

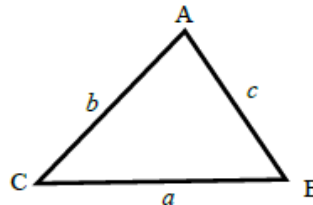
Bearings and the cosine rule

A LEVEL LINKS

Scheme of work: 4a. Trigonometric ratios and graphs

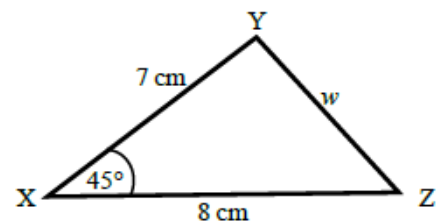
Key points

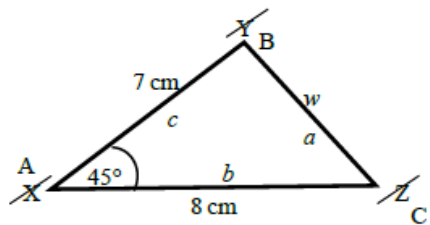
- a is the side opposite angle A .
 b is the side opposite angle B .
 c is the side opposite angle C .



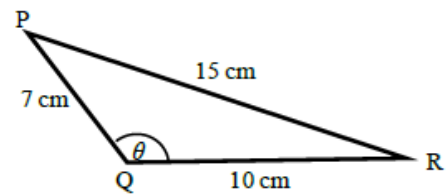
- You can use the cosine rule to find the length of a side when two sides and the included angle are given.
- To calculate an unknown side use the formula $a^2 = b^2 + c^2 - 2bc \cos A$.
- Alternatively, you can use the cosine rule to find an unknown angle if the lengths of all three sides are given.
- To calculate an unknown angle use the formula $\cos A = \frac{b^2 + c^2 - a^2}{2bc}$.

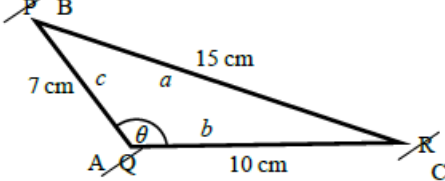
Example 1 Work out the length of side w .
Give your answer correct to 3 significant figures.



 $a^2 = b^2 + c^2 - 2bc \cos A$ $w^2 = 8^2 + 7^2 - 2 \times 8 \times 7 \times \cos 45^\circ$ $w^2 = 33.804\ 040\ 51\dots$ $w = \sqrt{33.804\ 040\ 51}$ $w = 5.81 \text{ cm}$	<ol style="list-style-type: none"> 1 Always start by labelling the angles and sides. 2 Write the cosine rule to find the side. 3 Substitute the values a, b and A into the formula. 4 Use a calculator to find w^2 and then w. 5 Round your final answer to 3 significant figures and write the units in your answer.
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Example 2 Work out the size of angle θ .
Give your answer correct to 1 decimal place.



 $\cos A = \frac{b^2 + c^2 - a^2}{2bc}$ $\cos \theta = \frac{10^2 + 7^2 - 15^2}{2 \times 10 \times 7}$ $\cos \theta = \frac{-76}{140}$ $\theta = 122.878\ 349\dots$ $\theta = 122.9^\circ$	<ol style="list-style-type: none"> 1 Always start by labelling the angles and sides. 2 Write the cosine rule to find the angle. 3 Substitute the values a, b and c into the formula. 4 Use \cos^{-1} to find the angle. 5 Use your calculator to work out $\cos^{-1}(-76 \div 140)$. 6 Round your answer to 1 decimal place and write the units in your answer.
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Practice question

1

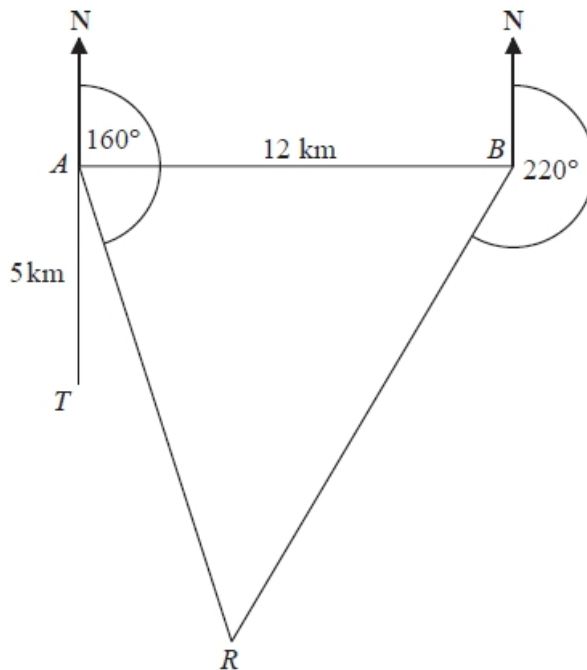


Diagram **NOT**
accurately drawn

There is a coastguard station at point A and at point B .
 B is due East of A .

The distance from A to B is 12 km.

There is a rowing boat at point R .

R is on a bearing of 160° from A .

R is on a bearing of 220° from B .

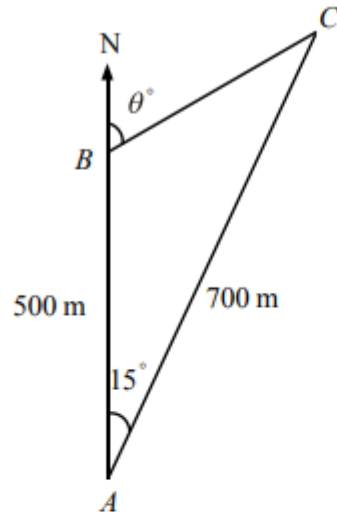
There is a speedboat at point T .

T is 5 km due South of A .

Work out the shortest distance from T to R .

Give your answer correct to 1 decimal place.

You must show all your working.



The diagram above shows 3 yachts A , B and C which are assumed to be in the same horizontal plane. Yacht B is 500 m due north of yacht A and yacht C is 700 m from A . The bearing of C from A is 015° .

- (a) Calculate the distance between yacht B and yacht C , in metres to 3 significant figures.

The bearing of yacht C from yacht B is θ° , as shown in the diagram.

- (b) Calculate the value of θ .

Answers

1. 6.2 km
2. $BC = 253, \theta = 45.8$