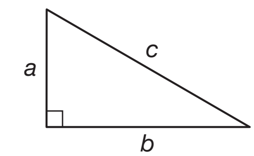
9 Solving Right Triangle Problems

Using the Pythagorean Theorem

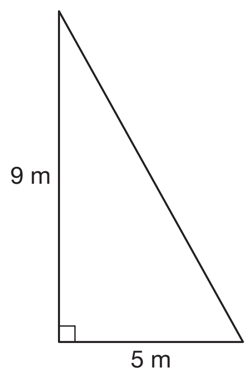
If you know the lengths of two sides of a right triangle, you can use the Pythagorean theorem to determine the length of the third side.



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

1. Use the Pythagorean theorem. Calculate the unknown side length. Label each length, to one decimal place.

a)



$(9\text{ m})^2 + (5\text{ m})^2 = c^2$

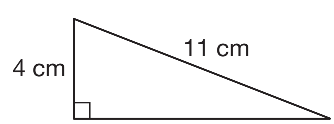
______ m^2 + ______ $\text{m}^2 = c^2$

______ $\text{m}^2 = c^2$

$\sqrt{\_\_\_\_\_\_\text{ m}^2} = \sqrt{c^2}$

______ $\text{m} = c$

b) $(4\text{ cm})^2 + b^2 = (11\text{ cm})^2$



$16\text{ cm}^2 + b^2 = 121\text{ cm}^2$

$b^2 = 121\text{ cm}^2 -$ ______ cm^2

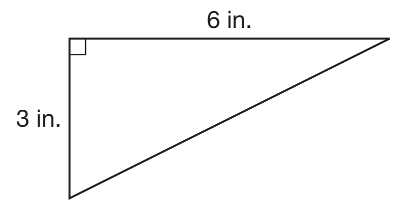
$b^2 =$ ______ cm^2

$\sqrt{b^2} = \sqrt{\_\_\_\_\_\_\text{ cm}^2}$

$b =$ ______ cm

Hint
Suppose that you know the lengths of *a* and *c*, but not the length of *b*. You can use $b^2 = c^2 - a^2$.

c)



$(3\text{ in.})^2 + (6\text{ in.})^2 = c^2$

______ sq in. + ______ sq in. $= c^2$

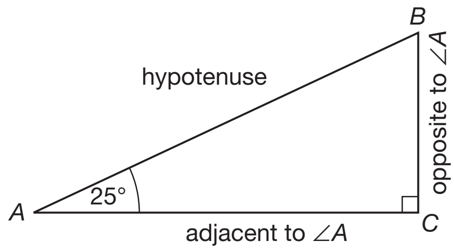
______ sq in. $= c^2$

$\sqrt{\_\_\_\_\_\_\text{ sq in.}} = \sqrt{c^2}$

______ in. $= c$

Using Trigonometric Ratios

Trigonometric ratios work for right triangles. You can use trigonometric ratios to calculate side lengths and angle measures.



- In the triangle above, ∠A is 25°.
- ∠B must be 65° since 25° + 90° + 65° = 180°.
- Every right triangle with a 25° angle has the same angles.
- Triangles with the same angles are similar.
- Similar triangles have the same side : side ratios.

Hint

The three trigonometric ratios for ∠A are

$\sin A = \frac{\text{opposite}}{\text{hypotenuse}}$

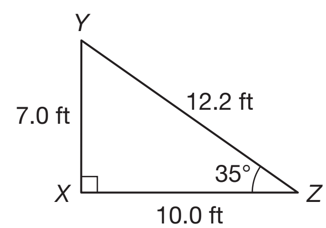
$\cos A = \frac{\text{adjacent}}{\text{hypotenuse}}$

$\tan A = \frac{\text{opposite}}{\text{adjacent}}$

2. a) Use side lengths to calculate each ratio in the chart below for the triangle at the right. Answer to four decimal places.

b) Calculate each ratio using the trig function keys on a calculator. Do your answers match?

Ratio	a) Using side lengths	b) Using a calculator
$\sin 35° = \frac{\text{opposite}}{\text{hypotenuse}}$	$\frac{7.0}{12.2}$ ft = ________ ft	sin 35° =
$\cos 35° = \frac{\text{adjacent}}{\text{hypotenuse}}$		
$\tan 35° = \frac{\text{opposite}}{\text{adjacent}}$		



3. a) Use a calculator. Enter the tangent of 35° that you calculated for Question 2. Then press $\tan^{-1}$. What does your calculator show, to the nearest whole number?

____

b) What does this number tell you about the triangle?

Tech Tip

Inverse Trig Functions

The $\sin^{-1}$, $\cos^{-1}$, and $\tan^{-1}$ keys are called inverse trig functions.