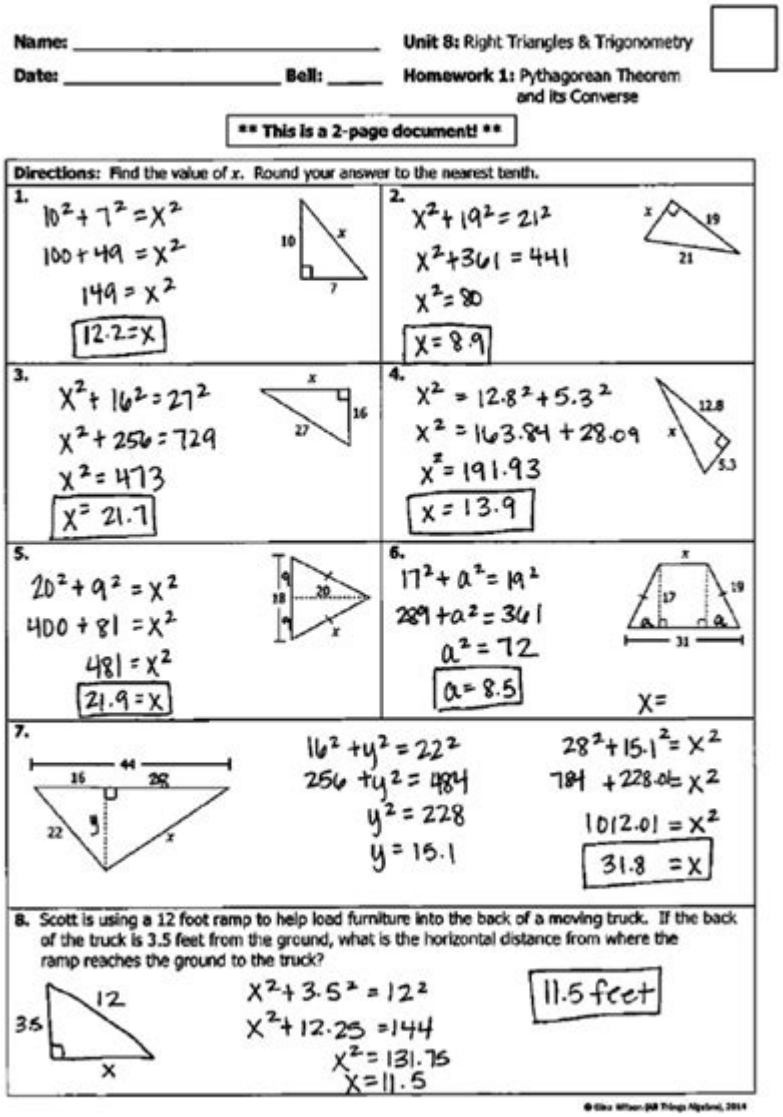
Pythagorean Theorem Answer Key



Name: _____ Unit 8: Right Triangles & Trigonometry

Date: _____ Bell: ____ Homework 1: Pythagorean Theorem and its Converse

** This is a 2-page document! **

Directions: Find the value of x. Round your answer to the nearest tenth.

1. $10^2 + 7^2 = x^2$; $100 + 49 = x^2$; $149 = x^2$; $12.2 = x$

2. $x^2 + 19^2 = 21^2$; $x^2 + 361 = 441$; $x^2 = 80$; $x = 8.9$

3. $x^2 + 16^2 = 27^2$; $x^2 + 256 = 729$; $x^2 = 473$; $x = 21.7$

4. $x^2 = 12.8^2 + 5.3^2$; $x^2 = 163.84 + 28.09$; $x^2 = 191.93$; $x = 13.9$

5. $20^2 + 9^2 = x^2$; $400 + 81 = x^2$; $481 = x^2$; $21.9 = x$

6. $17^2 + a^2 = 19^2$; $289 + a^2 = 361$; $a^2 = 72$; $a = 8.5$; $x =$

7. $16^2 + y^2 = 22^2$; $256 + y^2 = 484$; $y^2 = 228$; $y = 15.1$; $28^2 + 15.1^2 = x^2$; $784 + 228.01 = x^2$; $1012.01 = x^2$; $31.8 = x$

8. Scott is using a 12 foot ramp to help load furniture into the back of a moving truck. If the back of the truck is 3.5 feet from the ground, what is the horizontal distance from where the ramp reaches the ground to the truck?

$x^2 + 3.5^2 = 12^2$; $x^2 + 12.25 = 144$; $x^2 = 131.75$; $x = 11.5$; 11.5 feet

Pythagorean theorem answer key is an essential concept in mathematics, particularly in geometry, where it relates to right triangles. The theorem states that in a 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 fundamental principle has numerous applications in various fields, including architecture, engineering, and even computer science. In this article, we will delve into the Pythagorean theorem, explore its applications, and provide an answer key to some common problems involving this theorem.

Understanding the Pythagorean Theorem

The Pythagorean theorem can be expressed mathematically with the formula:

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

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

Visual Representation

To better understand the theorem, it's helpful to visualize it. Consider a right triangle with:
- Side a measuring 3 units,
- Side b measuring 4 units.

