Scaler Multiplication:
Consider doubling the cost of movie tickets as shown below.

<table>
<thead>
<tr>
<th></th>
<th>Children</th>
<th>Adult</th>
<th>Sr. Citizens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price</td>
<td>$3.50</td>
<td>$8.50</td>
<td>$5.50</td>
</tr>
</tbody>
</table>

Children doubles to Adult.

Sr. Citizens doubles to Sr. Citizens.

Mathematically, $2 \times \begin{bmatrix} 3.50 & 8.50 & 5.50 \end{bmatrix} = \begin{bmatrix} 7.00 & 17.00 & 11.00 \end{bmatrix}$

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:

**size of final matrix**

```
Row x Column and Row x Column
```

**must match**

To multiply two matrices:

1. Check for a “match” and note the “order;” No match means no multiplication is possible
2. Multiply first row of left matrix with first column of right matrix. Now sum up all products. This becomes the element $e_{11}$ in our matrix. For the element $e_{12}$, repeat multiplication of first row of left matrix with second 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 columns 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: \(2 \times 3\) \(\times\) \(3 \times 3\)

product dimensions= \(2 \times 3\) set up a template to fill in values:

\[
\begin{bmatrix}
1 & 2 \\
-4 & 3 \\
0 & 1 \\
\end{bmatrix}
\cdot
\begin{bmatrix}
5 & 7 & 0 \\
-2 & 3 & 1 \\
\end{bmatrix}
\]
\[
\begin{bmatrix}
1 & 0 \\
2 & 1
\end{bmatrix}
\cdot
\begin{bmatrix}
4 & -2 \\
1 & 6
\end{bmatrix}
\]