Matrix Math: Cheat Sheet

Identifying Matrix Sizes

The size of a matrix is the ***number of rows x number of columns***. Thus, the matrix below is a 2 x 3.

$$\begin{array}{cc} & \text{3 Columns} \\ \text{2 Rows} & \begin{bmatrix} 8 & 1 & 6 \\ 3 & 7 & 4 \end{bmatrix} \end{array}$$

If you have trouble remembering the difference between rows and columns, think of rows like church pews, which run horizontally when you look down on them. For columns, think of the columns in front of government buildings like the Supreme Court, which run vertically.

Adding Matrices

To ADD matrices, ***they must be the same size***. Add together the numbers that are in the same position within each matrix.

$$\begin{bmatrix} 8 & 1 & 6 \\ 3 & 7 & 4 \end{bmatrix} + \begin{bmatrix} 1 & 0 & -2 \\ 5 & -4 & 1 \end{bmatrix} = \begin{bmatrix} 9 & 1 & 4 \\ 8 & 3 & 5 \end{bmatrix}$$

Scalar Multiplication

This method of matrix multiplication refers to changing the scale of the matrix (hence, "scalar"). For a given matrix labeled **A**, any number placed before **A** indicates you should multiply every integer in **A** by that number, as shown below.

$$A = \begin{bmatrix} 1 & 3 \\ 4 & 2 \end{bmatrix} \qquad 2A = \begin{bmatrix} 2 & 6 \\ 8 & 2 \end{bmatrix}$$

Multiplying Matrices

To MULTIPLY matrices, ***the number of columns in the first matrix must be identical to the number of rows in the second matrix***. The size of the resulting matrix will be the number of rows in the first matrix x the number of columns in th second matrix.

Multiplication Process

1. To find the position Row 1, Column 1 in the new matrix, multiply Row 1 of the first matrix by Column 1 of the second matrix. Repeat for each position in the new matrix (for Row 1, Column 2, multiply Row 1 of the first matrix by Column 2 of the second matrix, etc.).
2. To multiply a row by a column, multiply the first integers in each then add them to the product of the second integers, then the product of the third, and so on.

• Remember: Matrix multiplication is NOT commutative, which means the order of the matrices *matters*. In the example below, if you flipped the order of the two matrices, you would end up with a 3 x 3 matrix instead of a 2 x 2.

$$\begin{bmatrix} 1 & 3 & 2 \\ 2 & -1 & 4 \end{bmatrix} \times \begin{bmatrix} 0 & 5 \\ -2 & 3 \\ 1 & 5 \end{bmatrix} = \begin{bmatrix} \boxed{-4} & 24 \\ 6 & 27 \end{bmatrix}$$

2 x 3 —— √ —— 3 x 2   2 x 2

$$(1 \times 0) + (3 \times -2) + (2 \times 1) = -4$$

Repeat for the other positions in the new 2 x 2 matrix!