

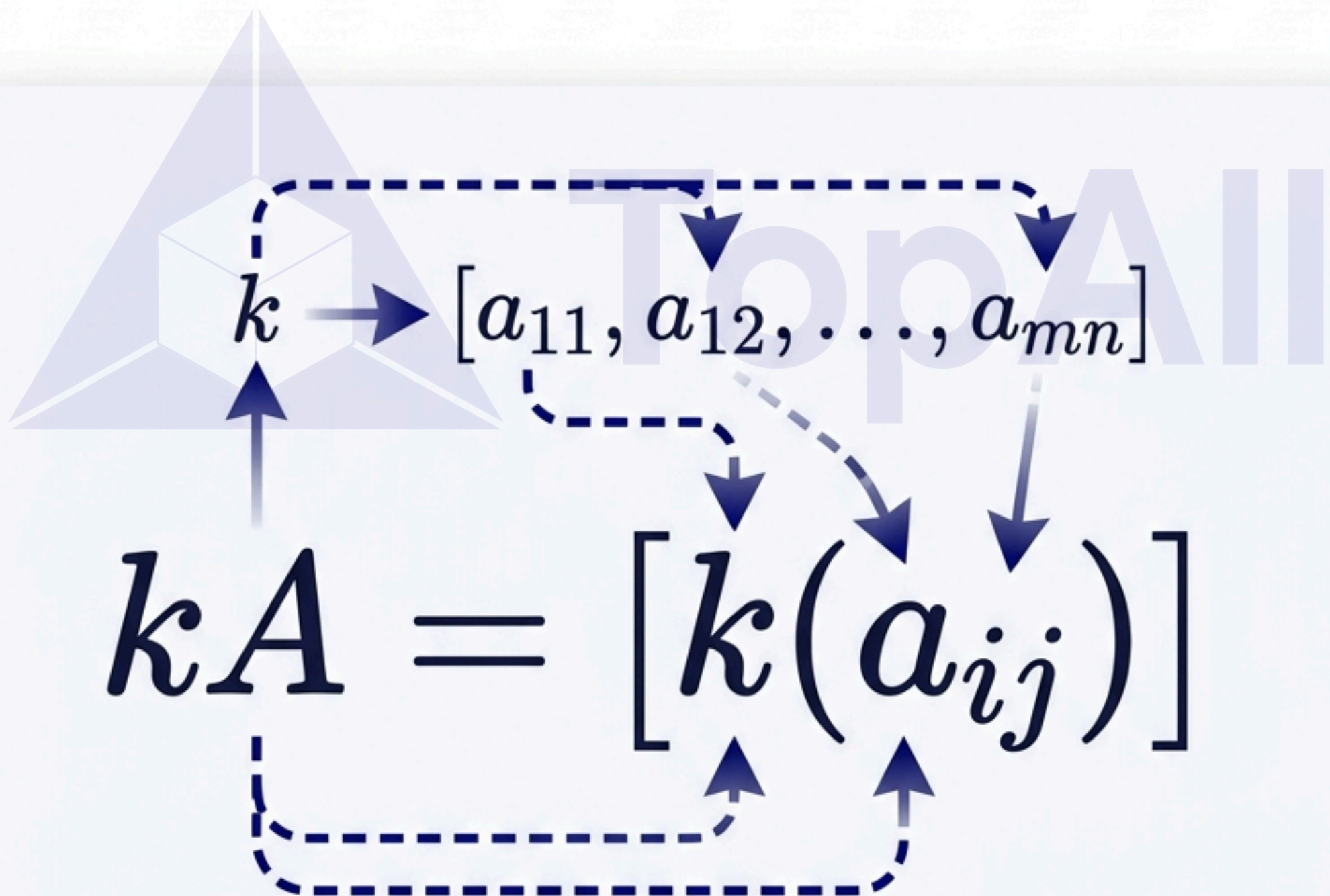
→ One Number. Every Entry.

