

Math Diversion 1044

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In mathematics, the art of asking questions is
more valuable than solving problems.
— Georg Cantor

Source: <https://www.youtube.com/watch?v=bGcA3Izipq4>
Title: Many People Can't Solve This Math Problem
Presenter: Brain Station

1 Problem

Given the figure below, solve for the length x of the hypotenuse of right triangle ABC.

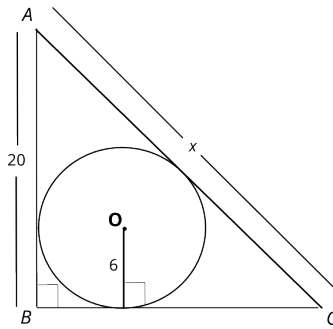


Figure 1. The circle at \mathbf{O} of radius 6 is inscribed in right triangle ABC, with hypotenuse $x = AC$.

2 Solution

Beside using the Pythagorean Theorem to solve this problem, I'll also be using a theorem in geometry called the *Tangent Segment Theorem*, which goes like this:

Given a circle and two non-parallel lines that are tangent to the circle at points a and b, respectively, and intersect each other at point c (outside the circle), then the length of line segment ac = the length of line segment bc.

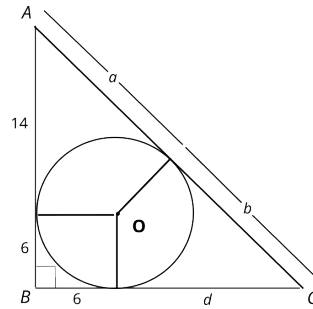


Figure 2. By use of the Tangent Segment Theorem, we get the more detailed version of Figure 1.

Beginning with the Pythagorean Theorem, we have that

$$AC^2 = AB^2 + BC^2 . \tag{1}$$

On substituting in values from the figure, we get

$$(a + b)^2 = 20^2 + (6 + d)^2 . \tag{2}$$

However, according to the Tangent Segment Theorem,

$$a = 14 \quad \text{and} \quad d = b , \tag{3}$$

thus (2) becomes

$$(14 + b)^2 = 20^2 + (6 + b)^2 . \tag{4}$$

On solving this for b we get

$$b = 15 . \tag{5}$$

Hence

$$x = a + b = 14 + 15 = 29 . \tag{6}$$