The Pythagorean Theorem

Models and mappings

Name _____ **Date** _____ **Score** _____ / 10

QUICK REVIEW

In a right triangle, $a^2 + b^2 = c^2$, where c is the hypotenuse opposite the right angle. For a missing leg, subtract: $a = \sqrt{c^2 - b^2}$. For a missing hypotenuse, add the leg squares. Use the positive root for a length. The converse tests whether three lengths form a right triangle; compare the longest-side square with the sum of the other squares.

Worked example

A right triangle has legs 5 and 7 units. Find its hypotenuse. Give an exact radical or integer; also round nonintegers to the nearest tenth.

1. The perpendicular legs are 5 units and 7 units, so $c^2 = 5^2 + 7^2$.
2. Evaluate the squares: $c^2 = 25 + 49 = 74$ square units. This is a squared length, not the side itself.
3. Take the positive root: $c = \sqrt{74} \approx 8.6$ units. It exceeds both legs; round only at the end.
Answer: $\sqrt{74} \approx 8.6$ units

Practice Problems

Show your thinking.

1. Find the hypotenuse of a right triangle with legs 6 and 8. Give an exact radical or integer; also round nonintegers to the nearest tenth.

2. Find the missing leg when the hypotenuse is 13 and the known leg is 5. Give an exact radical or integer; also round nonintegers to the nearest tenth.

3. A right triangle has legs 4 and 9. Find the longest side. Give an exact radical or integer; also round nonintegers to the nearest tenth.

4. The longest side of a right triangle is 10, and one leg is 7. Find the other leg. Give an exact radical or integer; also round nonintegers to the nearest tenth.

5. Do lengths $7, 24, 25$ form a right triangle? Show the square comparison.

6. Is a triangle with sides $6, 7, 10$ right? Check the longest side.

7. A right triangle has equal legs of length 3. Find the hypotenuse. Give an exact radical or integer; also round nonintegers to the nearest tenth.

8. Find the missing leg of a right triangle with hypotenuse 9 and other leg 4. Give an exact radical or integer; also round nonintegers to the nearest tenth.

9. Two perpendicular sides measure 2.5 and 6. Find the opposite side. Give an exact radical or integer; also round nonintegers to the nearest tenth.

10. A right triangle has hypotenuse 8.5 and leg 4. Find the other leg. Give an exact radical or integer; also round nonintegers to the nearest tenth.

Answer Key

1. 10 units
2. 12 units
3. $\sqrt{97} \approx 9.8$ units
4. $\sqrt{51} \approx 7.1$ units
5. Yes; a right triangle.
6. No; not a right triangle.
7. $\sqrt{18} \approx 4.2$ units
8. $\sqrt{65} \approx 8.1$ units
9. $\sqrt{42.25} \approx 6.5$ units
10. $\sqrt{56.25} \approx 7.5$ units

Step-by-Step Solutions

Follow each calculation, then check your own work.

Problem 1

1. The perpendicular legs are 6 units and 8 units, so $c^2 = 6^2 + 8^2$.
2. Evaluate the squares: $c^2 = 36 + 64 = 100$ square units. This is a squared length, not the side itself.
3. Take the positive root: $c = \sqrt{100} \approx 10.0$ units. It exceeds both legs; round only at the end.

Problem 2

1. The hypotenuse is 13 units; the known leg is 5 units. Thus $x^2 + 5^2 = 13^2$.
2. Subtract the known square: $x^2 = 169 - 25 = 144$ square units. Adding would instead find a hypotenuse.
3. Take the positive root: $x = \sqrt{144} \approx 12.0$ units. It is shorter than the hypotenuse 13 units; round only at the end.

Problem 3

1. The perpendicular legs are 4 units and 9 units, so $c^2 = 4^2 + 9^2$.
2. Evaluate the squares: $c^2 = 16 + 81 = 97$ square units. This is a squared length, not the side itself.
3. Take the positive root: $c = \sqrt{97} \approx 9.8$ units. It exceeds both legs; round only at the end.

Problem 4

1. The hypotenuse is 10 units; the known leg is 7 units. Thus $x^2 + 7^2 = 10^2$.
2. Subtract the known square: $x^2 = 100 - 49 = 51$ square units. Adding would instead find a hypotenuse.
3. Take the positive root: $x = \sqrt{51} \approx 7.1$ units. It is shorter than the hypotenuse 10 units; round only at the end.

Problem 5

1. The longest side is 25, so it is the only possible hypotenuse. Compute $7^2 + 24^2 = 49 + 576 = 625$.
2. The longest-side square is $25^2 = 625$. The two values are 625 and 625, which are equal.
3. Thus $7^2 + 24^2 = 25^2$; the converse confirms a right triangle.

Problem 6

1. The longest side is 10, so it is the only possible hypotenuse. Compute $6^2 + 7^2 = 36 + 49 = 85$.
2. The longest-side square is $10^2 = 100$. The two values are 85 and 100, which are unequal.
3. Thus $6^2 + 7^2 \neq 10^2$; the converse rules out a right triangle.

Problem 7

1. The perpendicular legs are 3 units and 3 units, so $c^2 = 3^2 + 3^2$.
2. Evaluate the squares: $c^2 = 9 + 9 = 18$ square units. This is a squared length, not the side itself.
3. Take the positive root: $c = \sqrt{18} \approx 4.2$ units. It exceeds both legs; round only at the end.

Problem 8

1. The hypotenuse is 9 units; the known leg is 4 units. Thus $x^2 + 4^2 = 9^2$.
2. Subtract the known square: $x^2 = 81 - 16 = 65$ square units. Adding would instead find a hypotenuse.
3. Take the positive root: $x = \sqrt{65} \approx 8.1$ units. It is shorter than the hypotenuse 9 units; round only at the end.

Problem 9

1. The perpendicular legs are 2.5 units and 6 units, so $c^2 = 2.5^2 + 6^2$.
2. Evaluate the squares: $c^2 = 6.25 + 36 = 42.25$ square units. This is a squared length, not the side itself.
3. Take the positive root: $c = \sqrt{42.25} \approx 6.5$ units. It exceeds both legs; round only at the end.

Problem 10

1. The hypotenuse is 8.5 units; the known leg is 4 units. Thus $x^2 + 4^2 = 8.5^2$.
2. Subtract the known square: $x^2 = 72.25 - 16 = 56.25$ square units. Adding would instead find a hypotenuse.
3. Take the positive root: $x = \sqrt{56.25} \approx 7.5$ units. It is shorter than the hypotenuse 8.5 units; round only at the end.

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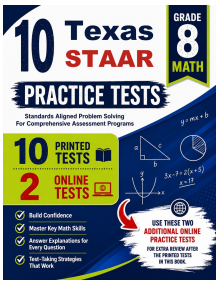

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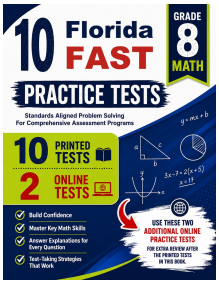

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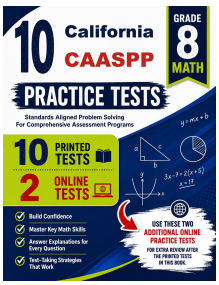

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