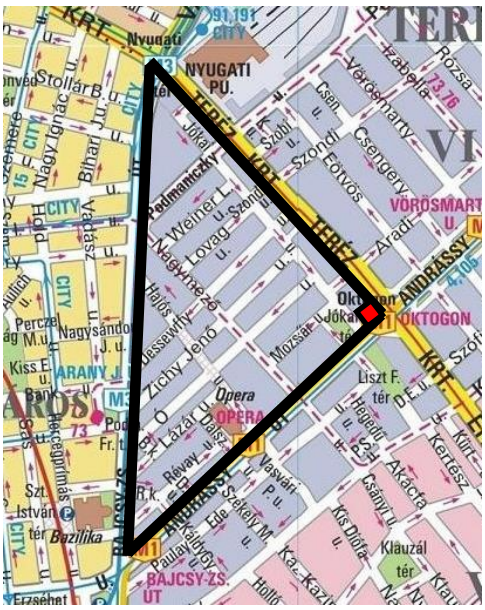
Introduction

A right angle is a 90° angle. They are everywhere – table corners, walls, boxes. Right-angled triangles are very important shapes.



Here's a right-angled triangle in Budapest, Hungary.

Nyugati rail station, at the top of the map, links to the airport.

Terez Korut is one of the main city ring roads.

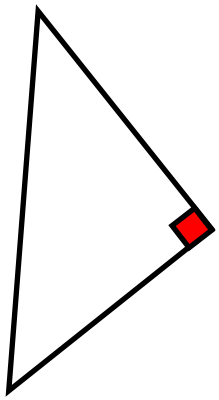
Andrassy Utca (Street) follows the route of the straight Metro line, the oldest on mainland Europe.

Oktagon is at the right angle.

Bajcsy – Zs Utca is opposite the right angle, so is the hypotenuse.

An important discovery relating to right-angled triangles is known as Pythagoras' Theorem.

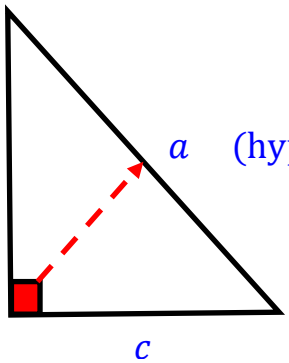
The hypotenuse is always the longest side and is opposite the



right angle

The square of the length of the hypotenuse is equal to the sum of the squares of the other two sides.

Or, if we label sides a, b and c:



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

You should memorise the following 'Pythagorean triples', natural numbers that fit this neatly:

$5^2 = 4^2 + 3^2$

$5^2 = 25 \quad 4^2 = 16 \quad 3^2 = 9$

$25 = 16 + 9$

and

$10^2 = 8^2 + 6^2$

$10^2 = 100 \quad 8^2 = 64 \quad 6^2 = 36$

$100 = 64 + 36$

Any multiples of 3, 4 and 5 will work.

Similarly:

$13^2 = 12^2 + 5^2$ and $25^2 = 24^2 + 7^2$

It is important to know these square numbers:

$1^2 = 1$	$6^2 = 36$	$11^2 = 121$
$2^2 = 4$	$7^2 = 49$	$12^2 = 144$
$3^2 = 9$	$8^2 = 64$	$13^2 = 169$
$4^2 = 16$	$9^2 = 81$	$14^2 = 196$
$5^2 = 25$	$10^2 = 100$	$15^2 = 225$

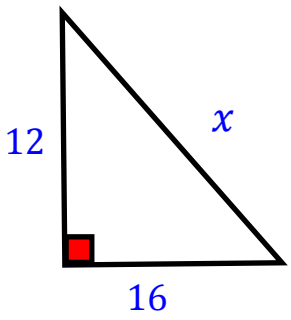
As well as squaring numbers we also need the inverse process ie. the square root.

$5^2 = 25 \leftrightarrow \sqrt{25} = 5$

$12^2 = 144 \leftrightarrow \sqrt{144} = 12$ etc

Questions on finding the length of the hypoteneuse

Example 1

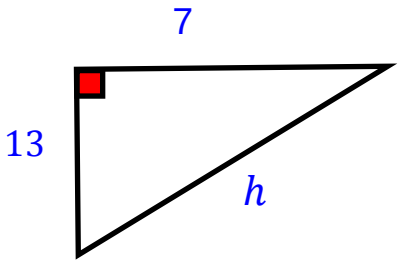


$$x^2 = 12^2 + 16^2$$
$$x^2 = 144 + 256$$
$$x^2 = 400$$
$$x = \sqrt{400} = 20$$

Notice that this is the 3, 4, 5 triangle again, enlarged by a scale factor of 4

$$20 = \mathbf{5} \times 4 \qquad 12 = \mathbf{3} \times 4 \qquad 16 = \mathbf{4} \times 4$$