Mastering Scalar Multiplication
& Matrix Difference



The Universal Scaling Factor

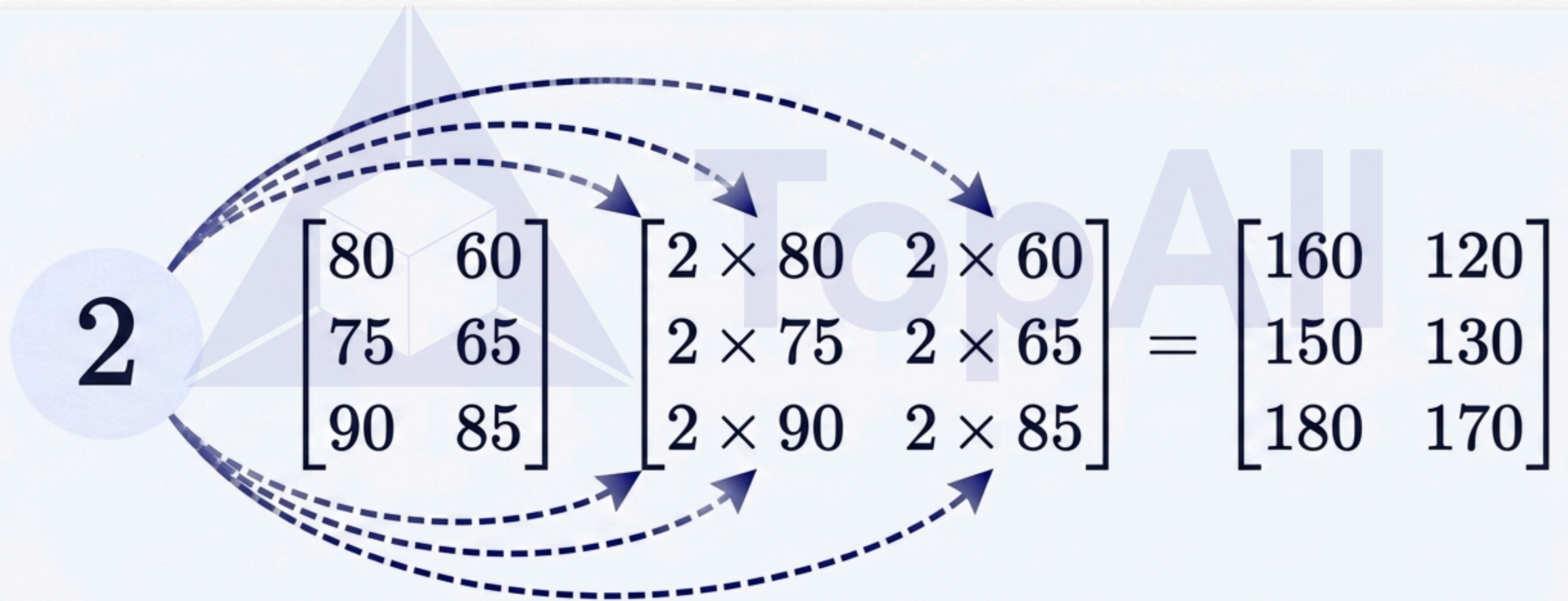
If $A = [a_{ij}]$ is an $m \times n$ matrix, and k is a scalar (a single number), then kA is a new matrix obtained by multiplying every element of A by k .



The (i, j) th element of kA is $k \cdot a_{ij}$

See the Scalar Distribute

Doubling factory production means scaling every individual entry.


$$2 \begin{bmatrix} 80 & 60 \\ 75 & 65 \\ 90 & 85 \end{bmatrix} = \begin{bmatrix} 2 \times 80 & 2 \times 60 \\ 2 \times 75 & 2 \times 65 \\ 2 \times 90 & 2 \times 85 \end{bmatrix} = \begin{bmatrix} 160 & 120 \\ 150 & 130 \\ 180 & 170 \end{bmatrix}$$



You've Learned the Theory. Let's Test Them Now.

$$E=mc^2$$



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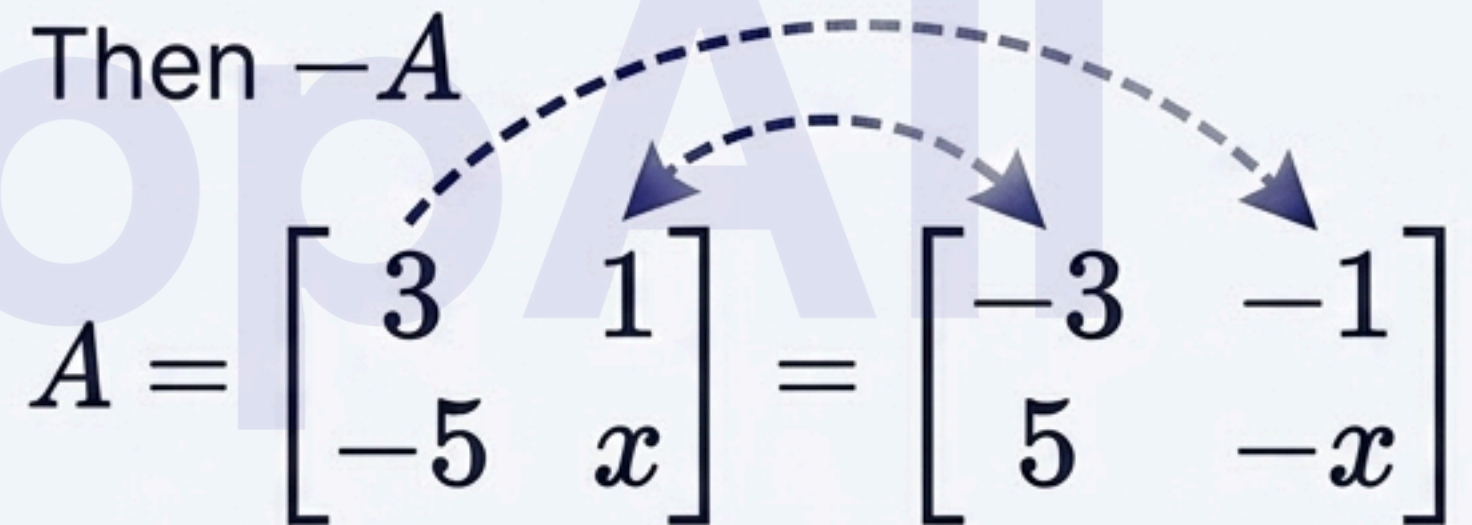
The Negative of a Matrix

