Pythagorean Theorem

Name: _____	Date: _____	Score: _____ / 24

Quick Review

In a **right triangle**, the two shorter sides are the **legs** and the side opposite the right angle is the **hypotenuse** (always the longest side). The **Pythagorean Theorem** says $a^2 + b^2 = c^2$, where a and b are the legs and c is the hypotenuse. To find the hypotenuse, add the squares of the legs and take the square root. To find a missing *leg*, subtract: $b^2 = c^2 - a^2$. Watch out — the hypotenuse must always be the biggest side, so subtract when you're solving for a leg.

◇ **Example:** A right triangle has legs 9 cm and 12 cm. Find the hypotenuse.

⇒ The two legs are 9 and 12, and we want the hypotenuse c. The Pythagorean Theorem says $a^2 + b^2 = c^2$, so square each leg and add: $9^2 + 12^2 = 81 + 144 = 225$. That sum equals c^2, so c is the square root: $c = \sqrt{225} = 15$. Since 15 is bigger than both legs, it makes sense as the hypotenuse.

Answer: $c = 15$ cm

PRACTICE

Find the missing side length of the right triangle.

1. legs $3, 4$; hypotenuse $=?$ _____
2. legs $6, 8$; hypotenuse $=?$ _____
3. legs $5, 12$; hypotenuse $=?$ _____
4. legs $8, 15$; hypotenuse $=?$ _____
5. legs $7, 24$; hypotenuse $=?$ _____
6. legs $9, 40$; hypotenuse $=?$ _____
7. legs $12, 35$; hypotenuse $=?$ _____
8. legs $20, 21$; hypotenuse $=?$ _____
9. leg 6, hypotenuse 10; other leg $=?$ _____
10. leg 5, hypotenuse 13; other leg $=?$ _____
11. leg 8, hypotenuse 17; other leg $=?$ _____
12. leg 7, hypotenuse 25; other leg $=?$ _____
13. leg 9, hypotenuse 15; other leg $=?$ _____
14. leg 10, hypotenuse 26; other leg $=?$ _____
15. legs $15, 20$; hypotenuse $=?$ _____
16. legs $10, 24$; hypotenuse $=?$ _____
17. legs $18, 24$; hypotenuse $=?$ _____
18. legs $1, 1$; hypotenuse $=?$ _____
19. legs $2, 3$; hypotenuse $=?$ _____
20. leg 12, hypotenuse 13; other leg $=?$ _____

♦ Word Problems

21. A ladder leans against a wall. Its base is 5 ft from the wall and it reaches 12 ft up the wall. How long is the ladder? _____
22. A rectangular TV screen is 24 inches wide and 7 inches tall. What is the length of its diagonal? _____
23. A soccer field is 40 yards wide. A player runs from one corner diagonally to the opposite corner, a distance of 41 yards. How long is the field? _____
24. A wire runs from the top of an 8 ft pole to a stake 15 ft from the pole's base. How long is the wire? _____

Answer Keys

1. $\boxed{5}$
2. $\boxed{10}$
3. $\boxed{13}$
4. $\boxed{17}$
5. $\boxed{25}$
6. $\boxed{41}$
7. $\boxed{37}$
8. $\boxed{29}$
9. $\boxed{8}$
10. $\boxed{12}$
11. $\boxed{15}$
12. $\boxed{24}$
13. $\boxed{12}$
14. $\boxed{24}$
15. $\boxed{25}$
16. $\boxed{26}$
17. $\boxed{30}$
18. $\boxed{\sqrt{2}}$
19. $\boxed{\sqrt{13}}$
20. $\boxed{5}$
21. $\boxed{13 \text{ ft}}$
22. $\boxed{25 \text{ inches}}$
23. $\boxed{9 \text{ yards}}$
24. $\boxed{17 \text{ ft}}$

Step-by-Step Explanations

1. $3^2 + 4^2 = 9 + 16 = 25$, so $c = \sqrt{25} = 5$.
2. $6^2 + 8^2 = 36 + 64 = 100$, so $c = \sqrt{100} = 10$.
3. $5^2 + 12^2 = 25 + 144 = 169$, so $c = \sqrt{169} = 13$.
4. $8^2 + 15^2 = 64 + 225 = 289$, so $c = \sqrt{289} = 17$.
5. $7^2 + 24^2 = 49 + 576 = 625$, so $c = \sqrt{625} = 25$.
6. $9^2 + 40^2 = 81 + 1600 = 1681$, so $c = \sqrt{1681} = 41$.
7. $12^2 + 35^2 = 144 + 1225 = 1369$, so $c = \sqrt{1369} = 37$.
8. $20^2 + 21^2 = 400 + 441 = 841$, so $c = \sqrt{841} = 29$.
9. $10^2 - 6^2 = 100 - 36 = 64$, so the leg is $\sqrt{64} = 8$.
10. $13^2 - 5^2 = 169 - 25 = 144$, so the leg is $\sqrt{144} = 12$.
11. $17^2 - 8^2 = 289 - 64 = 225$, so the leg is $\sqrt{225} = 15$.
12. $25^2 - 7^2 = 625 - 49 = 576$, so the leg is $\sqrt{576} = 24$.
13. $15^2 - 9^2 = 225 - 81 = 144$, so the leg is $\sqrt{144} = 12$.
14. $26^2 - 10^2 = 676 - 100 = 576$, so the leg is $\sqrt{576} = 24$.
15. $15^2 + 20^2 = 225 + 400 = 625$, so $c = \sqrt{625} = 25$.
16. $10^2 + 24^2 = 100 + 576 = 676$, so $c = \sqrt{676} = 26$.
17. $18^2 + 24^2 = 324 + 576 = 900$, so $c = \sqrt{900} = 30$.
18. $1^2 + 1^2 = 2$, so $c = \sqrt{2}$ (it stays as a radical).
19. $2^2 + 3^2 = 4 + 9 = 13$, so $c = \sqrt{13}$.
20. $13^2 - 12^2 = 169 - 144 = 25$, so the leg is $\sqrt{25} = 5$.
21. The wall and ground are the legs: $5^2 + 12^2 = 25 + 144 = 169$. The ladder is the hypotenuse, $\sqrt{169} = 13$ ft.
22. The diagonal is the hypotenuse of a right triangle with legs 24 and 7: $24^2 + 7^2 = 576 + 49 = 625$, so the diagonal is $\sqrt{625} = 25$ in.
23. The diagonal is the hypotenuse: $41^2 - 40^2 = 1681 - 1600 = 81$, so the field's length is $\sqrt{81} = 9$ yd.
24. The pole and ground are legs: $8^2 + 15^2 = 64 + 225 = 289$. The wire is the hypotenuse, $\sqrt{289} = 17$ ft.

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