Each number in a matrix is a ***matrix element***. You can identify a matrix element by its position within the matrix. Use a lowercase letter with subscripts. The subscripts represent the element's row number and column number, respectively.

For example, A = $[a_{ij}]$ = $\begin{bmatrix} 2 & 3 & -2 & 6 \\ 5 & -9 & 4 & -5 \\ -1 & 7 & 1 & 2 \end{bmatrix}$ is a _____ x _____ matrix.

Where is element a_{12}? It is in the _____ row and _____column. a_{12} =

Where is element a_{34}? It is in the _____ row and _____ column. a_{34} =

<u>Example 1:</u> Solving each matrix equation.

A) **Find 3X + A = B if**

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

B) **Find 2X - 2A =B if**

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

<u>Definition of Matrix Multiplication</u>

If *A* = [a_{ij}] is an *m x n* matrix and *B* = [b_{ij}] is an *n x p* matrix, the product *AB* is an *m x p* matrix *AB* = [c_{ij}]

$$c_{ij} = a_{i1}b_{1j} + a_{i2}b_{2j} + a_{i3}b_{3j} + \ . \ . \ . + a_{in}b_{nj}$$

Example 2: If possible, find the product and dimension of each of the following.

A) **AB=**

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

B) **AB=**

$$A=\begin{bmatrix}-1 & 6\\ -4 & 5\\ 0 & 3\end{bmatrix} \qquad B=\begin{bmatrix}2 & 3\\ 0 & 9\end{bmatrix}$$

C) **BA=**

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

D) $\mathbf{B^2}$ **=**

$$B=\begin{bmatrix}0 & -1 & 0\\ 4 & 0 & 2\\ 8 & -1 & 7\end{bmatrix}$$

Properties of Matrix Multiplication

Let *A*, *B*, and *C* be matrices and let *c* be a scalar.

1. $A(BC) = (AB)C$	**Associative Property of Matrix Multiplication**
2. $c(AB) = (cA)B = A(cB)$	**Associative Property of Scalar Multiplication**
3. $A(B + C) = AB + AC$	**Distributive Property**
4. $(A + B)C = AC + BC$	**Distributive Property**

Homework: Page 595 # 29-32 all, 33-39 odd, 47-51 odd