

Vectors and matrices as organised quantitative models

Original skill preparation; versioned source scope

Method and conditions

Quantity rows $\times$ price column (4, 5)

Row	Item A	Item B	Total cost
List 1	2	1	13
List 2	1	3	19

- A matrix uses labelled rows and columns.
- Ordered pairs; Pythagoras; multiplication and addition.

Worked method 1

Read and reason

A matrix uses labelled rows and columns. A quantity row $(2, 3)$ and price column $(4, 5)^T$ give cost $2(4) + 3(5) = 23$. The inner dimensions must agree before a matrix product exists. A displacement vector from A to B is $B - A$.

Original context 1

Read and reason

Task context

Read and reason

Each task below states its own complete data. Values may differ from the worked example.

Attempt 1.1

Read and reason

Points A and B in metres are $(1, -2)$ and $(7, 6)$. Find the displacement A to B and its magnitude. Then find the endpoint after adding displacement $(-3, 2)$ metres to B.

Reasoning 1.1

Read and reason

$\overrightarrow{AB} = B - A = (6, 8) \text{ m}$. Magnitude $|\overrightarrow{AB}| = \sqrt{6^2 + 8^2} \text{ m} = 10 \text{ m}$. New endpoint $B + (-3, 2) = (4, 8) \text{ metres}$. Direction must not be reversed.

Attempt 2.1

Read and reason

A shop's two orders have quantity rows $(3, 2)$ and $(1, 4)$ for pens and notebooks. Prices are 2 and 7 yuan respectively. Give the matrix product and both order costs.

Reasoning 2.1

Read and reason

$Q = \begin{pmatrix} 3 & 2 \\ 1 & 4 \end{pmatrix}$, $p = \begin{pmatrix} 2 \\ 7 \end{pmatrix}$ yuan per item. $Qp = \begin{pmatrix} 3(2) + 2(7) \\ 1(2) + 4(7) \end{pmatrix} = \begin{pmatrix} 20 \\ 30 \end{pmatrix}$ yuan. The item order must match the price order.

Attempt 3.1

Read and reason

A is 2 by 3 and B is 3 by 4. State the size of AB and whether BA is defined.

Reasoning 3.1

Read and reason

AB has matching inner dimension 3 and outer dimensions 2 by 4. BA would require $4=2$, so it is undefined. Reversing a product is not harmless.

Transfer and limits

Read and reason

Ordered pairs; Pythagoras; multiplication and addition.

Check yourself

Read and reason

Close the worked reasoning. Explain why the method fits the final transfer task, reconstruct its conclusion, and state a condition that would change your answer. Then check the full reasoning in the reference.