Multiplying Matrices

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MULTIPLYING MATRICES

Words To find the element in the *i*th row and *j*th column of the product matrix *AB*, multiply each element in the row of A by the corresponding element in the Column of B, then add the products.

Algebra $\begin{bmatrix} a & b \\ c & d \end{bmatrix} \cdot \begin{bmatrix} e & f \\ g & h \end{bmatrix} = \begin{bmatrix} ae + bg & af + bh \\ ce + dg & cf + dh \end{bmatrix}$

2x2 · 2x2 ✓

*You can only multiply matrices if the # of columns in matrix A equals the # of rows in matrix B

A row x col. B row x col

match

dim. of product

State whether the product is defined. If it is, then give the dimensions of the product AB.

1. A: 2x3 B: 3x4

2x3 · 3x4 ✓ skeleton

yes 2x4

2. A: 3x2 B: 3x2

3x2 · 3x2 (X)

not possible invalid dimensions

Multiply, if possible.

$\begin{bmatrix} R_1 \\ R_2 \\ \therefore \end{bmatrix} \begin{bmatrix} 1 & -4 \end{bmatrix} \cdot \begin{bmatrix} C_1 & C_2 \\ 3 & \\ 4 & \end{bmatrix}$

2x2 · 2x2 ✓ skeleton

- label rows of A + columns of B + draw bubbles
- draw + label a skeleton matrix to organize
- multiply rows of A to columns of B + slide through the bubble. Then add

$\begin{bmatrix} R_1 & C_1 & C_2 \\ & (-2)(-1)+(3)(-2) & (-2)(3)+(3)(4) \\ R_2 & (1)(-1)+(-4)(-2) & (1)(3)+(-4)(4) \end{bmatrix}$

$\begin{bmatrix} 2+-6 & -6+12 \\ -1+8 & 3+-16 \end{bmatrix} = \begin{bmatrix} -4 & 6 \\ 7 & -13 \end{bmatrix}$

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$\begin{bmatrix} R_1 \\ R_2 \\ R_3 \end{bmatrix} \begin{bmatrix} -3 & 3 \\ 3 & -2 \\ 0 & -1 \end{bmatrix} \cdot \begin{bmatrix} C_1 & C_2 \\ 1 & 0 \\ -2 & -1 \end{bmatrix}$

3x2 · 2x2 ✓ skeleton

$= \begin{bmatrix} R_1 & C_1 & C_2 \\ & (-3)(1)+(3)(-2) & 0+-3 \\ R_2 & 3+4 & 0+2 \\ R_3 & 0+2 & 0+1 \end{bmatrix}$

$\begin{bmatrix} -9 & -3 \\ 7 & 2 \\ 2 & 1 \end{bmatrix}$

$\begin{bmatrix} R_1 \\ R_2 \\ R_3 \end{bmatrix} \begin{bmatrix} 2 & 8 & -3 \\ 5 & 6 & 4 \\ -1 & 0 & 7 \end{bmatrix} \cdot \begin{bmatrix} C_1 & C_2 & C_3 \\ 10 & 9 & -2 \\ -1 & 5 & 8 \\ 3 & 7 & 0 \end{bmatrix}$

3x3 · 3x3 ✓ skeleton

$= \begin{bmatrix} R_1 & C_1 & C_2 & C_3 \\ & (2)(10)+(8)(-1)+(-3)(3) & 18+40-21 & -4+64+ \\ R_2 & 50-6+12 & 45+30+28 & -10+48+ \\ R_3 & -10+0+21 & -9+0+49 & 2+0+0 \end{bmatrix}$

$\begin{bmatrix} 3 & 37 & 60 \\ 56 & 103 & 38 \\ 11 & 40 & 2 \end{bmatrix}$

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