



# ACHIEVE ACADEMY

## GCSE Maths — Higher Tier

Transformations & Vectors · Practice Booklet

NAME:

---

CLASS:

---

DATE:

---

☐ Developing

☒ Secure

☐ Greater Depth

Answer every question in the working space provided. Method marks are available for correct working even if the final answer is wrong. Check the time allowed with your tutor before you start.

### Transformations & Vectors

---

Total marks available: 103

## ● Transformations & Vectors

✓  $(-1, -1), (1, -1), (1, 1), (-1, 1)$

Q1 · ● Developing · 3 marks

### METHOD

Enlargement, centre O, scale factor  $1/2$ :  $(x, y) \rightarrow ((1/2)x, (1/2)y)$

$$(-2, -2) \rightarrow (-1, -1)$$

$$(2, -2) \rightarrow (1, -1)$$

$$(2, 2) \rightarrow (1, 1)$$

$$(-2, 2) \rightarrow (-1, 1)$$

✓  $(-2, -3), (0, -3), (0, -1), (-2, -1)$

Q2 · ● Developing · 3 marks

### METHOD

Enlargement, centre O, scale factor  $1/2$ :  $(x, y) \rightarrow ((1/2)x, (1/2)y)$

$$(-4, -6) \rightarrow (-2, -3)$$

$$(0, -6) \rightarrow (0, -3)$$

$$(0, -2) \rightarrow (0, -1)$$

$$(-4, -2) \rightarrow (-2, -1)$$

✓  $(-1, -2), (1, -2), (1, 1)$

Q3 · ● Developing · 3 marks

### METHOD

Enlargement, centre O, scale factor  $1/3$ :  $(x, y) \rightarrow ((1/3)x, (1/3)y)$

$$(-3, -6) \rightarrow (-1, -2)$$

$$(3, -6) \rightarrow (1, -2)$$

$$(3, 3) \rightarrow (1, 1)$$

✓  $(-3, -3), (0, -3), (-3, -1)$

Q4 · ● Developing · 3 marks

### METHOD

Enlargement, centre O, scale factor  $1/2$ :  $(x, y) \rightarrow ((1/2)x, (1/2)y)$

$$(-6, -6) \rightarrow (-3, -3)$$

$$(0, -6) \rightarrow (0, -3)$$

$$(-6, -2) \rightarrow (-3, -1)$$

✓  $(-1, -3), (1, -3), (1, 0)$

Q5 · ● Developing · 3 marks

METHOD

Enlargement, centre O, scale factor  $1/2$ :  $(x, y) \rightarrow ((1/2)x, (1/2)y)$

$$(-2, -6) \rightarrow (-1, -3)$$

$$(2, -6) \rightarrow (1, -3)$$

$$(2, 0) \rightarrow (1, 0)$$

✓  $(-2, -2), (1, -2), (-2, 0)$

Q6 · ● Developing · 3 marks

METHOD

Enlargement, centre O, scale factor  $1/2$ :  $(x, y) \rightarrow ((1/2)x, (1/2)y)$

$$(-4, -4) \rightarrow (-2, -2)$$

$$(2, -4) \rightarrow (1, -2)$$

$$(-4, 0) \rightarrow (-2, 0)$$

✓  $(-2, -2), (1, -2), (-1, 1)$

Q7 · ● Developing · 3 marks

METHOD

Enlargement, centre O, scale factor  $1/2$ :  $(x, y) \rightarrow ((1/2)x, (1/2)y)$

$$(-4, -4) \rightarrow (-2, -2)$$

$$(2, -4) \rightarrow (1, -2)$$

$$(-2, 2) \rightarrow (-1, 1)$$

✓  $(-1, -1), (1, -1), (1, 2)$

Q8 · ● Developing · 3 marks

METHOD

Enlargement, centre O, scale factor  $1/3$ :  $(x, y) \rightarrow ((1/3)x, (1/3)y)$

$$(-3, -3) \rightarrow (-1, -1)$$

$$(3, -3) \rightarrow (1, -1)$$

$$(3, 6) \rightarrow (1, 2)$$

✓  $(-1, -2), (1, -2), (1, 0), (-1, 0)$

Q9 · ● Developing · 3 marks

METHOD

Enlargement, centre O, scale factor  $1/3$ :  $(x, y) \rightarrow ((1/3)x, (1/3)y)$

