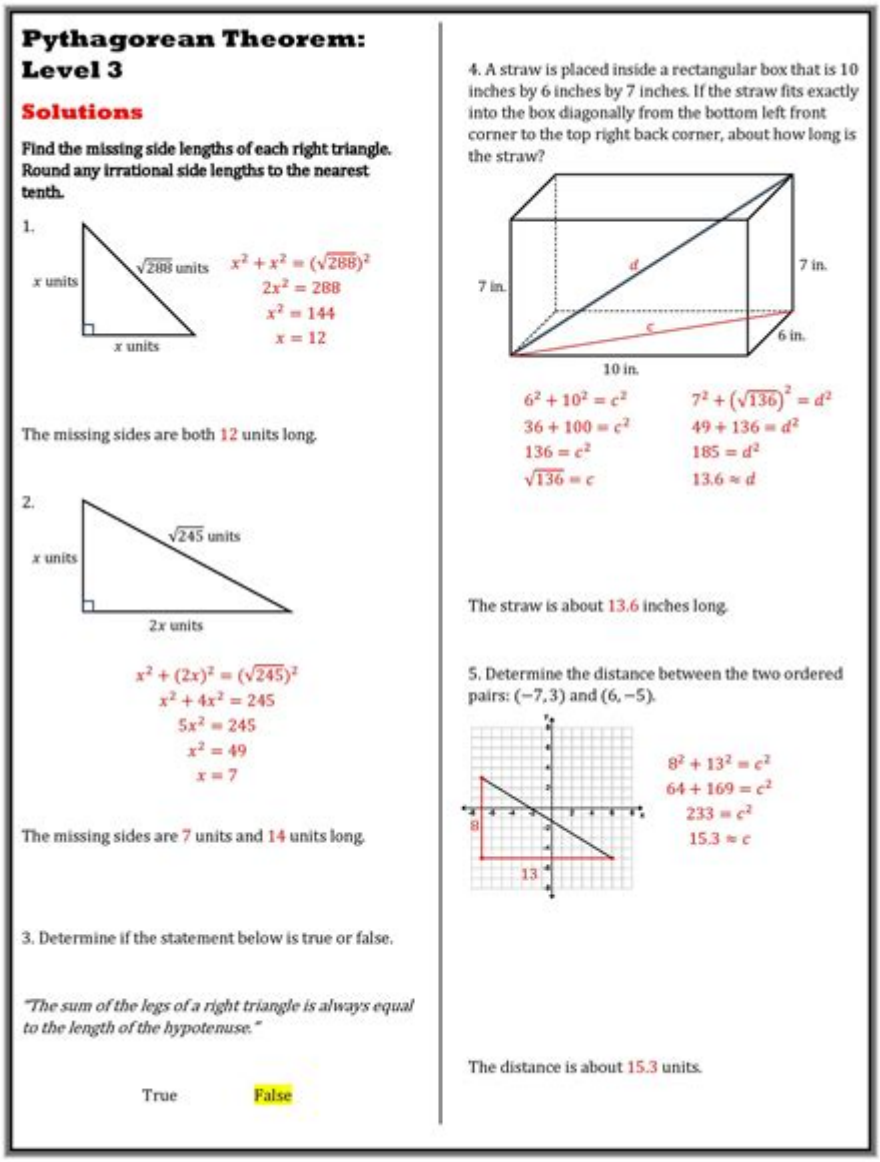
Pythagorean Theorem Worksheet With Answers



Pythagorean Theorem: Level 3

Solutions

Find the missing side lengths of each right triangle. Round any irrational side lengths to the nearest tenth.

1.

$x^2 + x^2 = (\sqrt{288})^2$
$2x^2 = 288$
$x^2 = 144$
$x = 12$

The missing sides are both 12 units long.

2.

$x^2 + (2x)^2 = (\sqrt{245})^2$
$x^2 + 4x^2 = 245$
$5x^2 = 245$
$x^2 = 49$
$x = 7$

The missing sides are 7 units and 14 units long.

