

# 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

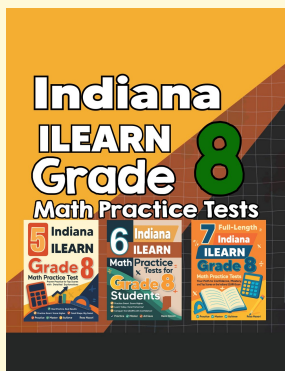
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| 1. <input type="text" value="5"/>   | 13. <input type="text" value="12"/>        |
| 2. <input type="text" value="10"/>  | 14. <input type="text" value="24"/>        |
| 3. <input type="text" value="13"/>  | 15. <input type="text" value="25"/>        |
| 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

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