The negative of a matrix A is denoted by $-A$. It is simply scalar multiplication where the scalar k is -1 .

$$-A = (-1)A$$

If $A = \begin{bmatrix} 3 & 1 \\ -5 & x \end{bmatrix}$

Then $-A$

$$A = \begin{bmatrix} 3 & 1 \\ -5 & x \end{bmatrix} = \begin{bmatrix} -3 & -1 \\ 5 & -x \end{bmatrix}$$


Every positive becomes negative. Every negative becomes positive.

Matrix Difference is Just Addition

For matrices A and B of the same order, the difference $D = A - B$ is defined as the sum of matrix A and the negative of matrix B .

$$A - B = A + (-1)B$$

Step 1 (Standard)

$$\begin{bmatrix} 2 & 3 \\ 4 & 6 \end{bmatrix} - \begin{bmatrix} 1 & 2 \\ 3 & 1 \end{bmatrix}$$


Step 2 (The Hidden Step)

$$\begin{bmatrix} 2 & 3 \\ 4 & 6 \end{bmatrix} + - \begin{bmatrix} -1 & -2 \\ -3 & -1 \end{bmatrix}$$


Step 3 (Result)

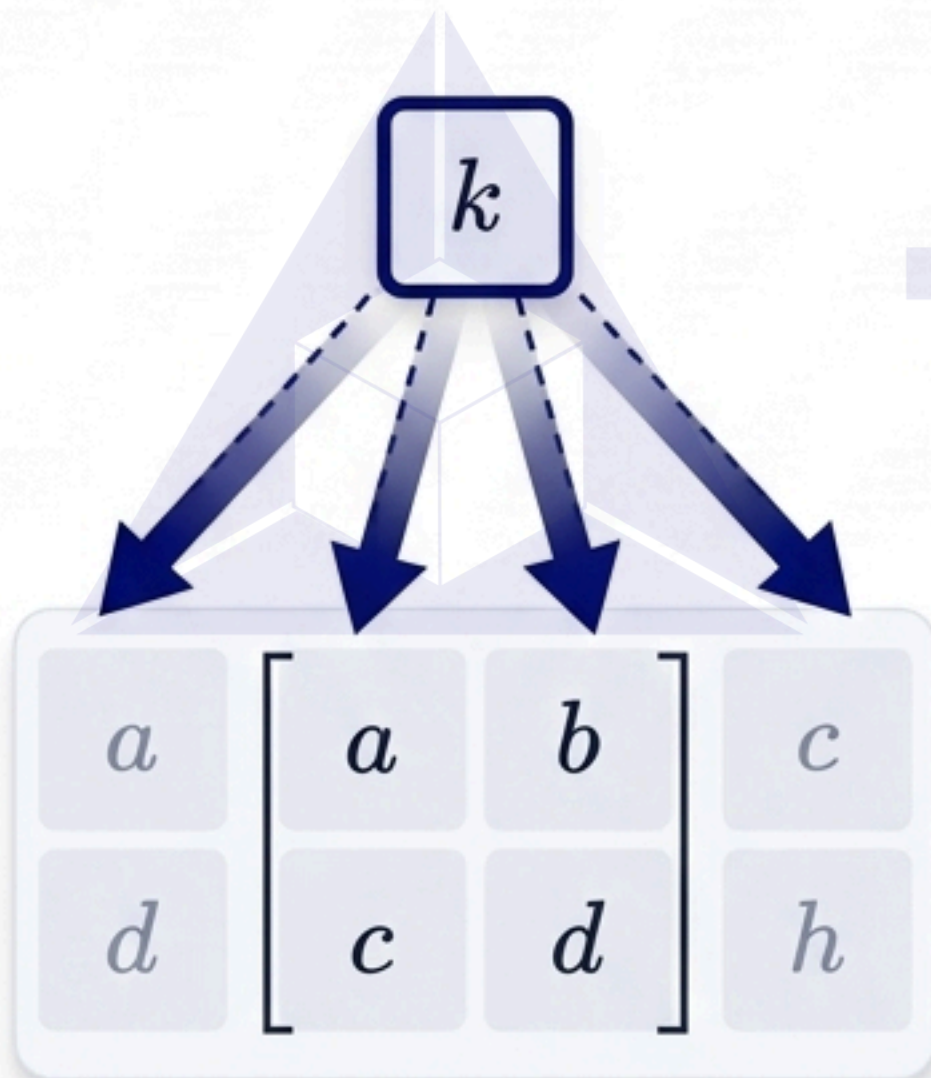
$$\begin{bmatrix} 1 & 1 \\ 1 & 5 \end{bmatrix}$$