Example 2



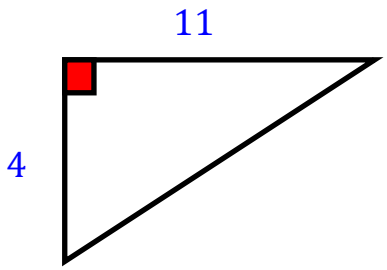
$$h^2 = 13^2 + 7^2$$
$$h^2 = 169 + 49$$
$$h^2 = 218$$
$$h = \sqrt{218} = 14.8$$

Note: Many questions don't have a whole number answer so a calculator is essential

Exercise A

Work out the hypotenuse for these.

1.



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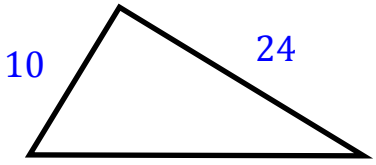

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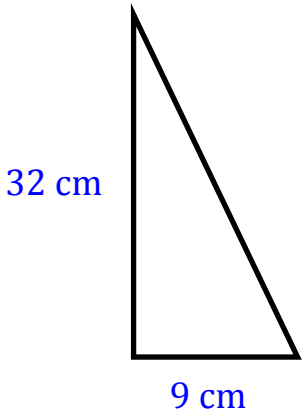


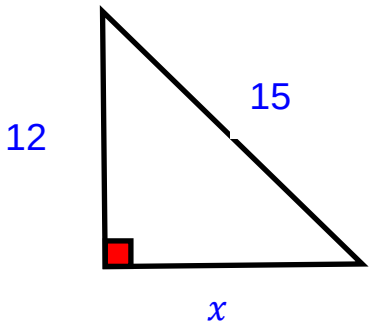
4. From the map on page 1, the length along Andrassy Ut is 910 m, and Terez Krt is 880 m.

   Calculate the length along Bajcsy – Zs Utca.

Questions on finding the length of one of the shorter sides

Example:

Calculate x:



This time we know the hypotenuse and need to calculate one of the other sides.

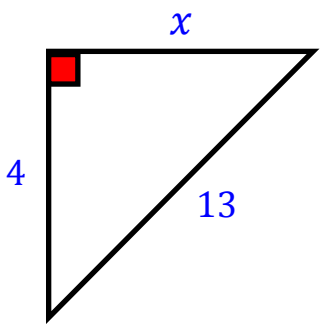
Notes:

1. We needed to change the subject of the formula to x.
2. Make sure the square root symbol covers everything on the right hand side.

$$15^2 = 12^2 + x^2$$
$$12^2 + x^2 = 15^2$$
$$x^2 = 15^2 - 12^2$$
$$x = \sqrt{15^2 - 12^2}$$

Exercise B

1.



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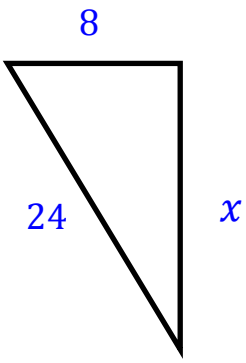

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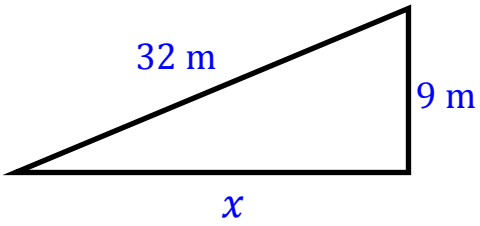

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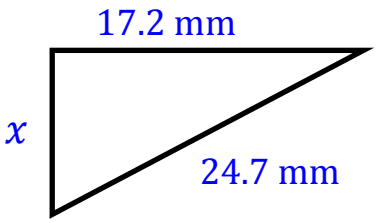
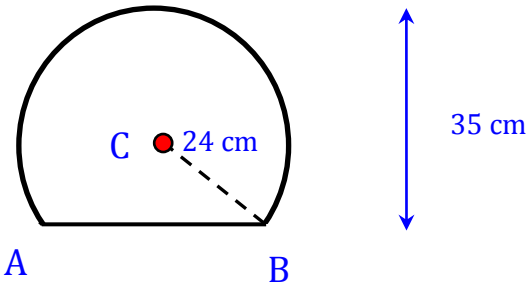


5. Pythagoras is often hidden within a question relating to circles:

A mirror is shaped like part of a circle.
The radius of the circle, centre C, is 24 cm.
The height of the mirror is 35 cm.



Calculate the length of the base of the mirror, represented in the diagram by AB.