Pythagorean Theorem

Suggested time: 75 minutes

What's important in this lesson:
In this lesson you will learn the Pythagorean Theorem and how to apply the theorem in practical examples.

Complete these steps:

1. Read through the lesson portion of the package independently.

2. Complete any of the examples in the lesson

3. Check your lesson answers with the lesson key your teacher has.

4. Seek assistance from the teacher as needed.

5. Complete the Assessment and Evaluation and submit for evaluation. Be sure to ask for any assistance when experiencing difficulties.
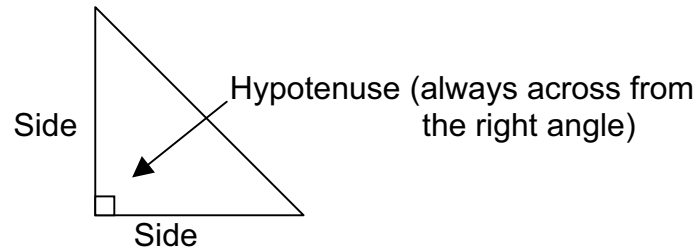

Hand-in the following to your teacher:

1. Assessment and Evaluation

Questions for the teacher:

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1. Evaluate without the use of a calculator.
    (a) $\sqrt{4}$ (b) $\sqrt{25}$ (c) $\sqrt{81}$

2. Evaluate using a calculator and round your answer to one decimal place.
    (a) $\sqrt{14}$ (b) $\sqrt{93}$ (c) $\sqrt{301}$

3. Draw 3 right-angled triangles.

4. Briefly explain how to identify the hypotenuse in a right-angled triangle.

Pythagorean Theorem

The Pythagorean Theorem is names for the Greek mathematician Pythagoras. He discovered the relationship between the sides of a right triangle. The relation states that the square of the hypotenuse is equal to the sum of the square of the lengths of the other sides.

Side

Hypotenuse (always across from the right angle)

Side

$$\text{Hypotenuse}^2 = \text{Side}^2 + \text{Side}^2$$

We commonly see this written as $c^2 = a^2 + b^2$, where a and b represent the length of the adjacent sides and c represents the length of the hypotenuse.

Example #1

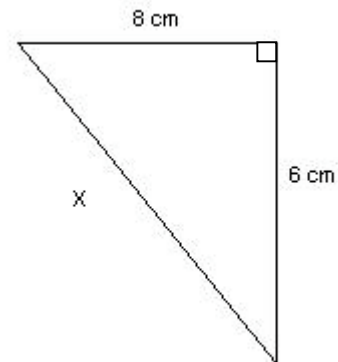Use the Pythagorean theorem to find the missing side.

Solution

$x^2 = 8^2 + 6^2$ Write equation

$x^2 = 64 + 36$ Simplify

$x^2 = 100$

$x = \sqrt{100}$ Square root both sides

$x = 10$

8 cm

6 cm

x

Therefore the side is 10 cm in length.

Example #2

Find the unknown side. Round your answer to 2 decimal places.

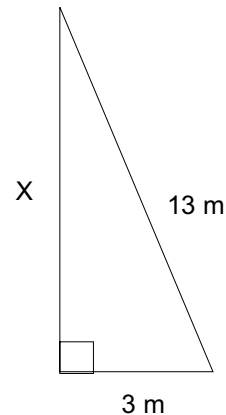**Solution**

$13^2 = x^2 + 3^2$

$169 = x^2 + 9$

$169 - 9 = x^2$

$160 = x^2$

$\sqrt{160} = x$

$12.65 = x$

Therefore the side is approximately 12.65 m in length.

Example #3 – Application

A 3 m ladder is leaning against a wall. The base of the ladder is 0.5 m from the wall. How far up the wall does the top of the ladder reach? Round your answer to the nearest hundredth of a metre. Provide a diagram.
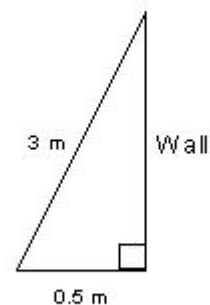

Solution

$w^2 + 0.5^2 = 3^2$

$w^2 + 0.25 = 9$

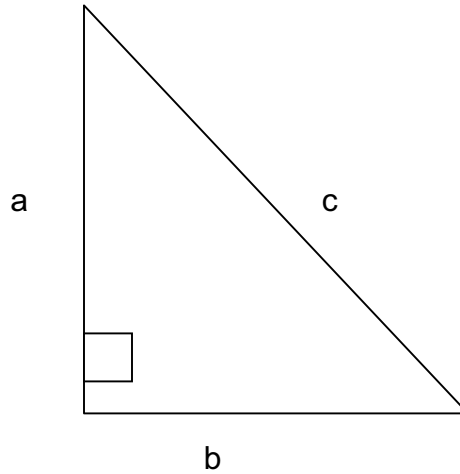$w^2 = 9 - 0.25$

$w^2 = 8.75$

$w = 2.96$

Therefore, the top of the ladder reaches approximately 2.96 m up the wall.

Exercises.

1. Based on the triangle below, calculate the length of the unknown side.

a

c

b

(a) If a=4 cm and b=3cm, find c.

(b) If a=5 cm and b=12 cm, find c.

(c) If a=6 cm and c=10 cm, find b.

(d) If a=15 cm and c=25 cm, find b.

(e) If b=12 cm and c=15 cm, find a.

(f) If b=40 cm and c=50 cm, find a.

2. A volleyball court is 18 m long and 9 m wide. Draw and label a diagram, then calculate the length of the diagonal.   Round to the nearest tenth.

3. A basketball court is 28 m long and 15 m wide. Draw and label a diagram, then calculate the length of the diagonal. Round to the nearest tenth.
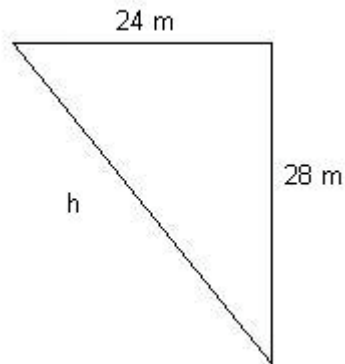
4. A 5 m ladder is placed against a wall. The base of the ladder is 3 m from the wall. How high up the wall does the ladder reach? Draw and label a diagram. Round to the nearest tenth.
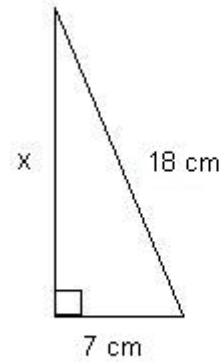
Assessment and Evaluation

1. Find the unknown side for each triangle. Round to the nearest tenth (one decimal).

   (a)

   24 m

   28 m

   h

   (b)

   x

   18 cm

   7 cm

2. In an emergency a person needs to be rescued from a building's window that is 6m high. The ladder must be placed a minimum of 1m from the base of the building. What is the required length for the ladder? Be sure to include a diagram.

3. Television and computer monitors are advertised using inch measure. The manufacturers use the diagonal distance from one corner to the opposite corner of the screen as their advertised measurement.

(a) Explain why the manufacturer would use this measure to report the size.

(b) Kenda has recently purchased a 27 inch flat panel television. If the width of the screen is 22 inches, then what is the height of the television? Round to one decimal place.

4. The bases on a baseball diamond are 90 feet apart. How far is home plate from second base? Include a diagram.

5. A farmer's field is rectangular and measures 150 m by 300 m. How much shorter is to walk diagonally across the field rather than around the outside? Round your answer to the nearest metre.

Finish

Farmer's Field

Start