

# Applying the Pythagorean Theorem

Name: \_\_\_\_\_ Date: \_\_\_\_\_ Score: \_\_\_\_\_ / 24

## Q Quick Review

The **Pythagorean Theorem** ( $a^2 + b^2 = c^2$ ) solves real problems whenever you can spot a *right triangle*. Look for square corners: a wall meeting the ground, the sides of a rectangle, a flag pole standing upright. The **diagonal** of a rectangle is the hypotenuse of a right triangle made from its length and width. To use the theorem, decide which sides are the *legs* and which is the *hypotenuse*, then either add the squares (to find the hypotenuse) or subtract (to find a leg). Always check that your answer is a sensible length.

◇ **Example:** A rectangular field is 40 m long and 30 m wide. How long is the diagonal walking path across it?  
 ⇒ The diagonal cuts the rectangle into two right triangles. The length and width are the two legs:  $a = 40$  and  $b = 30$ . The diagonal is the hypotenuse  $c$ . Apply  $a^2 + b^2 = c^2$ :  $40^2 + 30^2 = 1600 + 900 = 2500$ . So  $c = \sqrt{2500} = 50$ . The diagonal path is 50 meters long.

**Answer:** 50 m

## PRACTICE

Solve each problem using the Pythagorean Theorem.

- |   |   |
|---|---|
| 1. Rectangle $6 \times 8$ : diagonal _____    | 12. Right triangle legs 10, 24 : hypotenuse _____                 |
| 2. Rectangle $9 \times 12$ : diagonal _____   | 13. Boat: east 24, north 7. Straight-line distance? _____         |
| 3. Rectangle $5 \times 12$ : diagonal _____   | 14. Walk: east 15, north 20. Straight-line distance? _____        |
| 4. Rectangle $8 \times 15$ : diagonal _____   | 15. Kite string 25, ground distance 24. Height? _____             |
| 5. Rectangle $20 \times 21$ : diagonal _____  | 16. Square with side 6 : diagonal _____                           |
| 6. Ladder: base 9, reach up 12. Length? _____ | 17. Rectangle $12 \times 35$ : diagonal _____                     |
| 7. Ladder: base 7, reach up 24. Length? _____ | 18. Slide: ladder height 9, slide length 41. Base distance? _____ |
| 8. Wire: pole 8, stake 6 away. Length? _____  | 19. Rectangle $18 \times 24$ : diagonal _____                     |
| 9. Wire 13, pole 5. Distance to stake? _____  | 20. Right triangle legs 16, 30 : hypotenuse _____                 |
| 10. Ramp 17, horizontal run 15. Height? _____ |   |
| 11. TV screen $16 \times 12$ : diagonal _____ |   |

## ◆ Word Problems

- A baseball diamond is a square with sides 90 ft. Actually, consider a smaller practice diamond: a square with sides 60 ft. How far is the throw from home plate diagonally to second base? Round to the nearest tenth. \_\_\_\_\_
- A boat sails 24 km east, then turns and sails 7 km north. How far is the boat from its starting point in a straight line? \_\_\_\_\_
- A 25 ft ladder leans against a building with its base 7 ft from the wall. How high up the wall does the ladder reach? \_\_\_\_\_
- A rectangular computer monitor is 16 in wide and 12 in tall. Monitors are advertised by their diagonal size. What is this monitor's diagonal size? \_\_\_\_\_



## Answer Keys

- |        |                   |
|--------|-------------------|
| 1. 10  | 13. 25            |
| 2. 15  | 14. 25            |
| 3. 13  | 15. 7             |
| 4. 17  | 16. $6\sqrt{2}$   |
| 5. 29  | 17. 37            |
| 6. 15  | 18. 40            |
| 7. 25  | 19. 30            |
| 8. 10  | 20. 34            |
| 9. 12  | 21. about 84.9 ft |
| 10. 8  | 22. 25 km         |
| 11. 20 | 23. 24 ft         |
| 12. 26 | 24. 20 in         |

