inkMaths

ANSWER BOOK

Matrix algebra and transformations

Matrices · Year FM

6 questions · 20 marks

NAVY EDITION

SECTION A · Warm-up

A1 Rotation: rows (0, -1) and (1, 0). Reflection in $y = x$: rows (0, 1) and (1, 0). Both can be read off from where (1, 0) and (0, 1) land: the images are the columns. [2]

A2 AB has rows (4, -2), (6, 0); BA has rows (2, -2), (4, 2). They differ: matrix multiplication is not commutative, so the order of a product must never be swapped mid-working. [3]

SECTION B · Standard

B1 Multiply: rows (0, -1), (1, 0) applied to (3, 1) give (-1, 3). A sketch confirms it: the point swings from the first quadrant into the second, a quarter turn against the clock. [3]

B2 Reflection first, so it sits on the right: R M has rows (0, -1), (1, 0) times rows (1, 0), (0, -1), giving rows (0, 1), (1, 0): the reflection in $y = x$. The right-hand factor acts first; writing the product the other way round gives a different transformation. [4]

B3 The images of the base vectors are the columns: rows (2, 1), (0, 3). Then (2, 5) maps to $(2 \times 2 + 1 \times 5, 0 + 3 \times 5) = (9, 15)$. Columns-are-images turns matrix building into reading the question. [4]

SECTION C · Stretch

C1 Squaring gives rows (-1, 0), (0, -1), which is -I, a half turn. Squaring again gives $(-I)^2 = I$. So $R^4 = I$: four quarter turns make a full turn, and R is a matrix whose fourth power is the identity, matching the geometry exactly. [4]