Using the Pythagorean theorem:

$$
3^2 + 4^2 = c^2
$$
$$
9 + 16 = c^2
$$
$$
25 = c^2
$$
$$
c = 5
$$

Thus, the hypotenuse c is 5 units long.

Applications of the Pythagorean Theorem

The Pythagorean theorem has a wide range of applications across different domains. Below are some notable areas where this theorem plays a crucial role:

1. Architecture and Construction

In architecture, the Pythagorean theorem is used to ensure that buildings are constructed with right angles. For instance, when laying out the foundation of a structure, builders can measure out 3 feet, 4 feet, and confirm the diagonal to be 5 feet to ensure a right angle.

2. Navigation

Navigators use the Pythagorean theorem to calculate the shortest distance between two points on a map. By treating the map as a coordinate plane, the theorem helps determine the distance between two locations when the coordinates are known.

3. Computer Graphics

In computer graphics, the theorem is employed to compute distances between points and to perform collision detection among objects. For instance, when rendering a scene, a program can calculate the distance between an object and the camera using the theorem.

Common Problems and Answer Key

To provide a clearer understanding of how the Pythagorean theorem can be applied, we will present a series of problems along with their solutions. This answer key will serve as a practical reference for students and enthusiasts alike.

Problem 1

A right triangle has one leg measuring 6 units and another leg measuring 8 units. What is the length of the hypotenuse?

Solution:
Using the formula:
\[
a^2 + b^2 = c^2
\]
Substituting the values:
\[
6^2 + 8^2 = c^2

\]
\[
36 + 64 = c^2
\]
\[
100 = c^2
\]
\[
c = 10
\]
Hypotenuse = 10 units

Problem 2

If the hypotenuse of a right triangle is 13 units and one leg is 5 units, what is the length of the other leg?

Solution:
Using the formula:
\[
a^2 + b^2 = c^2
\]
Let \(a = 5 \) and \(c = 13 \):
\[
5^2 + b^2 = 13^2
\]
\[
25 + b^2 = 169
\]
\[
b^2 = 169 - 25
\]
\[
b^2 = 144
\]
\[
b = 12
\]
Other leg = 12 units

Problem 3

In a right triangle, one leg measures 9 units, and the hypotenuse measures 15 units. Find the length of the other leg.

Solution:
Using the formula:
$$
a^2 + b^2 = c^2
$$
Let $a = 9$ and $c = 15$:
$$
9^2 + b^2 = 15^2
$$
$$
81 + b^2 = 225
$$
$$
b^2 = 225 - 81
$$
$$
b^2 = 144
$$
$$
b = 12
$$
Other leg = 12 units

Problem 4

A ladder leans against a wall, forming a right triangle with the ground. If the foot of the ladder is 4 feet from the wall and the ladder reaches a height of 3 feet, what is the length of the ladder?

Solution:
Using the formula:
$$
a^2 + b^2 = c^2
$$
Where $a = 4$ (distance from the wall) and $b = 3$ (height):
$$
4^2 + 3^2 = c^2
$$
$$
```
```

16 + 9 = c^2
\]
\[
25 = c^2
\]
\[
c = 5
\]
Length of the ladder = 5 feet

Conclusion

The Pythagorean theorem is a powerful tool in mathematics with practical applications in various fields. Whether you are studying geometry or working on a real-world project, understanding how to apply this theorem is invaluable. The problems and solutions provided in this article serve as a foundational answer key for learning and mastering the Pythagorean theorem. As you practice more, you will find that the theorem not only enhances your mathematical skills but also enables you to solve complex problems with ease.

Frequently Asked Questions

What is the Pythagorean theorem formula?

The Pythagorean theorem formula is $a^2 + b^2 = c^2$, where 'c' is the hypotenuse and 'a' and 'b' are the legs of a right triangle.

How do you find the length of the hypotenuse using the Pythagorean theorem?

To find the length of the hypotenuse, square the lengths of the other two sides, add those squares together, and then take the square root of that sum: $c = \sqrt{(a^2 + b^2)}$.

Can the Pythagorean theorem be used for non-right triangles?

No, the Pythagorean theorem specifically applies only to right triangles.

What are some real-life applications of the Pythagorean theorem?

Real-life applications include construction, navigation, and various fields of engineering and physics.

Is the Pythagorean theorem applicable in three dimensions?

Yes, in three dimensions, the theorem can be extended to $a^3 + b^3 + c^3 = d^3$, where 'd' is the diagonal of a rectangular prism.

What is a common error when applying the Pythagorean theorem?

A common error is using the theorem for angles that are not 90 degrees or misidentifying which sides are 'a', 'b', or 'c'.

How do you use the Pythagorean theorem to determine if a triangle is a right triangle?

To determine if a triangle is a right triangle, check if the squares of the lengths of the two shorter sides add up to the square of the longest side: $a^2 + b^2 = c^2$.

What are some variations of the Pythagorean theorem?

Variations include the converse of the Pythagorean theorem and the Pythagorean triples, which are sets of three positive integers that satisfy the theorem.

Can the Pythagorean theorem be visualized?

Yes, the Pythagorean theorem can be visualized using geometric representations, such as squares built on each side of a right triangle.

What are Pythagorean triples?

Pythagorean triples are sets of three integers (a, b, c) that satisfy the Pythagorean theorem, such as (3, 4, 5) and (5, 12, 13).

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