

GCSE MATHS

Scale drawings and bearings

Long workbook

Questions on GCSE Maths topics, including challenges beyond typical exam questions.

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Topic recap

Scale

A scale $1 : n$ means one unit on the drawing represents n of the same units in reality. Convert units before simplifying the ratio.

Bearings

Measure clockwise from north and write bearings with three figures. A reverse bearing differs by 180° .

North and east distances

Draw a right-angled triangle with a north line. For a journey of d km on a bearing of θ , the distance east is $d \sin \theta$ and the distance north is $d \cos \theta$. A negative result means west or south.

Triangles

Draw north lines to calculate the interior angles. Use Pythagoras or trigonometry for right triangles and the sine/cosine rule for other triangles.

Use degree mode. Give bearings to the nearest degree and distances to 2 decimal places unless an exact value is requested.

Route diagrams are not to scale.

1. Scale drawings and maps

Example Problem 1

**

A map has scale 1:25,000. Two places are 6.4 cm apart on the map. Find their actual distance in kilometres.

The idea

1. Multiply by the scale factor in centimetres, then convert to kilometres.

Worked Solution

$$6.4 \times 25000 = 160000 \text{ cm}$$

Use the scale.

$$160000 / 100000 = 1.6 \text{ km}$$

There are 100,000 centimetres in a kilometre.

1 Scale drawings and maps

Q1 A scale is 1:50,000. Find the actual distance represented by 3 cm, in kilometres.

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Q2 A map uses 1:25,000. Find the map distance in centimetres representing 2 km.

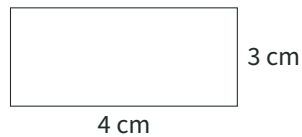
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Q3 A 12 m wall is drawn 6 cm long. Write the scale as 1: n .

**

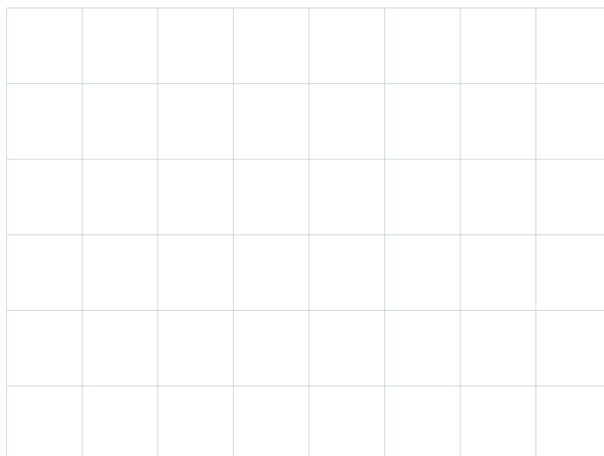
Q4 On a plan with scale 1:150, a rectangular room measures 4 cm by 3 cm. Find its actual perimeter in metres.

**



- Q5** Draw a scale plan of a 6 m by 4 m rectangular room at scale 1:100. Use the grid. Print at 100% size.

**



Each square is 1 cm by 1 cm

- Q6** At scale 1:200, a rectangular garden measures 4 cm by 3.5 cm. Find its actual area in square metres.



2. Reading and reversing bearings

Example Problem 2

**

The bearing of B from A is 075° . Find the bearing of A from B .



The idea

1. Reverse direction by adding half a turn.

Worked Solution

$$75^\circ + 180^\circ = 255^\circ$$

The result is already below 360° .

2 Reading and reversing bearings

Q7 Write the bearing of due east.

*

Q8 Write the bearing of south-west.

*

Q9 The bearing of B from A is 065° . Find the reverse bearing.

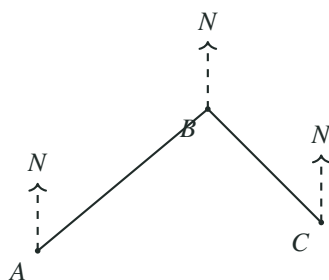
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Q10 The bearing of B from A is 310° . Find the reverse bearing.