### Step-by-Step Explanations

- |   |   |
|---|---|
| <p>1. <math>6^2 + 8^2 = 36 + 64 = 100</math>, so the diagonal is <math>\sqrt{100} = 10</math>.</p> <p>2. <math>9^2 + 12^2 = 81 + 144 = 225</math>, so the diagonal is <math>\sqrt{225} = 15</math>.</p> <p>3. <math>5^2 + 12^2 = 25 + 144 = 169</math>, so the diagonal is <math>\sqrt{169} = 13</math>.</p> <p>4. <math>8^2 + 15^2 = 64 + 225 = 289</math>, so the diagonal is <math>\sqrt{289} = 17</math>.</p> <p>5. <math>20^2 + 21^2 = 400 + 441 = 841</math>, so the diagonal is <math>\sqrt{841} = 29</math>.</p> <p>6. <math>9^2 + 12^2 = 81 + 144 = 225</math>, so the ladder is <math>\sqrt{225} = 15</math>.</p> <p>7. <math>7^2 + 24^2 = 49 + 576 = 625</math>, so the ladder is <math>\sqrt{625} = 25</math>.</p> <p>8. <math>8^2 + 6^2 = 64 + 36 = 100</math>, so the wire is <math>\sqrt{100} = 10</math>.</p> <p>9. <math>13^2 - 5^2 = 169 - 25 = 144</math>, so the distance is <math>\sqrt{144} = 12</math>.</p> <p>10. <math>17^2 - 15^2 = 289 - 225 = 64</math>, so the height is <math>\sqrt{64} = 8</math>.</p> <p>11. <math>16^2 + 12^2 = 256 + 144 = 400</math>, so the diagonal is <math>\sqrt{400} = 20</math>.</p> <p>12. <math>10^2 + 24^2 = 100 + 576 = 676</math>, so the hypotenuse is <math>\sqrt{676} = 26</math>.</p> <p>13. <math>24^2 + 7^2 = 576 + 49 = 625</math>, so the distance is <math>\sqrt{625} = 25</math>.</p> <p>14. <math>15^2 + 20^2 = 225 + 400 = 625</math>, so the distance is <math>\sqrt{625} = 25</math>.</p> | <p>15. <math>25^2 - 24^2 = 625 - 576 = 49</math>, so the height is <math>\sqrt{49} = 7</math>.</p> <p>16. <math>6^2 + 6^2 = 72</math>, so the diagonal is <math>\sqrt{72} = 6\sqrt{2}</math>.</p> <p>17. <math>12^2 + 35^2 = 144 + 1225 = 1369</math>, so the diagonal is <math>\sqrt{1369} = 37</math>.</p> <p>18. <math>41^2 - 9^2 = 1681 - 81 = 1600</math>, so the base distance is <math>\sqrt{1600} = 40</math>.</p> <p>19. <math>18^2 + 24^2 = 324 + 576 = 900</math>, so the diagonal is <math>\sqrt{900} = 30</math>.</p> <p>20. <math>16^2 + 30^2 = 256 + 900 = 1156</math>, so the hypotenuse is <math>\sqrt{1156} = 34</math>.</p> <p>21. The diagonal is the hypotenuse: <math>60^2 + 60^2 = 3600 + 3600 = 7200</math>, so the throw is <math>\sqrt{7200} \approx 84.9</math> ft.</p> <p>22. The two legs of the right triangle are 24 and 7: <math>24^2 + 7^2 = 576 + 49 = 625</math>, so the straight-line distance is <math>\sqrt{625} = 25</math> km.</p> <p>23. The ladder is the hypotenuse and the base distance is a leg: <math>25^2 - 7^2 = 625 - 49 = 576</math>, so the height is <math>\sqrt{576} = 24</math> ft.</p> <p>24. The diagonal is the hypotenuse of a right triangle with legs 16 and 12: <math>16^2 + 12^2 = 256 + 144 = 400</math>, so the diagonal is <math>\sqrt{400} = 20</math> in.</p> |
|---|---|



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