Applying the Pythagorean Theorem

Name: _____	Date: _____	Score: _____ / 24

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

Word Problems

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

Step-by-Step Explanations

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

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