Notes Section 6.5 – Properties and Applications of Matrices

Lesson Objectives

1. Addition or subtraction of matrices
2. Scalar multiplication of a matrix
3. Multiplying matrices

A. Addition or subtraction of matrices

In order to either add or subtract matrices, they must have the _____ **dimension**.

- **EXAMPLE:** Find $A + B$. [6.5.7]

$A = \begin{bmatrix} 7 & -9 \\ 8 & 0 \end{bmatrix}$ $B = \begin{bmatrix} -5 & -9 \\ 9 & -8 \end{bmatrix}$

To find $A + B$, simply add in _____ positions. $\begin{bmatrix} +(\quad) & +(\quad) \\ + & +(\quad) \end{bmatrix}$

$A + B =$

- **EXAMPLE:** Perform the matrix operation. [6.5-13]

$[-3 \quad 9 \quad 4] - [4 \quad 3]$ This is _____ _____ – they are _____ the _____ dimensions.

B. Scalar multiplication of a matrix

A _____ is like a coefficient (or "multiplier") to a matrix. It works sort of like using the distributive property – multiply _____ elements in the matrix by that scalar.

- **EXAMPLE:** If possible, use the given matrices *A* and *B* to find the following.

(a) $A + B$ **(b)** $3A$ **(c)** $4A - 3B$ [6.5.13]

$A = \begin{bmatrix} 2 & -3 & 2 \\ 1 & 4 & 7 \\ -6 & -1 & 4 \end{bmatrix}$ $B = \begin{bmatrix} -4 & 5 & 2 \\ 6 & 3 & 6 \end{bmatrix}$

(a) $\boldsymbol{A + B}$ **is** _____ because they are _____ the _____ dimensions.

(b) $3A = 3\begin{bmatrix} 2 & -3 & 2 \\ 1 & 4 & 7 \\ -6 & -1 & 4 \end{bmatrix} = \begin{bmatrix} 3 \cdot 2 & 3(-3) & 3 \cdot 2 \\ 3 \cdot 1 & 3 \cdot 4 & 3 \cdot 7 \\ 3(-6) & 3(-1) & 3 \cdot 4 \end{bmatrix} =$

NOTE: Multiplying by a scalar does _____ affect the dimensions of a matrix.

(c) $4A - 3B = 4\begin{bmatrix} 2 & -3 & 2 \\ 1 & 4 & 7 \\ -6 & -1 & 4 \end{bmatrix} - 3\begin{bmatrix} -4 & 5 & 2 \\ 6 & 3 & 6 \end{bmatrix}$

$\boldsymbol{4A - 3B}$ **is** _____ because they are _____ the _____ dimensions.

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- **EXAMPLE:** Find the following matrices where $A = \begin{bmatrix} 7 & -5 \\ 7 & -8 \\ 3 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} -2 & 5 \\ 7 & -9 \\ 6 & 5 \end{bmatrix}$.

  (we will be using graphing calculator)

  a. $A + B$ **b.** $-6A$ **c.** $-9A - 9B$ [6.5.15]

  First, you need to enter your matrices into your calculator

  1. Press **2ND**, x^{-1} (MATRIX), go to EDIT, **ENTER** for matrix [A].

  2. Enter the dimensions of matrix [A]; in this problem, it's 3 rows × 2 columns.

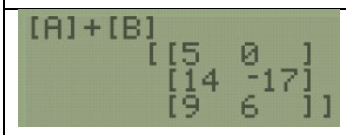
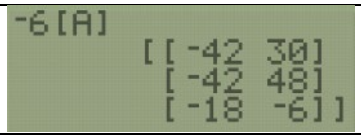
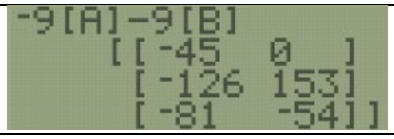
  3. Enter each of the elements of the matrix.
  4. Press **2ND**, **MODE** (QUIT).

