C32

Transformations

CHAPTER ASSIGNMENT

Name _____ Class _____ No. _____ Date _____

Use squared paper. Most questions use a diagram printed in the book: the page number is given, and the diagram cannot be reproduced here, so copy it from the book first. Column vectors are written (top / bottom), so (3 / 5) means 3 right and 5 up.

Practice questions from *Cambridge IGCSE Mathematics Core and Extended* (4th edition), Chapter 32 (Transformations), for classroom use. The Check yourself and Chapter quiz questions are Guru Jazzy's own.

Exercise 32.1 · Reflection: mirror lines

32.1.1 Book p. 453, diagram 1 (an object and its reflected image). Copy the diagram, then (a) draw the position of the mirror line, (b) give the equation of the mirror line.

32.1.2 Book p. 453, diagram 2 (two diamond shapes). Copy the diagram, then (a) draw the position of the mirror line, (b) give the equation of the mirror line.

32.1.3 Book p. 453, diagram 3 (two overlapping triangles). Copy the diagram, then (a) draw the position of the mirror line, (b) give the equation of the mirror line.

32.1.4 Book p. 453, diagram 4 (two L-shaped figures). Copy the diagram, then (a) draw the position of the mirror line, (b) give the equation of the mirror line.

32.1.5 Book p. 454, diagram 5 (two squares). Copy the diagram, then (a) draw the position of the mirror line, (b) give the equation of the mirror line.

32.1.6 Book p. 454, diagram 6 (four shapes; there are two mirror lines). Copy the diagram, then (a) draw the position of the mirror lines, (b) give the equations of the mirror lines.

32.1.7 Book p. 454, diagram 7 (four triangles; there are two mirror lines). Copy the diagram, then (a) draw the position of the mirror lines, (b) give the equations of the mirror lines.

32.1.8 Book p. 454, diagram 8 (a star made of triangles; there are several mirror lines). Copy the diagram, then (a) draw the position of the mirror lines, (b) give the equations of the mirror lines.

Exercise 32.2 · Reflection: drawing images

32.2.1 In Question 1 copy the diagram (book p. 454, a five-sided shape) four times and reflect the object in each of the lines given: (a) $x = 2$ · (b) $y = 0$ · (c) $y = x$ · (d) $y = -x$

32.2.2 In Question 2 copy the diagram (book p. 454, a six-sided shape) four times and reflect the object in each of the lines given: (a) $x = -1$ · (b) $y = -x - 1$ · (c) $y = x + 2$ · (d) $x = 0$

32.2.3 Copy the diagram (book p. 455, two triangles on a grid from −10 to 8), and reflect the triangles in the following lines: x = 1 and y = −3.

Exercise 32.3 · Rotation: drawing images

32.3.1 In the following, the object and centre of rotation have both been given. Copy each diagram and draw the object's image under the stated rotation about the marked point. Book p. 456, diagram 1: rotation 180°.

32.3.2 Book p. 456, diagram 2: rotation 90° clockwise.

32.3.3 Book p. 456, diagram 3: rotation 180°.

32.3.4 Book p. 456, diagram 4: rotation 90° clockwise about (3, 2).

32.3.5 Book p. 456, diagram 5: rotation 90° anti-clockwise about (0, 0).

32.3.6 Book p. 456, diagram 6: rotation 90° clockwise about (2, 1).

Exercise 32.4 · Rotation: finding the centre, angle and direction

32.4.1 In the following, the object (unshaded) and image (shaded) have been drawn. Copy each diagram and (a) mark the centre of rotation, (b) calculate the angle and direction of rotation. Book p. 457, diagram 1.

32.4.2 Book p. 457, diagram 2.

32.4.3 Book p. 457, diagram 3.

32.4.4 Book p. 457, diagram 4.

32.4.5 Book p. 457, diagram 5.

32.4.6 Book p. 457, diagram 6.

Exercise 32.5 · Translation: finding the vector

32.5.1 In the following diagrams, object A has been translated to each of images B and C. Give the translation vectors in each case. Book p. 458, diagram 1.

A to B	A to C

32.5.2 Book p. 458, diagram 2.

A to B	A to C

32.5.3 Book p. 458, diagram 3.

A to B	A to C

32.5.4 Book p. 458, diagram 4.

A to B	A to C

Exercise 32.6 · Translation: drawing images

32.6.1 (a) Copy each of the following diagrams and draw the object. (b) Translate the object by the vector given in each case and draw the image in its position. (Note that a bigger grid than the one shown may be needed.) Book p. 459, diagram 1 (a five-sided shape): vector (3 / 5).

