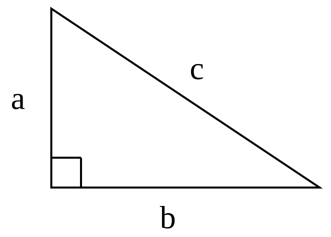
Trigonometry

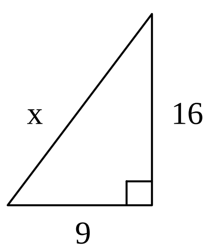
Pythagoras' Theorem

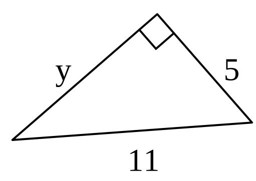
In a right-angled triangle, the square of the length of the longest side equals the sum of the squares of the lengths of the other two sides. In other words:



$$c^2 = a^2 + b^2$$

This means that you can work out the size of an angle in a right-angled triangle if you know the lengths of two of the sides, or you can work out the length of any side or angle if you know another angle and a side length:

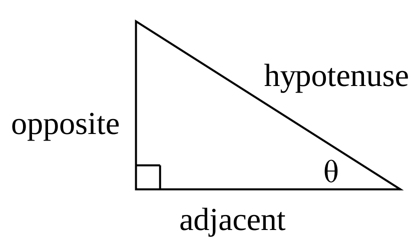




Trigonometric Ratios

In a right-angled triangle, the ratios between the side lengths are the fundamental ratios sine, cosine, and tangent. For a given angle θ, the "opposite" side is the side opposite θ, the "adjacent" side is the side next to θ, and the hypotenuse is the longest side.

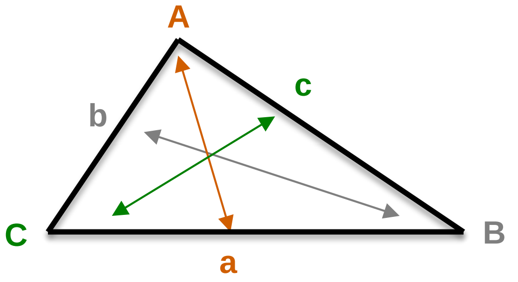
$$\sin\theta = \frac{opposite}{hypoteneuse} = \frac{O}{H} \qquad \cos\theta = \frac{adjacent}{hypoteneuse} = \frac{A}{H} \qquad \tan\theta = \frac{opposite}{adjacent} = \frac{O}{A}$$



Using the Sine and Cosine Rules

For ANY triangle (not just a right-angled triangle), the angles and sides of the triangle are defined as:

a is the side opposite angle **A**
b is the side opposite angle **B**
c is the side opposite angle **C**



Which one should you use? Firstly, decide what you know.

If you know **two angles:**

use the **Sine rule**

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

or

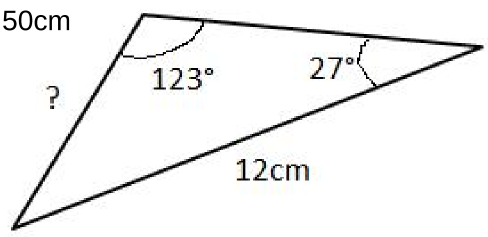
$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

Example:
Here we have been given 2 of the angles, but only one side measurement. The rule we need then is the sine rule, as 2 angles are involved.

$$\frac{12}{\sin 123°} = \frac{?}{\sin 27°}$$

$$? = \frac{12 \times \sin 27°}{\sin 123°}$$

So ? = 6.50cm



If you know **two sides and the angle between** them or if you know **all three sides:**

use the **Cosine rule**

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

Example:
Here we have been given three sides and we need to find the angle. The rule we need is the cosine rule which involves 3 sides and one angle. It is easier to use the cos A formula, as it is the angle we want to find.

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

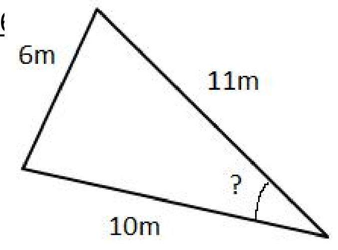
Using ? as our angle A, this gives us:

$$\cos ? = \frac{10^2 + 11^2 - (}{2 \times 10 \times 11}$$

So $\cos ? = \frac{185}{220}$

So ? = $\cos^{-1}$ 0.8409...

So ? = 32.8°



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