

Exercise walk-through

5.4

Enlargement and describing transformations

Pearson Edexcel · International GCSE · Mathematics A

1. Topic 5 at a glance

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Foundation 5.2 is the four transformations with complete descriptions; 5.1 (vectors) is Higher-only, from notation through resultants and moduli to geometrical proofs.

Must-know: column $\begin{pmatrix} x \\ y \end{pmatrix}$; modulus $\sqrt{x^2 + y^2}$; route rule $\overrightarrow{AB} + \overrightarrow{BC} = \overrightarrow{AC}$; reflection, rotation (centre, angle, direction), translation $\begin{pmatrix} a \\ b \end{pmatrix}$, enlargement (centre, factor).

3. Vector proofs

Vector proofs

Write the SAME vector two independent ways and equate. Parallelogram $OABC$ with $\overrightarrow{OA} = \mathbf{a}$, $\overrightarrow{OC} = \mathbf{c}$: $\overrightarrow{OB} = \mathbf{a} + \mathbf{c}$, and the midpoint M of the diagonal gives $\overrightarrow{AM} = \frac{1}{2}(\mathbf{c} - \mathbf{a}) = \frac{1}{2}\overrightarrow{AC}$ - the diagonals bisect each other.

June 2024 2HR Q25 family: vectors $\frac{8}{5}\mathbf{a} + \frac{3}{5}\mathbf{b}$ and $\frac{9}{4}\mathbf{b} - 2\mathbf{a}$, then $k\overrightarrow{OP}$ equal to a second route: equate the $\mathbf{a}$ and $\mathbf{b}$ coefficients separately and solve - the paper's $k = \frac{5}{8}$. Never assume a midpoint; write λ times and solve.

5. Enlargement and descriptions

Enlargement and descriptions

Enlargement: centre and positive scale factor (fractions shrink). About the origin $(x, y) \rightarrow (kx, ky)$; lengths scale by k , angles are preserved, so the image is SIMILAR, not congruent.

Complete descriptions: rotation, 90 degrees anticlockwise about $(0, 1)$; reflection in the line $y = x$; translation by the vector $(3, -2)$; enlargement, scale factor 2, centre $(1, 1)$. Rays through the centre confirm an enlargement.

Exercises 2.1·2.3

2.1 Enlarge $(3, 2)$ by scale factor 2 about the origin. [1]

2.2 Enlarge $(3, 2)$ by scale factor $\frac{1}{2}$ about the origin. [1]

2.3 A square of side 4 cm is enlarged by scale factor 3. Find the image's side and area. [2]

Exercises 2.1·2.3

2.1 Enlarge $(3, 2)$ by scale factor 2 about the origin. [1]

2.1 $(6, 4)$.

2.2 Enlarge $(3, 2)$ by scale factor $\frac{1}{2}$ about the origin. [1]

2.2 $(1.5, 1)$.

2.3 A square of side 4 cm is enlarged by scale factor 3. Find the image's side and area. [2]

2.3 Side 12 cm; area $9 \times 16 = 144 \text{ cm}^2$.

Exercises 2.4·3.2

2.4 Under an enlargement, angles are preserved but lengths are not. What is the relationship between object and image? [1]

3.1 (*Original.*) Triangle T has vertices $(1, 1)$, $(3, 1)$, $(1, 2)$. It is enlarged by scale factor 3, centre $(0, 0)$. (a) Write down the image's vertices. (b) Find the ratio of the image's area to T 's area. [4]

3.2 (*Original.*) Shape S is drawn on a grid; its image S' has every length three times as long, with corresponding rays from a fixed point $C(1, 2)$ passing through corresponding vertices. Describe the transformation fully. [2]

Exercises 2.4·3.2

2.4 Under an enlargement, angles are preserved but lengths are not. What is the relationship between object and image? [1]

2.4 Similar (same shape, different size).

3.1 (*Original.*) Triangle T has vertices $(1, 1)$, $(3, 1)$, $(1, 2)$. It is enlarged by scale factor 3, centre $(0, 0)$. (a) Write down the image's vertices. (b) Find the ratio of the image's area to T 's area. [4]

3.1 (a) $(3, 3)$, $(9, 3)$, $(3, 6)$. (b) Areas scale by $k^2 = 9$, so $9 : 1$.

3.2 (*Original.*) Shape S is drawn on a grid; its image S' has every length three times as long, with corresponding rays from a fixed point $C(1, 2)$ passing through corresponding vertices. Describe the transformation fully. [2]

3.2 Enlargement, scale factor 3, centre $(1, 2)$.

Exercise 3.3

3.3 (*Original.*) A rectangle 4 cm by 3 cm is enlarged with scale factor $\frac{1}{4}$, centre C . (a) Find the image's dimensions. (b) State two things the enlargement preserves. (c) A student says "the image is congruent to the original because angles match". Correct the error. [4]

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3.3 (a) 1 cm by 0.75 cm. (b) Angles are preserved, and so is the shape (sides stay parallel; the image is similar). (c) Congruent needs BOTH matching angles and matching lengths; an enlargement changes lengths, so the image is similar, not congruent.

Local review guidance: scale factor applied to coordinates or lengths from the stated centre; area ratio stated as k^2 ; descriptions carry centre AND factor. This is authored classroom guidance.