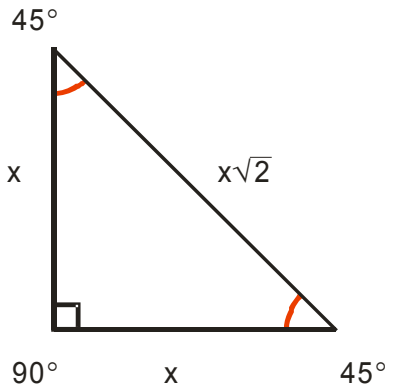
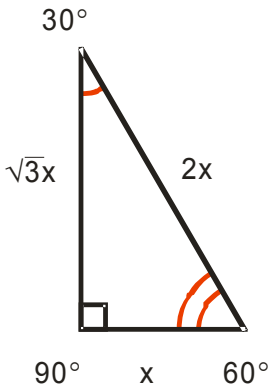
Special Right Triangles

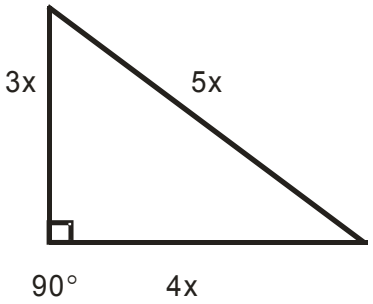
45-45-90 Triangle



30-60-90 Triangle

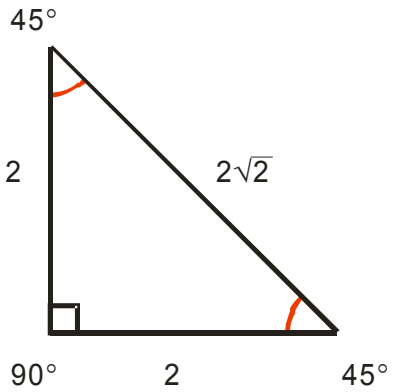


3-4-5 Triangle

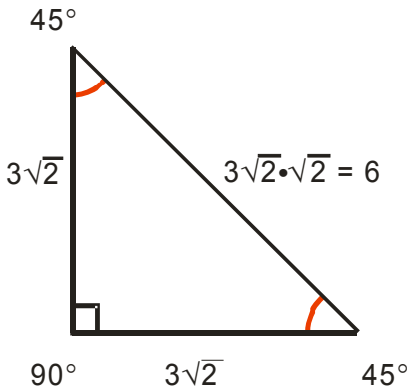


Two Special Right Triangles
Using the Pythagorean Theorem you can find the missing side length of any right triangle as long as you know two of the sides. But there are two special right triangles that you only need to know one side length to be able to find the lengths of the other two sides. One of those triangles is the 45-45-90 triangle and the other is the 30-60-90 triangle.

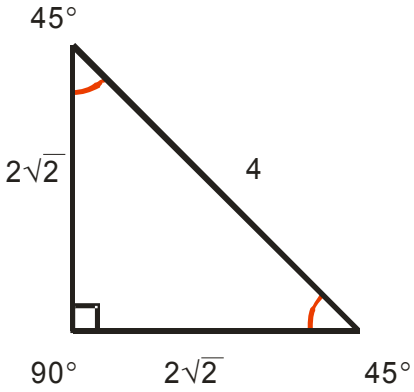
45-45-90 Right Triangle
Look at the 45-45-90 triangle pattern. In example 1 if x = 2 (the leg is 2) then the hypotenuse is $2\sqrt{2}$. In example 2 if x = $3\sqrt{2}$ then the hypotenuse is $3\sqrt{2}\cdot\sqrt{2} = 3\cdot 2 = 6$. For example 3 what if the hypotenuse which is $x\sqrt{2}$ is 4? Then $x\sqrt{2} = 4$ so $x = \frac{4}{\sqrt{2}}$. This simplifies to $2\sqrt{2}$. So the legs for a 45-45-90 triangle with a hypotenuse that is 4 would each be $2\sqrt{2}$. You can prove this to yourself using the Pythagorean Theorem.