$$(-3, -6) \rightarrow (-1, -2)$$

$$(3, -6) \rightarrow (1, -2)$$

$$(3, 0) \rightarrow (1, 0)$$

$$(-3, 0) \rightarrow (-1, 0)$$

✓  $(-1, 1), (1, 1), (1, 3), (-1, 3)$

Q10 · ● Developing · 3 marks

METHOD

Enlargement, centre O, scale factor  $1/2$ :  $(x, y) \rightarrow ((1/2)x, (1/2)y)$

$$(-2, 2) \rightarrow (-1, 1)$$

$$(2, 2) \rightarrow (1, 1)$$

$$(2, 6) \rightarrow (1, 3)$$

$$(-2, 6) \rightarrow (-1, 3)$$

✓  $(-1, -1), (-3, -1), (-3, -4)$

Q11 · ● Secure · 3 marks

METHOD

Enlargement, centre O, scale factor  $-1$ :  $(x, y) \rightarrow (-x, -y)$ . A negative scale factor maps the shape to the opposite side of the centre.

$$(1, 1) \rightarrow (-1, -1)$$

$$(3, 1) \rightarrow (-3, -1)$$

$$(3, 4) \rightarrow (-3, -4)$$

✓  $(-4, -2), (-8, -2), (-8, -8)$

Q12 · ● Secure · 3 marks

METHOD

Enlargement, centre O, scale factor  $-2$ :  $(x, y) \rightarrow (-2x, -2y)$ . A negative scale factor maps the shape to the opposite side of the centre.

$$(2, 1) \rightarrow (-4, -2)$$

$$(4, 1) \rightarrow (-8, -2)$$

$$(4, 4) \rightarrow (-8, -8)$$

✓  $(-3, 5), (-3, 2), (-1, 5)$

Q13 · ● Secure · 4 marks

METHOD

Apply the transformations in order.

Start:  $(-6, -6), (-3, -6), (-6, -4)$

After: rotate P by  $270^\circ$  anticlockwise about the origin,  $O \rightarrow (-6, 6), (-6, 3), (-4, 6)$

After: translate the result by the vector  $(3, -1) \rightarrow (-3, 5), (-3, 2), (-1, 5)$

✓  $(-2, -4), (-8, -4), (-2, -8)$

Q14 · ● Secure · 3 marks

METHOD

Enlargement, centre O, scale factor  $-2: (x, y) \rightarrow (-2x, -2y)$ . A negative scale factor maps the shape to the opposite side of the centre.

$(1, 2) \rightarrow (-2, -4)$

$(4, 2) \rightarrow (-8, -4)$

$(1, 4) \rightarrow (-2, -8)$

✓  $(-1, -6), (-1, -4), (-3, -4), (-3, -6)$

Q15 · ● Secure · 4 marks

METHOD

Apply the transformations in order.

Start:  $(-5, -3), (-3, -3), (-3, -1), (-5, -1)$

After: translate P by the vector  $(-1, 4) \rightarrow (-6, 1), (-4, 1), (-4, 3), (-6, 3)$

After: rotate the result by  $90^\circ$  anticlockwise about the origin,  $O \rightarrow (-1, -6), (-1, -4), (-3, -4), (-3, -6)$

✓  $(4, 0), (4, -3), (1, -1)$

Q16 · ● Secure · 4 marks

METHOD

Apply the transformations in order.

Start:  $(0, -4), (3, -4), (1, -1)$

After: rotate P by  $270^\circ$  anticlockwise about the origin,  $O \rightarrow (-4, 0), (-4, -3), (-1, -1)$

After: reflect the result in the y-axis  $\rightarrow (4, 0), (4, -3), (1, -1)$

✓  $(-1, -6), (-1, -3), (1, -3), (1, -6)$

Q17 · ● Secure · 4 marks

METHOD

Apply the transformations in order.

Start:  $(-6, -1), (-3, -1), (-3, 1), (-6, 1)$

After: rotate P by  $90^\circ$  anticlockwise about the origin,  $O \rightarrow (1, -6), (1, -3), (-1, -3), (-1, -6)$

After: reflect the result in the y-axis  $\rightarrow (-1, -6), (-1, -3), (1, -3), (1, -6)$

✓  $(-2, 1), (1, 1), (-2, -1)$

Q18 · ● Secure · 4 marks

METHOD

Apply the transformations in order.

