Keeper #2: Multiplying Matrices

$A = \begin{bmatrix} 2 & 0 & 2 \\ 1 & 5 & -4 \end{bmatrix}$ $B = \begin{bmatrix} -1 & 2 & 3 \\ 0 & 1 & 8 \end{bmatrix}$ $C = \begin{bmatrix} 3 & 3 & 5 \\ -4 & -5 & 0 \end{bmatrix}$

1. $A + B + C$

$\begin{bmatrix} 4 & 5 & 10 \\ -3 & 1 & 4 \end{bmatrix}$

2. $3C - 2B$

$\begin{bmatrix} 9 & 9 & 15 \\ -12 & -15 & 0 \end{bmatrix} - \begin{bmatrix} -2 & 4 & 6 \\ 0 & 2 & 16 \end{bmatrix}$

$\begin{bmatrix} 11 & 5 & 9 \\ -12 & -17 & -16 \end{bmatrix}$

3. $4A + C$

$\begin{bmatrix} 8 & 0 & 8 \\ 4 & 20 & -16 \end{bmatrix}$

$\begin{bmatrix} 11 & 3 & 13 \\ 0 & 15 & -16 \end{bmatrix}$

4. See if you can figure out the pattern in order for this to make sense!

$\begin{bmatrix} 1 & 5 \\ 2 & 4 \end{bmatrix} \times \begin{bmatrix} 3 & 4 \\ 1 & 8 \end{bmatrix} = \begin{bmatrix} 8 & 44 \\ 10 & 40 \end{bmatrix}$

To multiply an m x n matrix by an n x p matrix, the ns must be the same, and the result is an m x p matrix.

m x n n x p

State the resulting dimensions (if possible) if multiplying the following matrices:

a) [3x2] x [2x1]

3 x 1

b) [4x2] x [2x3]

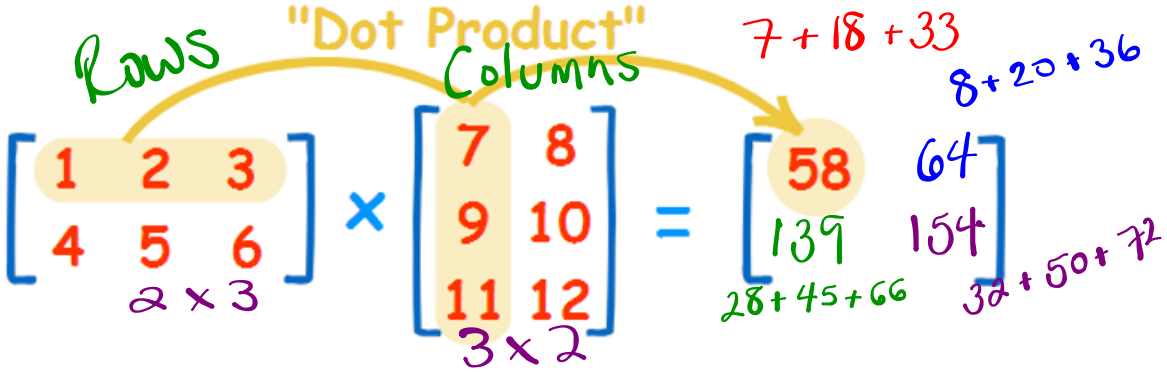
4 x 3

c) [2x2] x [3x2]

undef.

Matrix A Matrix B

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix} \times \begin{bmatrix} e & f \\ g & h \end{bmatrix} = \begin{bmatrix} ae+bg & af+bh \\ ce+dg & cf+dh \end{bmatrix} = \begin{bmatrix} R_1C_1 & R_1C_2 \\ R_2C_1 & R_2C_2 \end{bmatrix}$$



$$\begin{bmatrix} 1 & 5 \\ 2 & 4 \end{bmatrix} \times \begin{bmatrix} 3 & 4 \\ 1 & 8 \end{bmatrix} = \begin{bmatrix} 3+5 & 4+40 \\ 6+4 & 8+32 \end{bmatrix} = \begin{bmatrix} 8 & 44 \\ 10 & 40 \end{bmatrix}$$

$2 \times 2 \quad 2 \times 2$

Ex. 1

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

2x2 2x3 → 2x3

$$\begin{bmatrix} 15 & 20 & -15 \\ 22 & -14 & 18 \end{bmatrix}$$

Ex. 2

$$\begin{bmatrix} -1 & 0 \\ -3 & 5 \\ 3 & 4 \end{bmatrix} \cdot \begin{bmatrix} 6 & -3 \\ -1 & 3 \end{bmatrix}$$

3x2 2x2 → 3x2

$$\begin{bmatrix} -6 & 3 \\ -23 & 24 \\ 14 & 3 \end{bmatrix}$$

Ex. 3

$$\begin{bmatrix} -6 & 6 \\ 5 & 3 \end{bmatrix} \cdot \begin{bmatrix} 1 & 1 \\ -6 & 0 \end{bmatrix}$$

2x2 2x2 → 2x2

$$\begin{bmatrix} -42 & -6 \\ -13 & 5 \end{bmatrix}$$

Ex. 4

$$\begin{bmatrix} -4 & -4 & 5 \\ -4 & -2 & 2 \\ -5 & -4 & 0 \end{bmatrix} \cdot \begin{bmatrix} -1 & -4 & 2 \\ 0 & 2 & 2 \\ -6 & -4 & 1 \end{bmatrix}$$

3x3 3x3 → 3x3

$$\begin{bmatrix} -26 & -12 & -11 \\ -8 & 4 & -10 \\ 5 & 12 & -18 \end{bmatrix}$$

identity matrix

*Multiply any square matrix by $\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ for a 2x2 or $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ for a 3x3 and see what happens

$$\begin{bmatrix} 6 & -3 \\ -1 & 3 \end{bmatrix} \cdot \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} 6 & -3 \\ -1 & 3 \end{bmatrix}$$