  5. Repeat the process for matrix [B].

  Next, to call up a matrix to do a calculation:

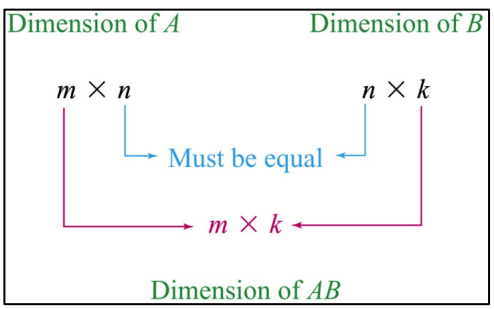
  Press **2ND**, x^{-1} (MATRIX), stay on NAMES, select your matrix, and press **ENTER**.

a. $A + B$	**b.** $-6A$	**c.** $-9A - 9B$
		
$A + B =$	$-6A =$	$-9A - 9B =$

C. Multiplying matrices – do NOT do this by hand! Use your CALCULATOR!

Multiplying matrices is different than adding or subtracting matrices in two ways:

- You _____ multiply corresponding positions like how add or subtract works.
- The two matrices _____ necessarily need to have the _____ dimensions.



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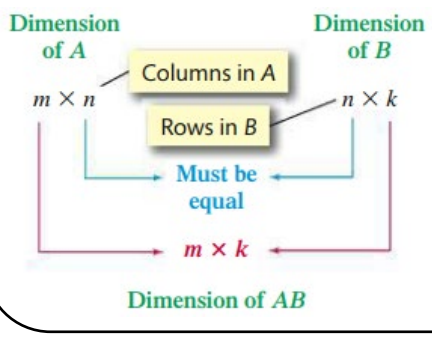
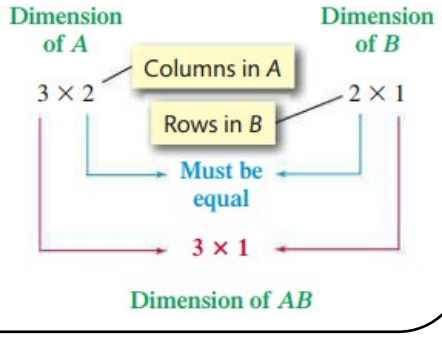
How Matrix Multiplication Works





NOTE: Do NOT do matrix multiplication _____ _____…EVER! Use _____ !!

- **EXAMPLE:** Find (if possible) **a.** AB and **b.** BA, if [6.5.31]

$$A = \begin{bmatrix} 2 & 4 \\ -4 & 4 \\ 5 & -3 \end{bmatrix}, B = \begin{bmatrix} 5 & -3 & -1 \\ -3 & 0 & -3 \end{bmatrix}$$

a. AB means [A][B] on calculator. **b.** BA means [B][A] on calculator.

First, check _____ to see if multiplication even works.

Dimension of [A] Dimension of [B] Dimension of [B] Dimension of [A]

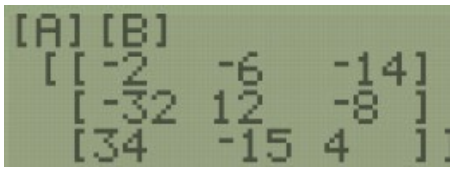
[×] [×]

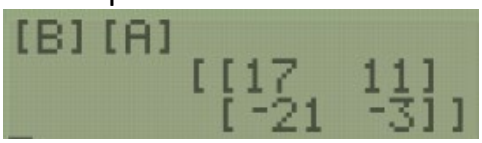
Do inside numbers match? _____ Do inside numbers match? _____

If yes, look at _____ numbers – that's dimension of product matrix.

Product matrix [A][B] will be [×] Product matrix [B][A] will be [×]

Use Calculator to find the matrix product





$AB =$

$BA =$

- **EXAMPLE:** Find the product of the following matrices, if possible. [6.5.29]

$$\begin{bmatrix} 7 & -8 & 4 \\ -6 & 0 & 8 \end{bmatrix}\begin{bmatrix} 6 & 2 & -2 \\ -8 & 9 & 7 \end{bmatrix}$$

Dimension of first matrix: [×] Dimension of second matrix: [×]

Do the inside numbers match? _____ ___ and ___

Conclusion: **The multiplication is** _____, even though they are same dimension.

Sources Used:

1. Pearson MyLab Math *College Algebra with Modeling and Visualization, 6th Edition*, Rockswold
2. Wabbitemu calculator emulator version 1.9.5.21 by Revolution Software, BootFree ©2006-2014 Ben Moody, Rom8x ©2005-2014 Andree Chea. Website https://archive.codeplex.com/?p=wabbit