

Worked answer key / 001

What Is This Formula Asking Me to Do?

Each answer explains the reasoning as well as the result. The numbered prompts match the lesson and card deck.

001-1 / RECOGNIZE

In a grid P , which address does p_{42} name?

Row 4, column 2 of P .

1. P names the whole grid; lowercase p with subscripts names one entry.
2. The first subscript 4 chooses the row. The second subscript 2 chooses the column.

001-2 / RECOGNIZE

Let A be 2×3 , B be 3×2 , and $C = AB$. Its entry rule is $c_{ij} = \sum_{z=1}^3 a_{iz} b_{zj}$. While finding c_{21} , which symbols stay fixed and which one runs?

$i = 2$ and $j = 1$ stay fixed; z runs through 1, 2, and 3.

1. The destination c_{21} fixes row i at 2 and column j at 1.
2. The bounds under and over $\sum$ tell z to take the values 1, 2, and 3.

001-3 / APPLY

Expand and evaluate $\sum_{k=1}^4 (k + 1)$.

$(1 + 1) + (2 + 1) + (3 + 1) + (4 + 1) = 2 + 3 + 4 + 5 = 14$.

1. The bounds include both endpoints, so there are four terms.
2. Evaluate $(k + 1)$ at each value and add the four results.

001-4 / APPLY

With $A = \begin{bmatrix} 2 & 1 & 3 \\ 4 & 2 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 2 \\ 3 & 1 \\ 2 & 4 \end{bmatrix}$, expand and calculate c_{12} in $C = AB$.

$c_{12} = 2 \times 2 + 1 \times 1 + 3 \times 4 = 4 + 1 + 12 = 17$.

1. For c_{12} , fix $i = 1$ and $j = 2$; z still runs through 1, 2, and 3.
2. A 's first row is $(2, 1, 3)$. B 's second column is $(2, 1, 4)$.
3. Multiply corresponding positions and add: $4 + 1 + 12 = 17$.

001-5 / TRANSFER

Expand and evaluate $\sum_{r=2}^4 3r$. Does changing the running letter from r to t change the value?

$3(2) + 3(3) + 3(4) = 6 + 9 + 12 = 27$. Renaming r to t does not change the value.

1. The lower bound starts the sum at 2; the upper bound ends it at 4, giving three terms.
2. The running letter is a placeholder. The same three values and rule give the same result with another letter.

001-6 / TRANSFER

A rule says $d_{ij} = \sum_{q=1}^5 x_{iq} y_{qj}$. How many products make one entry d_{ij} , and does the 5 say how many entries D has?

Five products make each chosen entry. The 5 does not say how many entries D has.

1. The running index q takes 1, 2, 3, 4, and 5, so the sum has five product terms.
2. The size of D comes from its available row and column addresses, which this sum bound alone does not specify.