

5.5 Mixed practice: vectors and transformations

Name: _____ Class: _____ Date: _____

Total: 21 marks

KEY WORDS translation

Mixed practice: vectors and transformations

Objective

Combine the topic-5 strands: vector routes with unknown ratios, moduli, transformation images and complete descriptions in unfamiliar settings (objectives Higher 5.1 A–G, Foundation 5.2 A–M).

1 Key knowledge and worked examples

One line per strand. Vectors: routes add tip-to-tail; reverse by negating; modulus by Pythagoras. Proofs: same vector two ways, then equate **a** and **b** coefficients. Transformations: name the type AND every parameter; the three isometries congrue the image, enlargements only make it similar.

2 Practice

2.1 Simplify $3\begin{pmatrix} 2 \\ -1 \end{pmatrix} - 2\begin{pmatrix} 1 \\ 4 \end{pmatrix}$ [2]

2.2 Find the modulus of $\begin{pmatrix} -8 \\ 6 \end{pmatrix}$ [2]

2.3 Rotate $(2, -5)$ by 180° about O [1]

2.4 Enlarge $(-4, 6)$ by scale factor $\frac{1}{2}$ about the origin. [1]

2.5 $\overrightarrow{AB} = 5\mathbf{a} - 2\mathbf{b}$ and $\overrightarrow{BC} = -3\mathbf{a} + 2\mathbf{b}$. Find $\overrightarrow{AC}$ [2]

3 Exam-style questions

3.1 (*Original.*) $OAPB$ is a parallelogram with $\overrightarrow{OA} = \mathbf{a}$ and $\overrightarrow{OB} = \mathbf{b}$. (a) Write $\overrightarrow{AB}$ and $\overrightarrow{OP}$ in terms of $\mathbf{a}$ and $\mathbf{b}$. (b) The point G satisfies $\overrightarrow{OG} = \frac{1}{3}\overrightarrow{OP}$. Find $\overrightarrow{AG}$ in terms of $\mathbf{a}$ and $\mathbf{b}$. (c) Explain how your answer shows that G does not lie on AB . [5]

3.2 (*Original.*) The point $Q(4, 3)$ is reflected in the y -axis to Q_1 ; Q_1 is then translated by $\begin{pmatrix} -1 \\ 2 \end{pmatrix}$ to Q_2 ; Q_2 is then rotated 90° anticlockwise about O to Q_3 . Find Q_3 . [3]

3.3 (*Original, transfer.*) A drone flies 6 km east then 8 km north (vectors from origin). (a) Write the two legs as column vectors. (b) Find the resultant displacement. (c) The drone then flies directly back to the start: write the return leg as a column vector and state its magnitude. [5]