



*Multiplying
Matrices*

Multiplying Matrices

- When multiplying matrices, you first need to look at the **dimensions** of both matrices. The term dimension refers to the size of the matrix.
- When multiplying matrices, first you need to make sure that the number of the **columns (vertical) in the first matrix** is the **same as** the number of the **rows (horizontal) in the second matrix**. If they are not the same, then the two matrices cannot be multiplied.
- If you put the dimensions of the first matrix next to the dimensions of the second matrix $(2 \times 3) (3 \times 2)$, the **two middle numbers must be the same in order to multiply**, and the two numbers on the outside ends will be the dimensions of the product matrix.

$$(2 \times 2)$$

Multiplying Matrices

- If $[A]$ is (4×3) and $[B]$ is (3×5) then what are the dimensions of the $[A] \times [B]$? 4×5
- Can a (5×2) matrix be multiplied by a (3×6) matrix?

$$(5 \times 2) (3 \times 6)$$

Multiply Two Matrices

- For you to do this, you have to multiply all the numbers in the first row of the first matrix by all the numbers in the first column of the second matrix.
- Then you multiply the numbers in the second row of the first matrix by all the numbers in the first column of the second matrix.
- Once you are done multiplying, you must add the products together. An example of the correct way to do this is shown on the next slide:

Multiply Two Matrices

$$\dots \begin{matrix} & \begin{matrix} 7 & 8 & 9 \end{matrix} \\ \begin{matrix} [1 & 2 & 3] \\ [4 & 5 & 6] \end{matrix} \times \begin{matrix} [7 & 10] \\ [8 & 11] \\ [9 & 12] \end{matrix} \end{matrix}$$

$$\begin{aligned} \rightarrow & (1 \times 7) + (2 \times 8) + (3 \times 9) = 50 \\ \rightarrow & (1 \times 10) + (2 \times 11) + (3 \times 12) = 68 \\ & (4 \times 7) + (5 \times 8) + (6 \times 9) = 122 \\ & (4 \times 10) + (5 \times 11) + (6 \times 12) = 167 \end{aligned}$$

$$\begin{matrix} & \begin{matrix} 1 & 2 & 3 \end{matrix} \\ \begin{matrix} [2 & 4 & 6] \\ [3 & 5 & 9] \end{matrix} \end{matrix} = \begin{matrix} [50 & 68] \\ [122 & 167] \end{matrix}$$

$$\begin{matrix} & \begin{matrix} 1 & 4 \end{matrix} \\ \begin{matrix} [1 & 4] \\ [2 & 5] \\ [3 & 6] \end{matrix} \end{matrix}$$

$$(2 \times 1) + (4 \times 2) + (6 \times 3) = 2 + 8 + 18 = 28$$



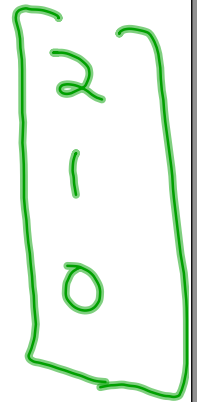
Multiplying Matrices



The table below shows the standings for four local hockey teams



Team	Wins	Ties	Losses
Blazers	7	2	4
Hawks	5	1	7
Tigers	8	0	5
Eagles	4	1	8



4x3

Multiplying Matrices

Teams are awarded 2 points for a win, 1 point for a tie and 0 points for a loss

- If you create a matrix [A] for the standings what size will it be? (4×3)

- If you create a matrix [B] for the points what size will it be in order to multiply it by [A]? (3×1)

- Multiply these matrices by hand to determine the number of points each team has.

$$[B] = \begin{bmatrix} 2 \\ 1 \\ 0 \end{bmatrix}$$

$$\begin{matrix} (4 \times 3) & (3 \times 1) \\ \begin{bmatrix} \\ \\ \\ \end{bmatrix} & \begin{bmatrix} \end{bmatrix} \end{matrix}$$

Answer

$$\begin{matrix} W & T & L \\ \begin{bmatrix} 7 & 2 & 4 \\ 5 & 1 & 7 \\ 8 & 0 & 5 \\ 4 & 1 & 8 \end{bmatrix} & \times & \begin{bmatrix} 2 \\ 1 \\ 0 \end{bmatrix} \end{matrix} \begin{matrix} W \\ T \\ L \end{matrix}$$

4x1

$$(7 \times 2) + (2 \times 1) + (4 \times 0) = 16$$

$$(5 \times 2) + (1 \times 1) + (7 \times 0) = 11$$

$$(8 \times 2) + (0 \times 1) + (5 \times 0) = 16$$

$$(4 \times 2) + (1 \times 1) + (8 \times 0) = 9$$

$$\begin{bmatrix} 16 \\ 11 \\ 16 \\ 9 \end{bmatrix}$$

Now let's check it with our calculator!!!



Question #2

(3x2)

[A]=

A developer builds a housing complex featuring 2, 3 and 4 bedroom units. Each unit comes in two different floor plans. Create a matrix [A] for this information

	Plan 1	Plan 2
Two bedroom	10	5
Three bedroom	25	10
Four Bedroom	15	10

Question #2

To build these homes lumber, concrete, fixtures and labor are needed.

Create a matrix [B] for this information.

(3×2) (2×4)

	Lumber	Concrete	Fixtures	Labor
Plan 1	7	8	9	20
Plan 2	8	9	9	22

[B]

Question #2

Use matrix multiplication to find the product of [A] and [B].

What will the size of your resulting matrix be?

$$\begin{matrix} & (3 \times 2) & (2 \times 4) \\ & \swarrow & \swarrow \\ (3 \times 4) & & \end{matrix}$$

Answer: Question #2

The size of the matrix will be 3x4

$$\begin{bmatrix} 110 & 125 & 135 & 310 \\ 255 & 290 & 315 & 720 \\ 185 & 210 & 225 & 520 \end{bmatrix}$$

What do the rows and columns represent??