Finding a missing angle given two sides

It is important to recall that sine, cosine and tangent are ratios which depend on a reference angle.

In the old days we had "trig tables" which listed all angles from 0° to 90° along with their sine, cosine and tangent ratios. Now we have calculators which can find the ratio for us and can also find the "INVERSE" of the ratio for us.

For instance, on your calculator you should find that the sine of 30° is 0.5

This is written as $\sin 30° = 0.5$

this also means that the INVERSE sine of 0.5 is 30°

This is written as $\sin^{-1}(0.5) = 30°$

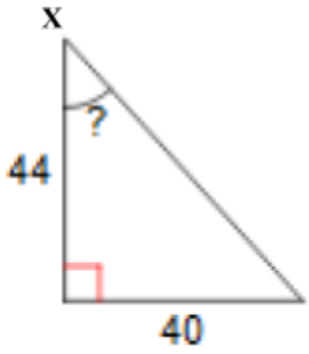
In other words if $\sin(\text{ANGLE}) = \text{RATIO}$ then $\sin^{-1}(\text{RATIO}) = \text{ANGLE}$

This also works for cosine and tangent ratios. The buttons for these are directly above the SIN, COS & TAN buttons, so you will need to use the "SHIFT" or "2nd" button to get there…

This being said, in order **to find an angle in a right triangle given two sides**, here are the steps:

1) Label the two given sides (as opposite, adjacent or hypotenuse) with respect to the angle you wish to find (your reference angle)
2) Use $S\frac{O}{H}C\frac{A}{H}T\frac{O}{A}$ to determine which ratio to use
3) Write the equation
4) Use the inverse trig ratio to solve for the angle

Examples: In each case we are solving for angle X.



In this triangle, the side measuring 40 is OPPOSITE angle X and the side measuring 44 is ADJACENT to angle X.

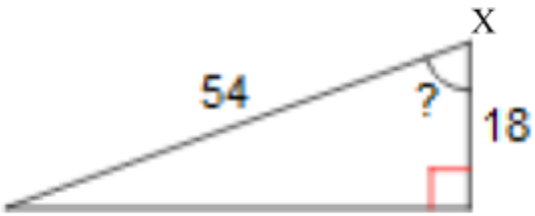
Since the tangent ratio is opposite over adjacent, we get the equation:

$\tan X = \frac{40}{44}$ in order to solve we use the inverse

$X = tan^{-1}\left(\frac{40}{44}\right)$

$X = 42.273689...°$ to one decimal place,

$X = 42.3°$



In this example, the side measuring 18 is ADJACENT to angle X and the side measuring 54 is the HYPOTENUSE.

Since the cosine ratio is the adjacent over the hypotenuse, we get the equation:

$\cos X = \frac{18}{54}$

$X = cos^{-1}\left(\frac{18}{54}\right)$

$X = 70.5287793...°$ to one decimal place,

$X = 70.5°$