Test answers - Transformations

Year: Year 8 · Duration: 45 minutes · /20

Answer to Question 1 (4 marks)

a. Reflecting in the x-axis keeps each x-coordinate and changes the sign of the y-coordinate: $(x, y) \to (x, -y)$. The image is $(1, -2)$, $(4, -2)$, $(1, -5)$. (1 mark for two correct, 2 marks for all three)

b. The vector $\begin{pmatrix} -3 \\ 2 \end{pmatrix}$ means 3 units left and 2 units up, so subtract 3 from each x and add 2 to each y. The image is $(-2, 4)$, $(1, 4)$, $(-2, 7)$. (1 mark for two correct, 2 marks for all three)

Both transformations keep the triangle the same size and shape, so the images are congruent to ABC. Check (a): each image point is the same distance below the axis as the original is above it. Check (b): AB is still 3 units long and horizontal.

Answer to Question 2 (4 marks)

a. A rotation of 90° anticlockwise about the origin sends (x, y) to $(-y, x)$. So $(2, 1) \to (-1, 2)$, $(4, 1) \to (-1, 4)$ and $(2, 3) \to (-3, 2)$. The image is $(-1, 2)$, $(-1, 4)$, $(-3, 2)$. (1 mark for two correct, 2 marks for all three)

b. Every coordinate has changed sign: $(x, y) \to (-x, -y)$. This is a **rotation of 180° about the origin** (1 mark for rotation, 1 mark for both the angle and the centre).

Tracing paper is a good check for (a): trace the triangle, pin the origin and turn the paper a quarter turn anticlockwise. For a 180° rotation the direction does not need to be stated, because clockwise and anticlockwise give the same image.

Answer to Question 3 (4 marks)

a. Multiply each length by the scale factor 4: $5 \times 4 = 20$ and $3 \times 4 = 12$. The image is **20 cm by 12 cm**. (1 mark)

b. Perimeter of R $= 2(5 + 3) =$**16 cm**; image $= 2(20 + 12) =$**64 cm**. The perimeter is multiplied by 4, the same as the lengths. (1 mark)

c. Area of R $= 5 \times 3 =$**15 cm²** (1 mark). Image $= 20 \times 12 =$**240 cm²** (1 mark).

The area has been multiplied by $240 \div 15 = 16$, which is 4^2. Lengths grow by the scale factor, but areas grow by its square, because both the length and the width are multiplied.

Answer to Question 4 (4 marks)

a. Scale factor = new length ÷ old length $= 60 \div 8 =$**7.5**. (1 mark)
b. Areas are multiplied by the square of the scale factor: $7.5^2 = 56.25$ (1 mark). The banner logo has area $30 \times 56.25 =$**1 687.5 cm²** (1 mark). There are $100 \times 100 = 10\,000$ cm² in 1 m², so this is $1687.5 \div 10000 = 0.16875$, about **0.17 m²** (1 mark).

Multiplying 30 by 7.5 gives only 225 cm², a common mistake that forgets areas scale twice. Dividing by 100 instead of 10 000 in the last step is the other error to avoid.

Answer to Question 5 (4 marks)

a. The mirror line $x = 3$ is vertical, so the y-coordinates stay the same. Each point ends the same distance on the other side of the line: $(x, y) \to (6 - x, y)$. For example, $(1, 1)$ is 2 units left of the line, so its image is 2 units right, at $(5, 1)$. The vertices of T_1 are $(5, 1)$**,** $(4, 1)$**,** $(5, 3)$ (1 mark for two, 2 marks for all three).
b. An enlargement by scale factor 2 from the origin doubles every coordinate. The vertices of T_2 are $(10, 2)$**,** $(8, 2)$**,** $(10, 6)$ (1 mark for two, 2 marks for all three).

Check: the sides of T_2 are twice as long as those of T_1.