Start:  $(-4, -2), (-1, -2), (-4, 0)$

After: translate P by the vector  $(2, 1) \rightarrow (-2, -1), (1, -1), (-2, 1)$

After: reflect the result in the x-axis  $\rightarrow (-2, 1), (1, 1), (-2, -1)$

✓  $(0, -4), (2, -4), (2, -6), (0, -6)$

Q19 · ● Secure · 4 marks

METHOD

Apply the transformations in order.

Start:  $(0, 4), (2, 4), (2, 6), (0, 6)$

After: rotate P by  $180^\circ$  anticlockwise about the origin,  $O \rightarrow (0, -4), (-2, -4), (-2, -6), (0, -6)$

After: reflect the result in the y-axis  $\rightarrow (0, -4), (2, -4), (2, -6), (0, -6)$

✓  $(-2, -2), (-8, -2), (-4, -8)$

Q20 · ● Secure · 3 marks

METHOD

Enlargement, centre O, scale factor  $-2: (x, y) \rightarrow (-2x, -2y)$ . A negative scale factor maps the shape to the opposite side of the centre.

$(1, 1) \rightarrow (-2, -2)$

$(4, 1) \rightarrow (-8, -2)$

$(2, 4) \rightarrow (-4, -8)$

✓ Rotation of  $180^\circ$  about the origin, (0, 0)

Q21 · ● Greater Depth · 3 marks

METHOD

P maps onto P' by a single transformation: Rotation of  $180^\circ$  about the origin, (0, 0).

✓  $AB = (1, 4)$ ,  $|AB| = 4.123$

Q22 · ● Greater Depth · 4 marks

METHOD

$$AB = b - a = (0, 4) - (-1, 0) = (1, 4)$$

$$|AB| = \sqrt{1^2 + 4^2}$$

$$|AB| = \sqrt{17} = 4.123$$

✓ Enlargement, scale factor 2, centre (0, 0)

Q23 · ● Greater Depth · 3 marks

METHOD

P maps onto P' by a single transformation: Enlargement, scale factor 2, centre (0, 0).

✓  $AB = (9, -3)$ ,  $|AB| = 9.487$

Q24 · ● Greater Depth · 4 marks

METHOD

$$AB = b - a = (6, 1) - (-3, 4) = (9, -3)$$

$$|AB| = \sqrt{9^2 + (-3)^2}$$

$$|AB| = \sqrt{90} = 9.487$$

✓ Reflection in the y-axis

Q25 · ● Greater Depth · 3 marks

METHOD

P maps onto P' by a single transformation: Reflection in the y-axis.

✓  $AB = (3, -2), |AB| = 3.606$

Q26 · ● Greater Depth · 4 marks

METHOD

$$AB = b - a = (2, 0) - (-1, 2) = (3, -2)$$

$$|AB| = \sqrt{(3)^2 + (-2)^2}$$

$$|AB| = \sqrt{13} = 3.606$$

✓  $AB = (-6, -4), |AB| = 7.211$

Q27 · ● Greater Depth · 4 marks

METHOD

$$AB = b - a = (-3, -2) - (3, 2) = (-6, -4)$$

$$|AB| = \sqrt{((-6)^2 + (-4)^2)}$$

$$|AB| = \sqrt{52} = 7.211$$

✓  $AB = (0, -1), |AB| = 1.0$

Q28 · ● Greater Depth · 4 marks

METHOD

$$AB = b - a = (2, 2) - (2, 3) = (0, -1)$$

$$|AB| = \sqrt{(0)^2 + (-1)^2}$$

$$|AB| = \sqrt{1} = 1.0$$

✓  $AB = (-2, 6), |AB| = 6.325$

Q29 · ● Greater Depth · 4 marks

METHOD

$$AB = b - a = (1, 3) - (3, -3) = (-2, 6)$$

$$|AB| = \sqrt{((-2)^2 + 6^2)}$$

$$|AB| = \sqrt{40} = 6.325$$

✓  $AB = (-8, -6), |AB| = 10.0$

Q30 · ● Greater Depth · 4 marks

METHOD

$$AB = b - a = (-2, -1) - (6, 5) = (-8, -6)$$

$$|AB| = \sqrt{((-8)^2 + (-6)^2)}$$

$$|AB| = \sqrt{100} = 10.0$$