
- T/F Infrared Radiation Is Trapped Close To Our Surface By The Greenhouse Effect.

Back to Home