3. Determine if the statement below is true or false.

"The sum of the legs of a right triangle is always equal to the length of the hypotenuse."

True False

4. A straw is placed inside a rectangular box that is 10 inches by 6 inches by 7 inches. If the straw fits exactly into the box diagonally from the bottom left front corner to the top right back corner, about how long is the straw?

$6^2 + 10^2 = c^2$
$36 + 100 = c^2$
$136 = c^2$
$\sqrt{136} = c$

$7^2 + (\sqrt{136})^2 = d^2$
$49 + 136 = d^2$
$185 = d^2$
$13.6 \approx d$

The straw is about 13.6 inches long.

5. Determine the distance between the two ordered pairs: $(-7, 3)$ and $(6, -5)$.

$8^2 + 13^2 = c^2$
$64 + 169 = c^2$
$233 = c^2$
$15.3 \approx c$

The distance is about 15.3 units.

Pythagorean theorem worksheet with answers is a valuable educational resource designed to help students grasp the fundamentals of this geometric principle. The Pythagorean theorem is a foundational concept in mathematics, especially in geometry, that relates the sides of a right triangle. It states that in any right triangle, the square of the length of the hypotenuse (the side opposite the right angle) is equal to the sum of the squares of the lengths of the other two sides. This theorem is not only crucial for solving geometrical problems but also finds applications in various fields such as physics, engineering, architecture, and computer science. This article will explore the Pythagorean theorem, provide a comprehensive worksheet, and present answers to ensure a thorough understanding of this essential mathematical principle.

Understanding the Pythagorean Theorem

The Pythagorean theorem can be mathematically expressed as:

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

Where:
- c is the length of the hypotenuse,
- a and b are the lengths of the other two sides of the triangle.

Historical Background

The theorem is named after the ancient Greek mathematician Pythagoras, who is believed to have made significant contributions to mathematics, particularly in the study of triangles. However, the principles of the theorem were known to Babylonian and Indian mathematicians long before Pythagoras. The theorem not only serves as a crucial tool in mathematics but also showcases the beauty and interconnectedness of mathematical concepts developed over centuries.

Applications of the Pythagorean Theorem

The Pythagorean theorem has numerous applications in real life, including:

1. Construction: Builders use the theorem to ensure structures are square and level.
2. Navigation: Pilots and sailors use the theorem to calculate distances and plot courses.
3. Computer Graphics: The theorem helps in the creation of algorithms that render images and animations.
4. Physics: It is used to resolve vector components and analyze forces.

Creating a Pythagorean Theorem Worksheet

A well-structured worksheet can reinforce students’ understanding of the Pythagorean theorem. Below is a sample worksheet that includes a variety of problems, encouraging students to apply the theorem in different scenarios.

Sample Worksheet Problems

Instructions: Solve the following problems using the Pythagorean theorem. Show all your work for full credit.

1. Find the length of the hypotenuse in a right triangle where one leg measures 6 cm and the other leg measures 8 cm.

2. Calculate the length of one leg of a right triangle if the hypotenuse is 10 m and the other leg is 6 m.

3. Determine the length of the hypotenuse in a right triangle with legs measuring 5 ft and 12 ft.

4. A ladder leans against a wall. If the base of the ladder is 4 ft away from the wall and the ladder is 5 ft long, how high does the ladder reach on the wall?

5. A rectangular park has a diagonal path that measures 13 m. If one side of the park is 5 m, find the length of the other side.

6. Two buildings are separated by a distance of 30 m. If one building is 40 m tall, find the distance from the top of the taller building to the bottom of the shorter building.

7. A right triangle has legs measuring 9 inches and 12 inches. What is the length of the hypotenuse?

8. Find the area of a right triangle with legs measuring 7 cm and 24 cm. Use the Pythagorean theorem to first find the hypotenuse.