Example 1



Example 2

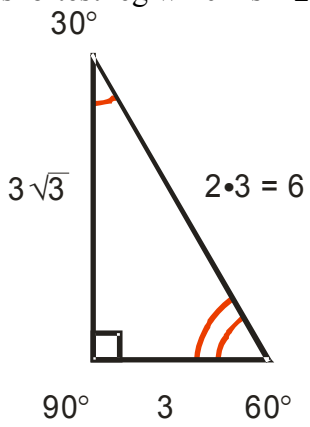


Example 3

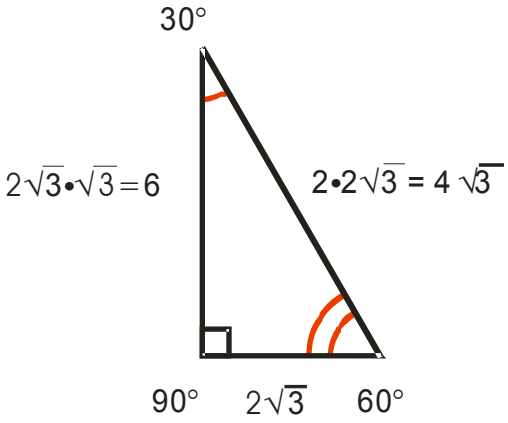
Special Right Triangles

30-60-90 Right Triangle

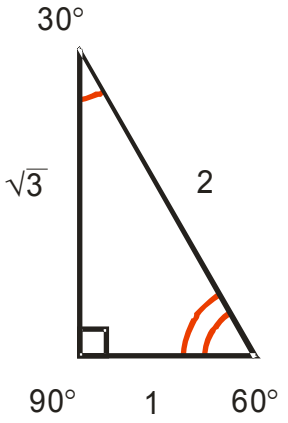
The hypotenuse is always twice the length of the shortest leg (the leg across from the 30° angle). The longest leg (the leg across from the 60° angle) is $x\sqrt{3}$ (is $\sqrt{3}$ times the length of the shortest leg). If you have a 30-60-90 triangle with a hypotenuse of 6 the shortest leg will be 3 because the hypotenuse is twice the length of the shortest leg. For this same triangle the longest leg will be $3\sqrt{3}$. For a 30-60-90 triangle with the longest leg equal to 6 you have $x\sqrt{3} = 6$ so $x = \frac{6}{\sqrt{3}}$ which simplifies to $2\sqrt{3}$ so the shortest leg is $2\sqrt{3}$. The hypotenuse is twice the length of the shortest leg which is $2 \cdot 2\sqrt{3}$ or $4\sqrt{3}$.



Example 1



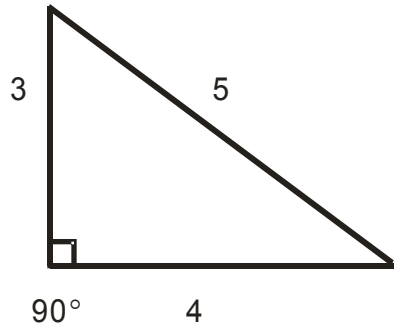
Example 2



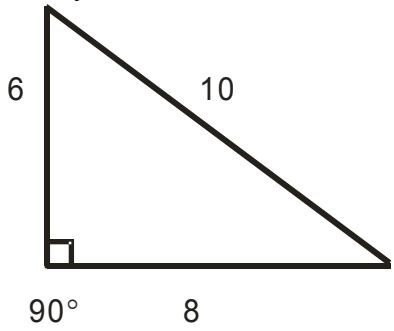
Example 3

3-4-5 Right Triangle

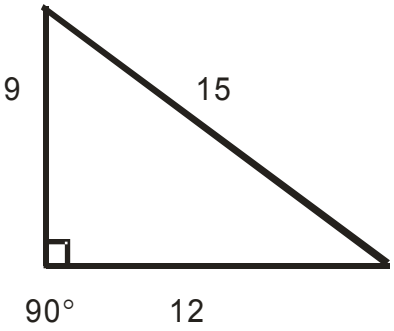
Unlike the 45-45-90 triangle and the 30-60-90 triangle where you only need to know one side length to find the other two side lengths, you will have to know two of the side lengths to find the third side length in a 3-4-5 triangle. You have to use the Pythagorean Theorem to solve these unless you remember the pattern. The most common pattern is the 3-4-5 pattern. The next one is 6-8-10 which is just the 3-4-5 with each side multiplied by 2. Others are 9-12-15 and 12-16-20 and so on.



Example 1



Example 2



Example 3

A common trick played on students is to give them a right triangle with two of the legs labeled with the numbers from this pattern. One leg will have either the smallest number or the middle number from the pattern and the other leg will have the largest number from the pattern. That is the trick, the largest number from the pattern has to be on the hypotenuse not on one of the legs. If the largest number is on one of the legs the triangle is not a 3-4-5 pattern right triangle.