Pythagorean Theorem

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Right Triangle

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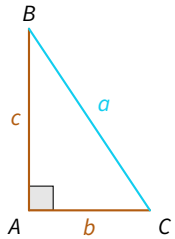
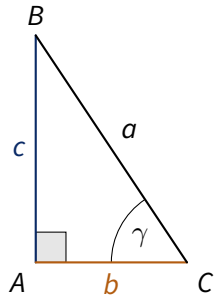
A triangle is called **right**, if one of its angles is a right angle (90°).
Right triangles have been of special import in many fields and so their sides have unique names:



The short sides are called *catheti* and the long side is called *hypothenuse*.

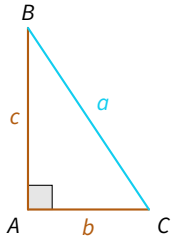
Right Triangle



With respect to a chosen angle γ, the side *c* is called *opposite* and *b* is called *adjacent*.

Pythagorean Theorem

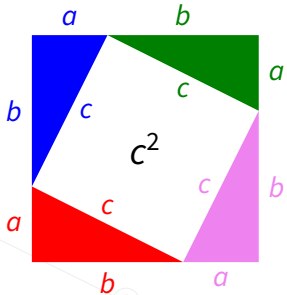
Pythagorean Theorem



Given a right triangle, the **Pythagorean Theorem** says that

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

Pythagorean Theorem – Proof



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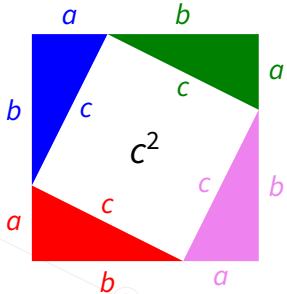

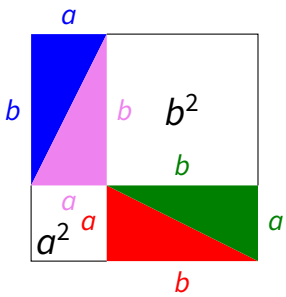

Pythagorean Theorem – Problem 1

What is the length of the hypotenuse in a right triangle if the catheti are 5 and 12?

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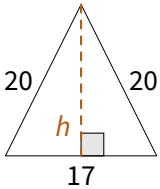
What is the length of the hypotenuse in a right triangle if the catheti are 5 and 12?
We simply calculate (h means hypotenuse)

$$h^2 = 5^2 + 12^2 = 169$$
$$h = \sqrt{169} = 13.$$

Pythagorean Theorem – Problem 2

Find the height of the following isosceles triangle:



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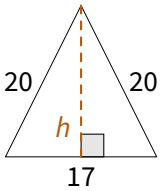

We have two right triangles next to each other – each one with hypotenuse of length 20 and one cathetus of length $17/2 = 8.5$.

Pythagorean Theorem – Problem 2

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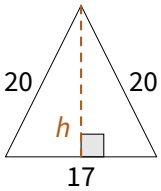

We have two right triangles next to each other – each one with hypotenuse of length 20 and one cathetus of length $17/2 = 8.5$. So, we know that

$$20^2 = 8.5^2 + h^2,$$

and thus $h^2 = 20^2 - 8.5^2 = 327.75$ and $h = \sqrt{327.75} = 18.1$.