The JEE Trap

Do not confuse scalar multiplication with matrix multiplication.

Scalar Multiplication

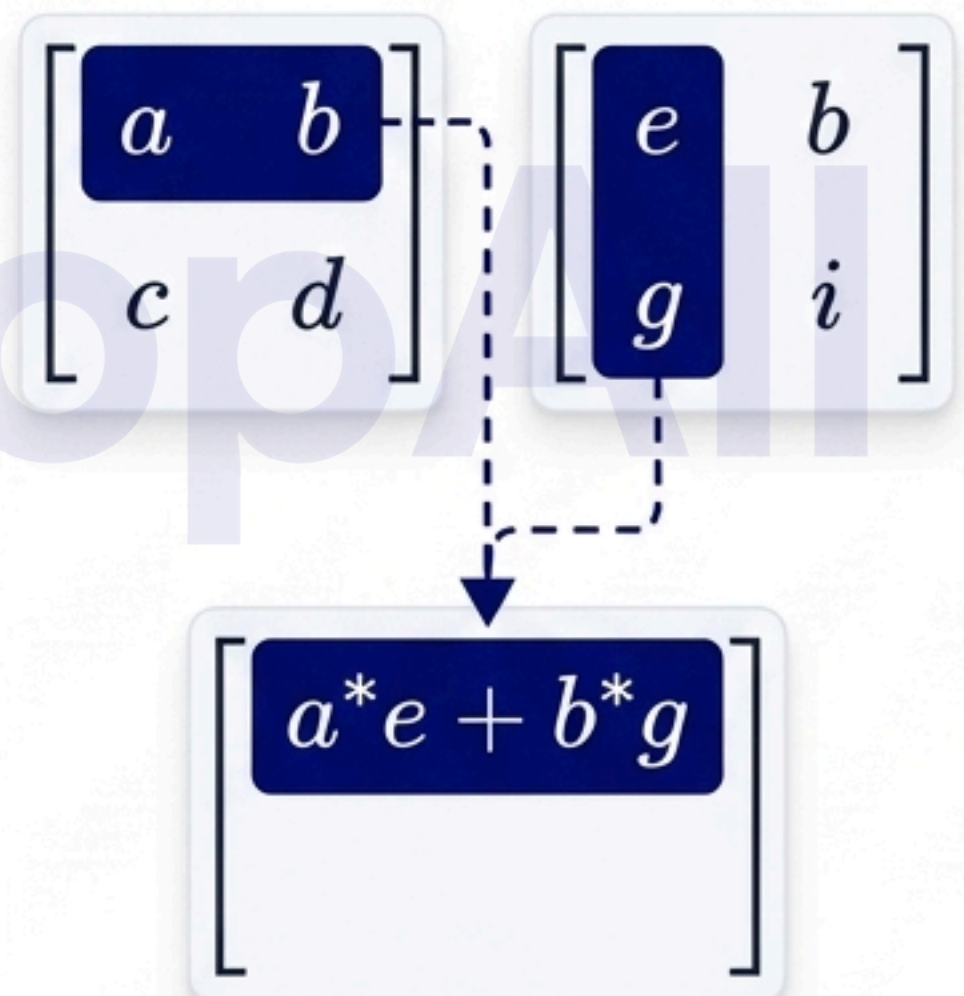
(kA)



A single number hits every single entry. Changes magnitude.

Matrix Multiplication

(AB)



Operates via complex 'Row-by-Column' dot products. Transforms coordinate space.

Key Takeaways



Scalar applies to every entry.

Unlike matrix multiplication, a scalar k acts uniformly on a_{ij} regardless of its row or column position.

Negative changes every sign.

Finding $-A$ is mathematically identical to performing scalar multiplication with $k = -1$.

Subtraction is addition of negative.

We do not define subtraction natively; $A - B$ is always executed as $A + (-1)B$, requiring matrices of the exact same order.



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