

Matrix Multiplication Explanation

Matrix A

1	2
3	4

Matrix B

5	6
7	8

Matrix C

9	10
11	12

Step 1: Multiply $A \times B$

Formula: $(A \times B)_{ij} = \sum (A_{ik} \times B_{kj})$

Each element is formed by multiplying a row from A with a column from B and summing the results.

$A \times B =$

$[[1 \times 5 + 2 \times 7, 1 \times 6 + 2 \times 8],$

$[3 \times 5 + 4 \times 7, 3 \times 6 + 4 \times 8]]$

$= [[19, 22], [43, 50]]$

Step 2: Multiply the result with C

$[[19, 22], [43, 50]] \times [[9, 10], [11, 12]]$

$= [[19 \times 9 + 22 \times 11, 19 \times 10 + 22 \times 12],$

$[43 \times 9 + 50 \times 11, 43 \times 10 + 50 \times 12]]$

$= [[413, 454], [937, 1030]]$

Final result:

$[[413, 454], [937, 1030]]$

General Matrix Multiplication Formula:

For matrices $A(m \times n)$ and $B(n \times p)$:

$$C = A \times B \Rightarrow C_{ij} = \sum (A_{ik} \times B_{kj})$$

The result has dimensions $(m \times p)$. Multiplication is valid only when the number of columns of A equals the number of rows of B .