

The cosine rule

The COSINE RULE applies to any triangle. You don't need a right angle.

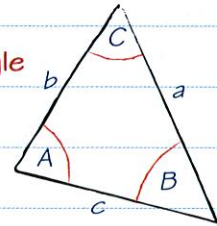
You usually use the cosine rule when you are given two sides and the included angle (SAS) or when you are given three sides and want to work out an angle (SSS).

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

This version is on the formula sheet. Use it to find a missing side.

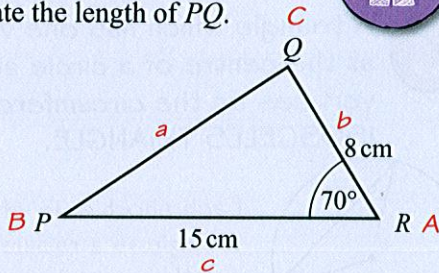
Learn this version. It's useful for finding a missing angle.



Worked example

grade
A

Calculate the length of PQ.



$$\begin{aligned} a^2 &= b^2 + c^2 - 2bc \cos A \\ PQ^2 &= 8^2 + 15^2 - 2 \times 8 \times 15 \times \cos 70^\circ \\ &= 206.9151\dots \\ PQ &= 14.4 \text{ cm (to 3 s.f.)} \end{aligned}$$

This is not a right-angled triangle so you can't use $S^O_H C^A_H T^O_A$. You know two sides and the included angle (SAS) so you can use the cosine rule.

Let a represent the side you want to calculate.

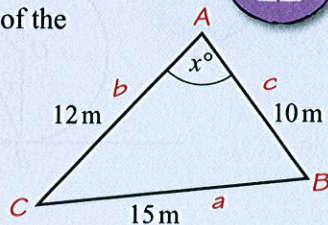
Substitute the values you are given into the formula.

Use BIDMAS when you work out the value of the right-hand side. Do **not** work out $8^2 + 15^2 - 2 \times 8 \times 15$ and then multiply by $\cos 70^\circ$.

Worked example

grade
A

Calculate the size of the angle marked x.



$$\begin{aligned} \cos A &= \frac{b^2 + c^2 - a^2}{2bc} \\ \cos x^\circ &= \frac{12^2 + 10^2 - 15^2}{2 \times 12 \times 10} \\ &= \frac{19}{240} \\ x^\circ &= 85.4593\dots^\circ = 85.5^\circ \text{ (to 3 s.f.)} \end{aligned}$$

You know all three sides (SSS) so you can use the cosine rule.

You need to find an angle so use this version:

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

Let A represent the angle you want to calculate.

Use the \cos^{-1} function on your calculator to find the angle.

Now try this

edexcel

Calculate the length of AB.

Give your answer correct to 3 significant figures.

(3 marks)

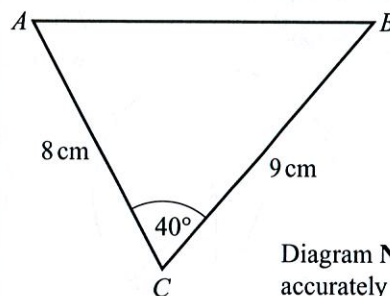


Diagram NOT accurately drawn

grade
A

Sine or cosine?

Use the sine rule when a problem involves two sides and two angles.

Use the cosine rule when a problem involves three sides and one angle.

Look at page 89 for an A* cosine rule question.