32.6.2 Book p. 459, diagram 2 (a block shape): vector (5 / −4).

32.6.3 Book p. 459, diagram 3 (a square): vector (−4 / 6).

32.6.4 Book p. 459, diagram 4 (a parallelogram): vector (−2 / −5).

32.6.5 Book p. 459, diagram 5 (a triangle): vector (−6 / 0).

32.6.6 Book p. 459, diagram 6 (a bow-tie shape): vector (0 / −1).

Exercise 32.7 · Enlargement: finding the centre and scale factor

32.7.1 Copy the following diagrams and find (a) the centre of enlargement, (b) the scale factor of enlargement. Book p. 462, diagram 1 (triangle ABC and its image A'B'C').

32.7.2 Book p. 462, diagram 2 (rectangle ABCD and its image A'B'C'D').

32.7.3 Book p. 462, diagram 3 (rectangle ABCD inside its image A'B'C'D').

32.7.4 Book p. 462, diagram 4 (triangle ABC and its image A'B'C').

32.7.5 Book p. 462, diagram 5 (rectangle ABCD and the smaller image A'B'C'D').

Exercise 32.8 · Enlargement: drawing images

32.8.1 Copy the following diagrams and enlarge the objects by the scale factor given and from the centre of enlargement shown. (Grids larger than those shown may be needed.) Book p. 462, diagram 1 (a triangle, centre O): scale factor 2.

32.8.2 Book p. 462, diagram 2 (an L-shape, centre O): scale factor 2.

32.8.3 Book p. 463, diagram 3 (a rectangle, centre O): scale factor 3.

32.8.4 Book p. 463, diagram 4 (a rectangle, centre O): scale factor 1/3.

Exercise 32.9 · Negative enlargement

32.9.1 Copy the following diagram (book p. 463, square ABCD and its image A'B'C'D') and then calculate the scale factor of enlargement and show the position of the centre of enlargement.

32.9.2 The scale factor of enlargement and centre of enlargement are both given. Copy and complete the diagram (book p. 464, triangle ABC with centre O). Scale factor of enlargement is −2.5.

32.9.3 The scale factor of enlargement and centre of enlargement are both given. Copy and complete the diagram (book p. 464, quadrilateral ABCD with centre O). Scale factor of enlargement is −2.

32.9.4 Copy the following diagram (book p. 464, triangle ABC and its image A'B'C') and then calculate the scale factor of enlargement and show the position of the centre of enlargement.

32.9.5 An object and part of its image under enlargement are given in the diagram (book p. 465, quadrilateral ABCD with part of A'B'C'D'). Copy the diagram and complete the image. Also find the centre of enlargement and calculate the scale factor of enlargement.

32.9.6 In the diagram (book p. 465), part of an object in the shape of a quadrilateral and its image under enlargement are drawn. Copy and complete the diagram. Also find the centre of enlargement and calculate the scale factor of enlargement.

Exercise 32.10 · Combinations of transformations

32.10.1 For each of the following questions, copy the diagram. After each transformation, draw the image on the same grid and label it clearly. The square ABCD (book p. 466) is mapped onto A'B'C'D' by a reflection in the line y = 3. A'B'C'D' then maps onto A"B"C"D" as a result of a 90° rotation in a clockwise direction about the point (−2, 5).

32.10.2 The rectangle ABCD (book p. 466) is mapped onto A'B'C'D' by an enlargement of scale factor −2 with its centre at (0, 5). A'B'C'D' then maps onto A"B"C"D" as a result of a reflection in the line $y = -x + 7$.

Student assessment 1

SA1.1 Copy the diagram (book p. 467, an object and its reflected image). (a) Draw on your diagram the position of the mirror line. (b) Find the equation of the mirror line.

SA1.2 The triangle ABC is mapped onto triangle A'B'C' by a rotation (book p. 467). (a) Find the coordinates of the centre of rotation. (b) Give the angle and direction of rotation.

SA1.3 Write down the column vector of the translation which maps (book p. 467, rectangles A, B and C): (a) rectangle A to rectangle B, (b) rectangle B to rectangle C.

SA1.4 Enlarge the triangle (book p. 467) by a scale factor 2 and from the centre of enlargement O.

