

Pythagorean Theorem

Name: _____ Date: _____ Score: _____ / 24

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

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|-------------------------------------|--|
| 1. <input type="text" value="5"/> | 13. <input type="text" value="12"/> |
| 2. <input type="text" value="10"/> | 14. <input type="text" value="24"/> |
| 3. <input type="text" value="13"/> | 15. <input type="text" value="25"/> |
| 4. <input type="text" value="17"/> | 16. <input type="text" value="26"/> |
| 5. <input type="text" value="25"/> | 17. <input type="text" value="30"/> |
| 6. <input type="text" value="41"/> | 18. <input type="text" value="√2"/> |
| 7. <input type="text" value="37"/> | 19. <input type="text" value="√13"/> |
| 8. <input type="text" value="29"/> | 20. <input type="text" value="5"/> |
| 9. <input type="text" value="8"/> | 21. <input type="text" value="13 ft"/> |
| 10. <input type="text" value="12"/> | 22. <input type="text" value="25 inches"/> |
| 11. <input type="text" value="15"/> | 23. <input type="text" value="9 yards"/> |
| 12. <input type="text" value="24"/> | 24. <input type="text" value="17 ft"/> |

Step-by-Step Explanations

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