Extra Credit Problem

9. A right triangle has an angle of 45 degrees. If one leg measures x, express the length of the hypotenuse in terms of x.

Answer Key for the Pythagorean Theorem Worksheet

Here are the solutions to the problems outlined in the worksheet. Students should compare their answers with the key to ensure they understand the theorem’s application.

1. Problem 1:
- $c^2 = 6^2 + 8^2$
- $c^2 = 36 + 64$
- $c^2 = 100$
- $c = 10 \, \text{cm}$

2. Problem 2:
- $c^2 = 10^2$
- $10^2 = 6^2 + b^2$
- $100 = 36 + b^2$
- $b^2 = 64$
- $b = 8 \, \text{m}$

3. Problem 3:
- $c^2 = 5^2 + 12^2$
- $c^2 = 25 + 144$

- $c^2 = 169$
- $c = 13 \, \text{ft}$

4. Problem 4:
- $c^2 = 4^2 + h^2$
- $5^2 = 16 + h^2$
- $25 = 16 + h^2$
- $h^2 = 9$
- $h = 3 \, \text{ft}$

5. Problem 5:
- $c^2 = 5^2 + b^2$
- $13^2 = 25 + b^2$
- $169 = 25 + b^2$
- $b^2 = 144$
- $b = 12 \, \text{m}$

6. Problem 6:
- $d^2 = 40^2 + 30^2$
- $d^2 = 1600 + 900$
- $d^2 = 2500$
- $d = 50 \, \text{m}$

7. Problem 7:
- $c^2 = 9^2 + 12^2$
- $c^2 = 81 + 144$
- $c^2 = 225$
- $c = 15 \, \text{inches}$

8. Problem 8:
- Area = $\frac{1}{2} \times 7 \times 24 = 84 \, \text{cm}^2$
- $c = \sqrt{7^2 + 24^2} = \sqrt{49 + 576} = \sqrt{625} = 25 \, \text{cm}$

Extra Credit Problem 9:
- $c = x\sqrt{2}$

Conclusion

The Pythagorean theorem is a powerful mathematical tool that has stood the test of time, finding relevance in various fields beyond pure mathematics. A well-structured worksheet, such as the one provided, can help students practice and reinforce their understanding of this theorem. By solving problems that apply the Pythagorean theorem to real-life situations, students can develop critical thinking and problem-solving skills. Such worksheets not only prepare students for academic success but also equip them with essential skills applicable in everyday life.

Frequently Asked Questions

What is a Pythagorean theorem worksheet used for?

A Pythagorean theorem worksheet is used to help students practice and understand the relationship between the lengths of the sides of a right triangle, specifically that the square of the hypotenuse is equal to the sum of the squares of the other two sides.

How can I find the hypotenuse using a Pythagorean theorem worksheet?

To find the hypotenuse using a Pythagorean theorem worksheet, you can use the formula $a^2 + b^2 = c^2$, where 'a' and 'b' are the lengths of the legs of the triangle, and 'c' is the length of the hypotenuse. Solve for 'c' by taking the square root of the sum of the squares of 'a' and 'b'.

Are there any online resources for Pythagorean theorem worksheets?

Yes, there are many online resources that offer free downloadable Pythagorean theorem worksheets, complete with answer keys. Websites like Khan Academy, Math-Drills, and Education.com provide a variety of practice problems for different skill levels.

What types of problems can I expect on a Pythagorean theorem worksheet?

On a Pythagorean theorem worksheet, you can expect problems that require you to calculate the length of one side of a right triangle when the other two sides are given, as well as word problems that apply the theorem in real-world contexts.

Can Pythagorean theorem worksheets help prepare for standardized tests?

Yes, practicing with Pythagorean theorem worksheets can help students prepare for standardized tests, as they reinforce key concepts and problem-solving skills that are commonly tested in math sections of exams.

Pythagorean Theorem Worksheet With Answers

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