Student assessment 2

SA2.1 Copy the diagram (book p. 468, an object on a grid). (a) Draw in the mirror line with equation $y = x - 1$. (b) Reflect the object in the mirror line.

SA2.2 Write down the column vector of the translation which maps (book p. 468, triangles A, B and C): (a) triangle A to triangle B, (b) triangle B to triangle C.

SA2.3 Enlarge the rectangle (book p. 468) by a scale factor 1.5 and from the centre of enlargement O.

SA2.4 Square ABCD is mapped onto square A'B'C'D'. Square A'B'C'D' is subsequently mapped onto square A"B"C"D" (book p. 469). (a) Describe fully the transformation which maps ABCD onto A'B'C'D'. (b) Describe fully the transformation which maps A'B'C'D' onto A"B"C"D".

Student assessment 3

SA3.1 An object ABCD and its image A'B'C'D' are shown (book p. 469). (a) Find the position of the centre of enlargement. (b) Calculate the scale factor of enlargement.

SA3.2 The square ABCD is mapped onto A'B'C'D'. A'B'C'D' is subsequently mapped onto A"B"C"D" (book p. 469). (a) Describe in full the transformation which maps ABCD onto A'B'C'D'. (b) Describe in full the transformation which maps A'B'C'D' onto A"B"C"D".

SA3.3 An object WXYZ and its image W'X'Y'Z' are shown (book p. 470). (a) Find the position of the centre of enlargement. (b) Calculate the scale factor of enlargement.

SA3.4 Triangle ABC is mapped onto A'B'C'. A'B'C' is subsequently mapped onto A"B"C" (book p. 470). (a) Describe in full the transformation which maps ABC onto A'B'C'. (b) Describe in full the transformation which maps A'B'C' onto A"B"C".

Check yourself

C1 Reflect the point (3, 2) in the line x = 5.

C2 Rotate the point (2, 1) through 90° clockwise about the origin.

C3 The point (−1, 4) is translated to (5, 2). Write down the column vector of the translation.

C4 Enlarge the point (4, 3) by scale factor 2 from the centre (1, 1). Then enlarge it by scale factor −2 from the same centre.

C5 Triangle PQR is reflected in the y-axis and the image is then translated by (0 / −4). Describe where P(2, 5) ends up.

Chapter quiz

Q1 What is the image of (3, 2) after reflection in the y-axis?

A	B	C	D
(3, −2)	(−3, −2)	(−3, 2)	(2, 3)

Q2 The point (2, 5) is reflected in the line x = 4. What is the image?

A	B	C	D
(6, 5)	(8, 5)	(2, 3)	(4, 5)

Q3 A point goes from (1, 4) to (7, 4) in a reflection. What is the mirror line?

A	B	C	D
y = 4	x = 3	x = 8	x = 4

Q4 Rotate (2, 1) through 90° clockwise about the origin. Where does it go?

A	B	C	D
(−1, 2)	(1, −2)	(−2, 1)	(−2, −1)

Q5 What is the image of (3, −2) after a rotation of 180° about the origin?

A	B	C	D
(3, 2)	(−3, 2)	(−3, −2)	(2, −3)

Q6 Which three things describe a rotation fully?

A	B	C	D
Mirror line and distance	Vector and scale factor	Centre, angle and direction	Centre and scale factor

Q7 Translate (6, 1) by the vector (−4 over 5). What is the image?

A	B	C	D
(10, −4)	(2, −4)	(10, 6)	(2, 6)

Q8 A shape is enlarged by scale factor 3 with centre (0, 0). Where does (2, −1) go?

A	B	C	D
(6, −3)	(5, 2)	(−6, 3)	(6, 3)

Q9 A side of length 6 cm becomes 15 cm in an enlargement. What is the scale factor?

A	B	C	D
9	0.4	2.5	3

Q10 An enlargement has scale factor 1/2. What is true of the image?

A	B	C	D
It is larger than the object	It is on the other side of the centre	It is not an enlargement	It is smaller than the object

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Q11 Enlarge (1, 2) by scale factor −2 with centre (0, 0). What is the image?

A	B	C	D
(2, 4)	(−2, −4)	(−1, −2)	(−2, 4)

Q12 The point (1, 3) is reflected in the line y = x. What is the image?

A	B	C	D
(3, 1)	(−1, −3)	(−3, −1)	(1, −3)

End of assignment · Check your answers against the chapter at gurujazzy.com/subjects/o-level-mathematics/chapter-32-transformations/