**

Q11 From P , A is on bearing 040° and B on bearing 115° . Find the smaller angle APB .

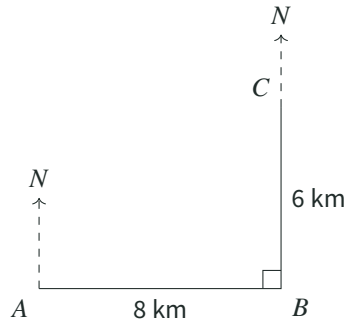
Q12 The bearing of B from A is 050° . The bearing of C from B is 140° . Find angle ABC .



3. Right-angled routes

Example Problem 3

A ship travels 8 km east, then 6 km north. Find its distance and bearing from its start.



The idea

1. Use Pythagoras for the perpendicular legs, then measure the bearing from north.

Worked Solution

$$d = \sqrt{8^2 + 6^2} = 10 \text{ km}$$

Find the direct distance.

$$\theta = \tan^{-1}(8/6) \approx 53.13^\circ$$

East is opposite the angle measured from north.

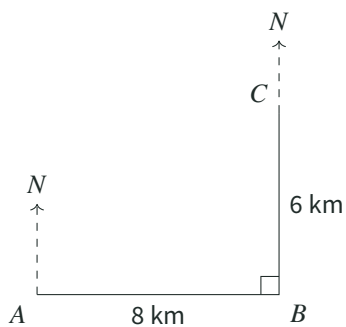
Bearing 053°

Round and use three figures.

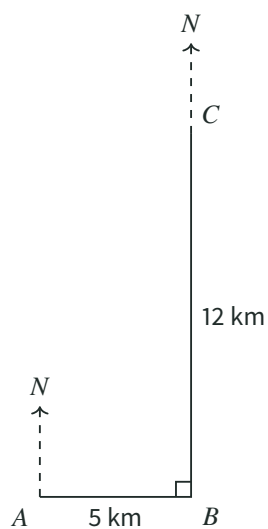
3 Right-angled routes

Q13 A walker goes 8 km east from A to B , then 6 km north to C . Find AC exactly.

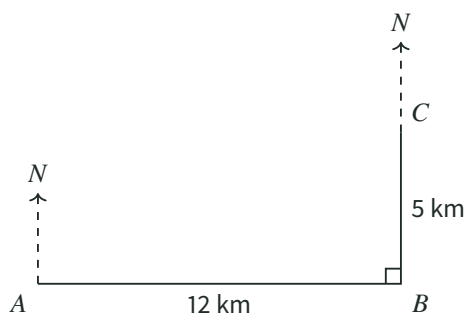
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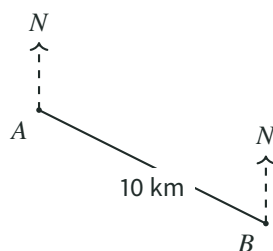
Q14 For the route shown, find the bearing of C from A .



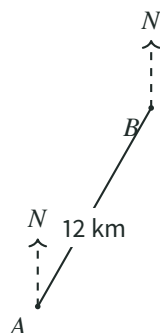
Q15 For the route shown, find the bearing of A from C.



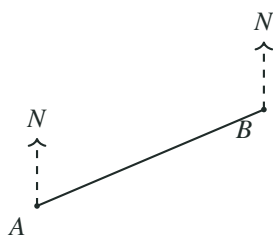
Q16 A ship travels 10 km on bearing 120° . How far east of its start is it?



Q17 A ship travels 12 km on bearing 030° . How far north of its start is it?



Q18 B is 12 km east and 5 km north of A. Find (a) AB exactly; (b) the bearing of B from A .

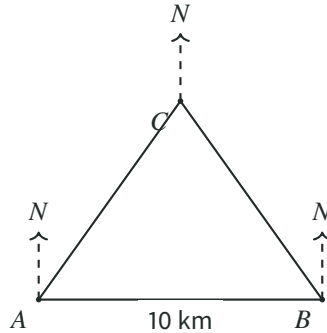


4. Multi-stage routes and finding a position

Example Problem 4

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A and B are 10 km apart, with B due east of A . C is on a bearing of 035° from A and 325° from B . Find AC .



