

Pythagorean Theorem

Recall

What is the Pythagorean Theorem (as an equation)?

$$a^2 + b^2 = c^2 \quad \leftarrow c \text{ is the hypotenuse}$$

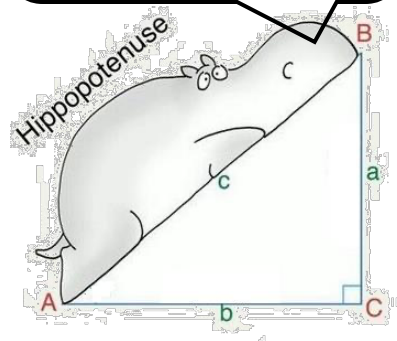
When can we use the Pythagorean Theorem (geometric shape)?

 right triangles (90° angle)

Why do we use it?

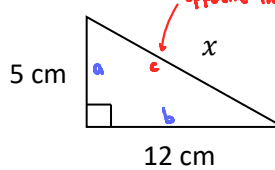
to find unknown side lengths

The Pythagorean Theorem states that "the square of the hypotenuse is equal to the sum of the squares of the other two sides".



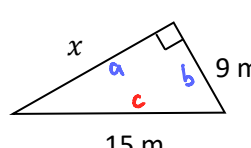
Example 1: Determine the value of x . Round all answers accurate to 2 decimal place.

a)



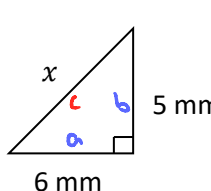
$$\begin{aligned} 5^2 + 12^2 &= x^2 \\ 25 + 144 &= x^2 \\ 169 &= x^2 \\ \sqrt{169} &= \sqrt{x^2} \\ 13 &= x \\ \therefore x &= 13 \text{ cm} \end{aligned}$$

b)



$$\begin{aligned} x^2 + 9^2 &= 15^2 \\ x^2 + 81 &= 225 \\ x^2 &= 225 - 81 \\ x^2 &= 144 \\ \sqrt{x^2} &= \sqrt{144} \\ x &= 12 \\ \therefore x &= 12 \text{ m} \end{aligned}$$

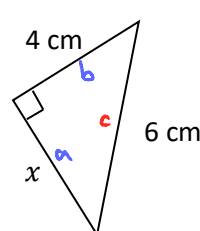
c)



$$\begin{aligned} 6^2 + 5^2 &= x^2 \\ 36 + 25 &= x^2 \\ 61 &= x^2 \\ \sqrt{61} &= \sqrt{x^2} \\ 7.81 &= x \\ \therefore x &= 7.81 \text{ mm} \end{aligned}$$

REMEMBER when rounding

d)



$$\begin{aligned} x^2 + 4^2 &= 6^2 \\ x^2 + 16 &= 36 \\ x^2 &= 20 \\ \sqrt{x^2} &= \sqrt{20} \\ x &= 4.47 \\ \therefore x &= 4.47 \text{ cm} \end{aligned}$$

In general, when finding the hypotenuse, we will be adding.
When finding a side other than the hypotenuse, we will be subtracting.

Example 2: Is the triangle with lengths 6 cm, 21 cm and 23 cm a right triangle? Show work.

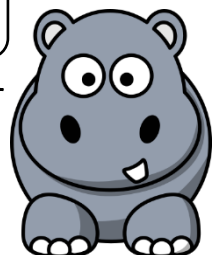
LS/RS check
(does this triangle meet
Pythagorean Thm conditions)

$$\begin{aligned} \text{LS} \\ 6^2 + 21^2 \\ &= 36 + 441 \\ &= 477 \end{aligned}$$

$$\begin{aligned} \text{RS} \\ 23^2 \\ &= 529 \end{aligned}$$

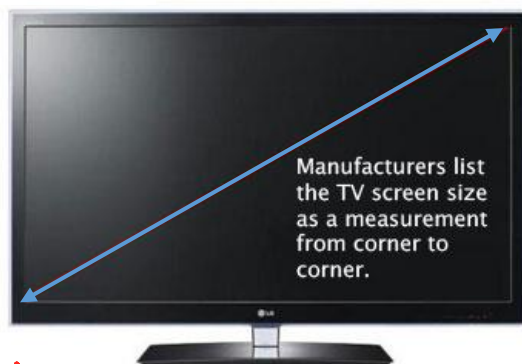
LS \neq RS
 \therefore It is not a right triangle

largest side length
would be hypotenuse





Did you know...?



65in | 4K | 4x HDMI | SMART



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\$1,048.00

LIMITED TIME OFFER
Sony 65 in. 4K HDR Google
Smart TV, KD65X80J
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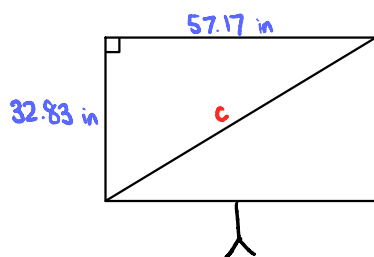
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Smart TV, KD55X80J
★★★★★ (92)

round to 2 decimal
places

hypotenuse

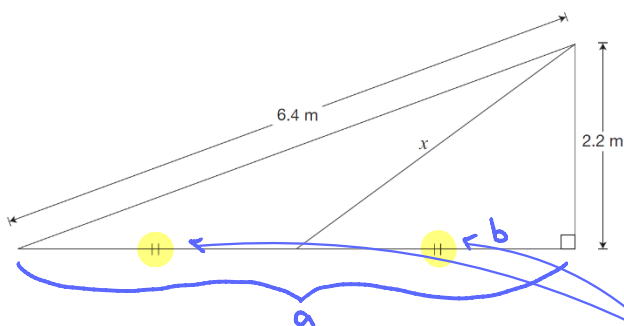
Example 3: What is the advertised size of the television if the length of the television is 57.17 inches and the height is 32.83 inches?



$$\begin{aligned} c^2 &= 32.83^2 + 57.17^2 \\ c^2 &= 1077.8089 + 3268.4089 \\ c^2 &= 4346.2178 \\ \sqrt{c^2} &= \sqrt{4346.2178} \\ c &\approx 65.93 \end{aligned}$$

∴ The advertised size
of the television is
about 65.93 in.

Example 4: The diagram below shows a small right triangle inside a large right triangle. Determine the value of x . Show your work.



1) Let a be the length of the large triangle

$$\begin{aligned} a^2 + 2.2^2 &= 6.4^2 \\ a^2 + 4.84 &= 40.96 \\ a^2 &= 36.12 \\ \sqrt{a^2} &= \sqrt{36.12} \\ a &\approx 6 \text{ m} \end{aligned}$$

2) sides have same length
∴ $b \approx \frac{6}{2}$
 $\approx 3 \text{ m}$
using a rounded number

3) $x^2 \approx 3^2 + 2.2^2$
 $x^2 \approx 9 + 4.84$
 $x^2 \approx 13.84$
 $\sqrt{x^2} \approx \sqrt{13.84}$
 $x \approx 3.7$
∴ $x \approx 3.7 \text{ m}$