Aim: How do we multiply matrices?

I.   Do Now: Multiplying a matrix by a real number (scalar) is easy; we just multiply each entry by the scalar. Multiplying a matrix by another matrix may seem unusual at first, but the definition has many practical applications. Refer to the example below and try to fill in the remaining three entries.

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix} \times \begin{bmatrix} 7 & 8 \\ 9 & 10 \\ 11 & 12 \end{bmatrix} = \begin{bmatrix} 58 & \\ & \end{bmatrix}$$

II. Development:

Given $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$, $B = \begin{bmatrix} 0 & 1 \\ 2 & 3 \end{bmatrix}$, and $C = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, find each product:

(a) AB (b) BA (c) BC (d) CB

What conclusions can you draw from the answers above?

> *Important Note:*
>
> To multiply an **m×n** matrix by an **n×p** matrix, the **n**'s must be the same, and the result is an **m×p** matrix.
>
> m×n ✗ n×p → m×p

III. Additional Practice:
Multiply, if possible.

1. $\begin{bmatrix} 1 & 2 \\ 1 & 1 \end{bmatrix}\begin{bmatrix} -1 & 2 \\ 1 & -1 \end{bmatrix}$

2. $\begin{bmatrix} 1 & -2 & -3 \end{bmatrix}\begin{bmatrix} 2 \\ -1 \\ 1 \end{bmatrix}$

3. $\begin{bmatrix} 2 \\ -1 \\ 1 \end{bmatrix}\begin{bmatrix} 1 & -2 & -3 \end{bmatrix}$

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

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

IV. Application
6. Two softball teams submit equipment lists to their sponsors.

	Women's Team	Men's Team
Bats	12	15
Balls	45	38
Gloves	15	17

Each bat costs $48, each ball costs $4, and each glove costs $42.
Use matrices to find the total cost of equipment for each team.

HW50
• p. 527: 10, 12, 16, 19, 41, 47, 48, 50, 87
       (do #47, #48, and #50 by hand)