The idea

1. Convert each bearing into an angle inside the triangle, then use the sine rule.

Worked Solution

$$\angle A = 55^\circ$$

$$\angle B = 55^\circ$$

$$\angle C = 70^\circ$$

$$\frac{AC}{\sin 55^\circ} = \frac{10}{\sin 70^\circ}$$

$$AC \approx 8.72 \text{ km}$$

Subtract the bearings from the relevant east/west directions.

Angles in a triangle sum to 180° .

Pair each side with its opposite angle.

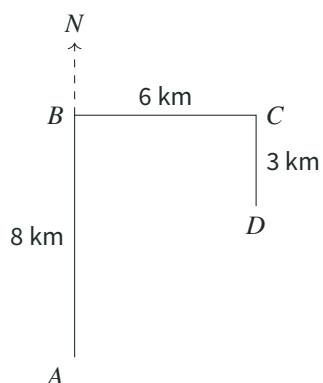
Evaluate in degree mode and round.

4 Multi-stage routes and finding a position

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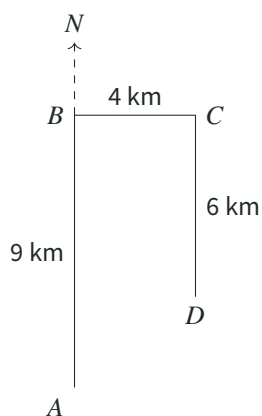
Q19 A walker travels 8 km north, 6 km east, then 3 km south. Find the direct distance from the start to the finish.

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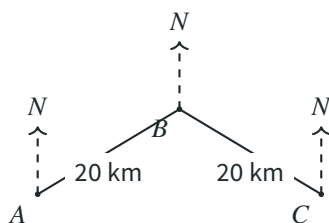


Q20 For the three-stage route shown, find the bearing of the finish from the start.

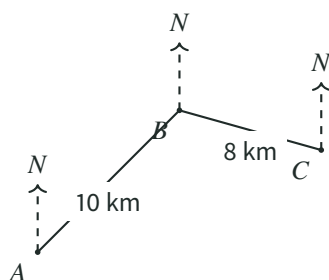
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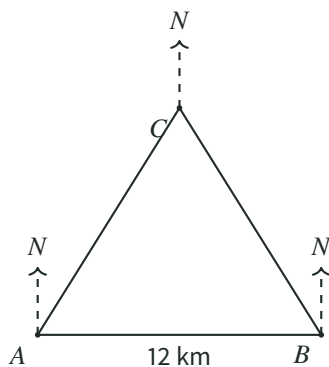
- Q21** A ship travels 20 km on bearing 060° , then 20 km on bearing 120° . Find (a) its distance from the start; (b) its bearing from the start.



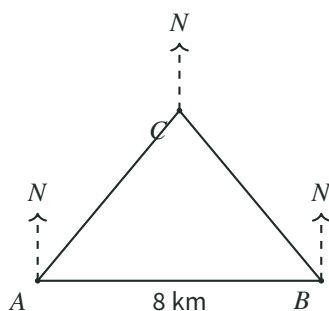
- Q22** A ship travels 10 km on bearing 045° , then 8 km on bearing 105° . Find the direct distance from its start to its finish.



Q23 B is 12 km due east of A . C is on bearing 030° from A and 330° from B . Find AC exactly.



Q24 B is 8 km due east of A . A tower C is on bearing 040° from A and 320° from B . Find (a) AC ;
(b) the perpendicular distance of C north of line AB .



Solving principles

1. Match the units

Convert centimetres to metres or kilometres before interpreting a map length.

2. Draw north first

Mark where the bearing starts, then turn clockwise.

3. Use the interior angle

A bearing is not automatically the angle inside a triangle.

4. Track each journey

For several legs, add east-west and north-south movements separately.