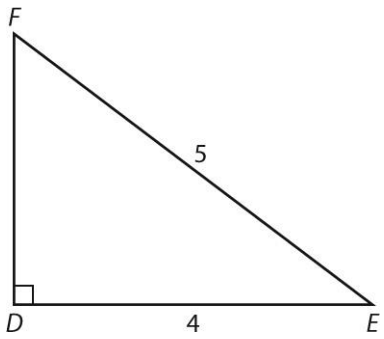
Solving Right Triangles using Trigonometry (SOHCAHTOA)

A triangle is ***solved*** when the measures of all three angles and all three sides are known. We can solve a right triangle using trigonometry ratios and the Pythagorean Theorem.

Here is the plan for solving a right triangle:

1. If given 1 side length and 1 acute angle, use trigonometry to find either both missing sides or 1 additional side and use the Pythagorean Theorem to find the third side. The missing acute angle can be found by subtracting the given acute angle from 90°.
2. If given 2 sides but no acute angles, use the Pythagorean Theorem to find the missing side then use inverse trigonometry to find one of the acute angles. Then subtract that angle from 90° to find the third angle. This is the example shown below.

Using the given information in the figure, we can solve the triangle by finding *DF* and the measures of all three angles.



$\cos\angle E = \frac{4}{5}$, so $\text{m}\angle E = \cos^{-1}\left(\frac{4}{5}\right) \approx 36.9°$

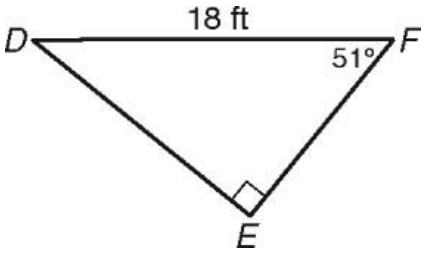
$\text{m}\angle F = 90° - \text{m}\angle E \approx 53.1°$

$FE^2 = FD^2 + DE^2$

$FD = \sqrt{FE^2 - DE^2}$

$FD = \sqrt{5^2 - 4^2} = \sqrt{9} = 3$

Here is an example of case 1:
To find the m<D, subtract…..90-51 = 39

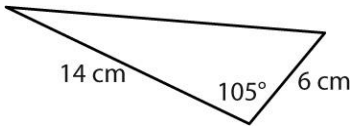


To find DE, use $\sin 51 = \frac{x}{18}$, so DE = 14 (13.988…..)

Using the Pythagorean Theorem, $EF^2 + 14^2 = 18^2$, so EF=11.3

The area of a triangle can be found if the measures of one of its angles and the length of the sides adjacent to that angle are known.

The area of triangle *ABC* can be found using the formula:



$\frac{1}{2}ab\sin C$ or $\frac{1}{2}bc\sin A$ or $\frac{1}{2}ac\sin B$, depending on the information given. In the figure, the triangle has an area of $\frac{1}{2}(14)(6)\sin(105°) \approx 40.6 \text{ cm}^2$.