Year 9 Bearings and Transformations – Revision Notes

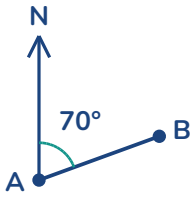
HappyKids.fit

Year 9 · Maths · Bearings, Coordinates and Transformations · Key ideas and worked examples

For grown-ups and learners: read each part and try the worked example. Then work through the sheets: Foundation, Developing, Challenge, then Mixed Practice to revise everything. Show your working: it earns marks in tests and helps you spot mistakes.

1. Maps, plans and bearings

A scale of **1 : 50 000** means 1 cm on the map is 50 000 cm = 500 m in real life. Multiply a map length by the scale, then change the units (100 cm = 1 m, 100 000 cm = 1 km); divide to go back to the map. A **bearing** is measured clockwise from north with three figures, and the bearing back is 180° different: if B is on 070° from A, then A is on 250° from B.



Example: A plan of a room has a scale of 1 : 50. On the plan the room is 10 cm by 10 cm. Find the real length and width of the room in metres.
→ Multiply by 50: 10 × 50 = 500 cm and 10 × 50 = 500 cm
→ In metres: 5 m by 5 m
Answer: 5 m by 5 m

2. Points on a line segment

To find the point P with **AP : PB = 1 : 3**, split the segment into 1 + 3 = 4 equal parts. From A (1, 2) to B (9, 10), x and y each change by 8, a quarter is 2, so P = (3, 4). The midpoint is the case 1 : 1. If M is the midpoint and you know A, go the same step again from M to reach B.

Example: P lies on the line segment from A (3, 1) to B (13, −9) so that AP : PB = 1 : 4. Find the coordinates of P.
→ AP is 1/5 of AB
→ AB: x changes by 10, y by −10
→ 1/5 of these: 2 and −2, so P = (5, −1)
Answer: (5, −1)

3. Combined transformations and congruence

Do the transformations **in order**, using the image of the first as the object of the second. Reflections, rotations and translations keep every length and angle, so the final image is always **congruent** to the object. To **describe** a single transformation fully: a reflection needs its **mirror line**; a rotation its **angle, direction and centre**; a translation its **vector**; an enlargement its **scale factor and centre**.

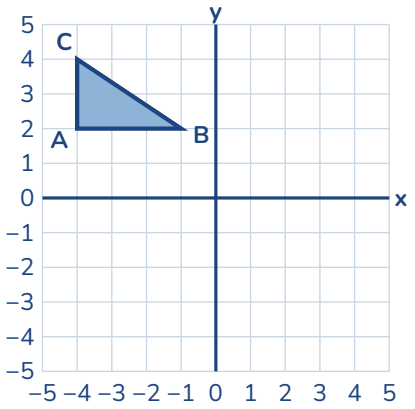
Example: Take triangle ABC. First rotate it 180° about (0, −1), then rotate it 90° clockwise about (1, 0). Write the coordinates of the final image of A, B and C.

→ First: A → (4, −4), B → (1, −4), C → (4, −6)

→ Then: A" (−3, −3), B" (−3, 0), C" (−5, −3)

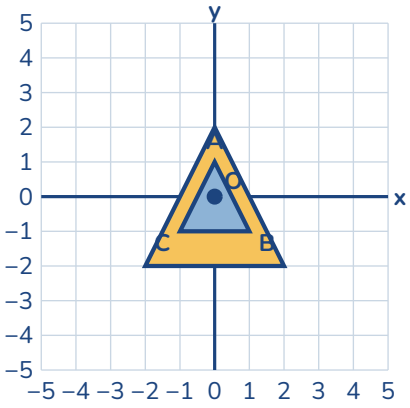
→ The final image is congruent to ABC

Answer: A" (−3, −3), B" (−3, 0), C" (−5, −3)



4. Enlargement from any centre

To enlarge by scale factor k from centre O, multiply the distance (across and up) from O to every corner by k. The centre can be **outside**, **on** or **inside** the shape; a corner on the centre stays where it is. To find the centre, join matching corners of the object and image with straight lines: they meet at the centre. The scale factor is image length ÷ object length.



In the grid, the small triangle ABC is the **object** and the large triangle is its **image** after an enlargement with scale factor **2** from centre **O (0, 0)**, which is inside the shape. A (0, 1) is 1 up from O, so its image is 2 up, at (0, 2); B (1, −1) moves to (2, −2).

5. Perimeter and area after an enlargement

With scale factor k, every length is multiplied by k, so the **perimeter is multiplied by k**. The area is multiplied by **k^2**, because both the length and the width are multiplied by k. A 2 cm by 3 cm rectangle enlarged by scale factor 3 becomes 6 cm by 9 cm: the perimeter goes from 10 cm to 30 cm (× 3) and the area from 6 cm² to 54 cm² (× 9).

Example: A square has an area of 9 cm^2. It is enlarged by scale factor 2. Find the side length, perimeter and area of the image.
→ Original side √9 = 3 cm
→ Image side 2 × 3 = 6 cm, perimeter 4 × 6 = 24 cm
→ Area 6^2 = 36 cm^2 (× 4)
Answer: side 6 cm; perimeter 24 cm; area 36 cm^2

Think like a mathematician: test a few cases (**specialising**), look for the rule that always works (**generalising**), and explain why you are sure (**convincing**). When you check someone's working, say what is wrong and how to **improve** it.

Common mistakes: dividing by 10 000 instead of 100 000 to get kilometres. Writing a back bearing over 360°. Using 1/3 for the ratio 1 : 3. Enlarging from the origin instead of the centre. Multiplying the area by k instead of k^2.