3.6 Multiplying Matrices

A MATRIX IS A RECTANGULAR ARRAY OF NUMBERS ENCLOSED IN BRACKETS. ITS DIMENSIONS ARE DESCRIBED AS ROW x COLUMN. EACH VALUE IN A MATRIX IN CALLED AN ENTRY.

RULES FOR MULTIPLYING MATRICES:

1. The number of columns in the first matrix must be the same as the number of rows in the second matrix.
2. The product of m x n and n x p is a matrix with dimensions m x p.

$A_{2X3} = \begin{bmatrix} 3 & 5 & 7 \\ 4 & 1 & 2 \end{bmatrix}$ $B_{3X4} = \begin{bmatrix} 2 & 3 & 3 & 8 \\ 9 & 5 & 2 & 0 \\ 0 & 1 & 6 & 7 \end{bmatrix}$ Dimensions of A and B: 2x3 and 3x4. Answer should be __________.

matrix notation

Determine if it is possible to multiply the following matrices. If so, determine the dimensions of the resulting matrix.

$A = \begin{bmatrix} 2 & 3 \\ 5 & 7 \end{bmatrix}$ $B = \begin{bmatrix} 4 & 6 \\ 3 & 15 \end{bmatrix}$ $C = \begin{bmatrix} 2 & 4 & 3 & 8 \\ 9 & 5 & -2 & 0 \\ 0 & 1 & -6 & 7 \end{bmatrix}$ $D = \begin{bmatrix} 4 & 6 & 5 \\ 3 & 15 & 8 \end{bmatrix}$ $E = \begin{bmatrix} 2 & 14 \\ 7 & -3 \\ 0 & 1 \end{bmatrix}$

1) AD

2x2 2x3

yes result = 2x3 matrix

2) DA

2x3 2x2

no!

3) CB

3x4 2x2

no!

4) DC

2x3 3x4 yes!

= 2x4 matrix

5) ED

3x2 2x3 yes!

result = 3x3 matrix

6) DE

2x3 3x2

yes! result = 2x2 matrix

To multiply matrices you multiply the 1st row in A by the 1st column in B! Add the sums of the products!

GIVEN:

$A = \begin{bmatrix} 0 & 4 & 9 \\ -3 & 3 & 2 \end{bmatrix}$ $B = \begin{bmatrix} 5 & 1 \\ -2 & 7 \\ 6 & 0 \end{bmatrix}$ $C = \begin{bmatrix} 11 & -1 \\ 12 & 10 \end{bmatrix}$

2x3 3x2

Find the following products, if possible.

1. AB

2x3 3x2 result = 2x2

$$\begin{bmatrix} 0 - 8 + 54 & 0 + 28 + 0 \\ -15 - 6 + 12 & -3 + 21 + 0 \end{bmatrix} = \begin{bmatrix} 46 & 28 \\ -9 & 18 \end{bmatrix}$$

2. BC

$$\begin{bmatrix} 5 & 1 \\ -2 & 7 \\ 6 & 0 \end{bmatrix} \cdot \begin{bmatrix} 11 & -1 \\ 12 & 10 \end{bmatrix} = \begin{bmatrix} 55+12 & -5+10 \\ -22+84 & 2+70 \\ 66+0 & -6+0 \end{bmatrix} = \begin{bmatrix} 67 & 5 \\ 62 & 72 \\ 66 & -6 \end{bmatrix}$$

3. CB

$$\begin{bmatrix} 11 & -1 \\ 12 & 10 \end{bmatrix} \begin{bmatrix} 5 & 1 \\ -2 & 7 \\ 6 & 0 \end{bmatrix}$$

$2 \times 2 \quad 3 \times 2$

not possible

NEED TO KNOW:

A square matrix has the same number of rows and columns. The main diagonal is the diagonal from the upper left corner to the lower right corner.

$$\begin{bmatrix} 2 & 3 \\ 9 & 12 \end{bmatrix}$$

Square matrices are the only matrices that you can raise to a power!!

$A = \begin{bmatrix} 7 & 1 \\ 2 & 0 \end{bmatrix}$ *Find* A^2

$$\begin{bmatrix} 7 & 1 \\ 2 & 0 \end{bmatrix} \cdot \begin{bmatrix} 7 & 1 \\ 2 & 0 \end{bmatrix} = \begin{bmatrix} 49+2 & 7+0 \\ 14+0 & 2+0 \end{bmatrix} = \begin{bmatrix} 51 & 7 \\ 14 & 2 \end{bmatrix}$$

$C = \begin{bmatrix} 1 & 0 & 2 \\ 4 & 9 & 5 \end{bmatrix}$ *Can you find* C^2*? Why or why not?*

not possible

$C \cdot C$

$2 \times 3 \quad 2 \times 3$

Inner dimensions don't match