Algebra 2

Lesson 4-3: Matrix Multiplication

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Scaler Multiplication:

Consider doubling the cost of movie tickets as shown below.

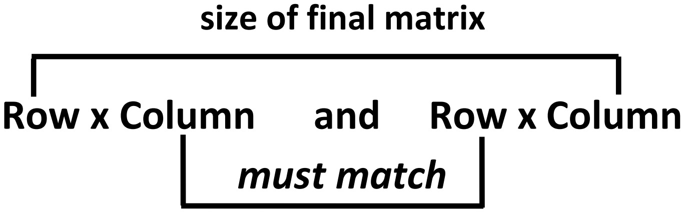
Children	\$3.50		Children	\$7.00
Adult	\$8.50	**doubles to** →	Adult	\$17.00
Sr. Citizens	\$5.50		Sr. Citizens	\$11.00

Mathematically, $2 \times [3.50 \quad 8.50 \quad 5.50\,] = [7.00 \quad 17.00 \quad 11.00]$

Notice that every entry was doubled. In general, multiplying or dividing a matrix by a constant factor is called **scaler** multiplication. The word “scaler” comes from the root word “scale.”

Example: Simplify $-3 \times \begin{bmatrix} 3 & -2 & 5 \\ 4 & 0 & -1 \end{bmatrix} = \begin{bmatrix} -9 & 6 & -15 \\ -12 & 0 & 3 \end{bmatrix}$ *(simply “distribute” the – 3 to each element in the matrix)*

Matrix multiplication is a bit more complicated. To multiply two matrices the column size of the first matrix must match the row size of the second matrix. In other words:



To multiply two matrices:

1. Check for a “match” and note the “order;” No match means no multiplication is possible
2. Multiply **first <u>row</u>** of left matrix with **first <u>column</u>** of right matrix. Now sum up all products. This becomes the element $\mathbf{e_{11}}$ in our matrix. For the element $\mathbf{e_{12}}$**,** repeat multiplication of **first row** of left matrix with **<u>second</u> column** of right matrix. Sum up products. Note the element address tells you that you will need to multiply the row 1 elements with the column 2 elements.
3. Repeat until all **rows** of left matrix have been multiplied with all **<u>columns</u>** of the right matrix.

Multiply the matrices

$\begin{bmatrix} 3 & 2 & 0 \\ -1 & 4 & -2 \end{bmatrix} \times \begin{bmatrix} 1 & 4 & 0 \\ -2 & 3 & 2 \\ 1 & 0 & -3 \end{bmatrix}$ check: $\underbrace{\mathbf{2} \times \overbrace{\mathbf{3}\ \boldsymbol{times}\ \mathbf{3}}^{\text{match}} \times \mathbf{3}}$

product dimensions= 2×3 set up a template to fill in values:

$$\begin{bmatrix} 1 & 2 \\ -4 & 3 \\ 0 & 1 \end{bmatrix} \cdot \begin{bmatrix} 5 & 7 & 0 \\ -2 & 3 & 1 \end{bmatrix}$$

$$\begin{bmatrix}1 & 0\\2 & 1\end{bmatrix}\cdot\begin{bmatrix}4 & -2\\1 & 6\end{bmatrix}$$

$$\begin{bmatrix}3 & 2 & 0\\1 & -1 & 5\end{bmatrix}\cdot\begin{bmatrix}4 & -2 & 3\\2 & 0 & 4\end{bmatrix}$$