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5. Exploration of matrix multiplication

Exploration

2/2 points (graded)

Let A and B both be 3×3 matrices. So in particular, we can take the matrix product AB and the matrix product BA.

Let A be the matrix representing the linear transformation that rotates all vectors in \mathbb{R}^3 90 degrees counterclockwise about the positive y-axis.

$$A = egin{pmatrix} 0 & 0 & -1 \ 0 & 1 & 0 \ 1 & 0 & 0 \end{pmatrix}$$

Let B be the matrix representing the linear transformation that projects all vectors in \mathbb{R}^3 onto the xy-plane.

$$B = egin{pmatrix} 1 & 0 & 0 \ 0 & 1 & 0 \ 0 & 0 & 0 \end{pmatrix}$$

What is
$$AB \begin{pmatrix} 0 \\ 0 \\ 1 \end{pmatrix}$$

(Enter as a column vector. Separate entries using a semicolon: for example type [a; b; c] for

the column vector
$$\begin{pmatrix} a \\ b \\ c \end{pmatrix}$$
 .)

What is
$$BA egin{pmatrix} 0 \ 0 \ 1 \end{pmatrix}$$

(Enter as a column vector. Separate entries using a semicolon: for example type [a; b; c] for

the column vector
$$\begin{pmatrix} a \\ b \\ c \end{pmatrix}$$
.)

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You have used 1 of 5 attempts

1 Answers are displayed within the problem

MATLAB activity

Generate two square, random matrices $m{A}$ and $m{B}$ of the same size using <code>MATLAB</code> online.

To do this, type rand(10) for example to generate a 10x10 square matrix whose entries are random numbers between 0 and 1. You may wish to shift this by 1/2 and multiply by any number 2n to get random entries between -n and n: e.g. (rand(10)-0.5)*200.

Find AB.

Find BA.

Does AB = BA?

Conjecture based on exploration

1/1 point (graded)

In general, for two $n \times n$ matrices A and B, does AB = BA?





Solution:

Matrix multiplication is not commutative! That is $AB \neq BA$ for almost all matrices. This somewhat surprising fact makes the study of matrices even more interesting. This is often first example of a non-commutative multiplication people encounter.

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You have used 1 of 1 attempt

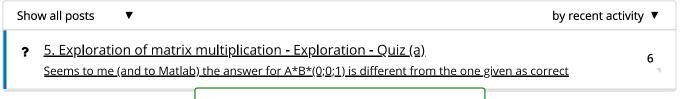
1 Answers are displayed within the problem

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