

8-2

Special Right Triangles

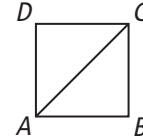


Vocabulary

Review

1. Circle the segment that is a *diagonal* of square $ABCD$.

\overline{AB} \overline{AC} \overline{AD} \overline{BC} \overline{CD}



2. Underline the correct word to complete the sentence.

A *diagonal* is a line segment that joins two sides / vertices of a polygon.

Vocabulary Builder

complement (noun) KAHM pluh munt

Other Word Form: complementary (adjective)

Math Usage: When the measures of two angles have a sum of 90, each angle is a **complement** of the other.

Nonexample: Two angles whose measures sum to 180 are supplementary.

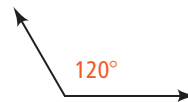
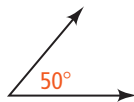
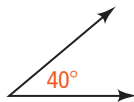
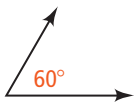
Use Your Vocabulary

Complete each statement with the word *complement* or *complementary*.

3. If $m\angle A = 40$ and $m\angle B = 50$, the angles are ?.
4. If $m\angle A = 30$ and $m\angle B = 60$, $\angle B$ is the ? of $\angle A$.
5. $\angle P$ and $\angle Q$ are ? because the sum of their measures is 90.

Complete.

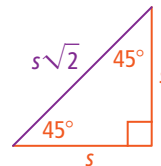
6. If $\angle R$ has a measure of 35, then the *complement* of $\angle R$ has a measure of .
7. If $\angle X$ has a measure of 22, then the *complement* of $\angle X$ has a measure of .
8. If $\angle C$ has a measure of 65, then the *complement* of $\angle C$ has a measure of .
9. Circle the *complementary* angles.



Take note

Theorem 8-5 45°-45°-90° Triangle Theorem

In a 45°-45°-90° triangle, both **legs** are congruent and the length of the **hypotenuse** is $\sqrt{2}$ times the length of a **leg**.



Complete each statement for a 45°-45°-90° triangle.

10. hypotenuse = · leg
11. If leg = 10, then hypotenuse = · .



Problem 1 Finding the Length of the Hypotenuse

Got It? What is the length of the hypotenuse of a 45°-45°-90° triangle with leg length $5\sqrt{3}$?

12. Use the justifications to find the length of the hypotenuse.

$$\begin{aligned} \text{hypotenuse} &= \text{input} \cdot \text{leg} && 45^\circ\text{-}45^\circ\text{-}90^\circ \text{ Triangle Theorem} \\ &= \sqrt{2} \cdot \text{input} && \text{Substitute.} \\ &= \text{input} \cdot \text{input} && \text{Commutative Property of Multiplication.} \\ &= \text{input} && \text{Simplify.} \end{aligned}$$



Problem 2 Finding the Length of a Leg

Got It? The length of the hypotenuse of a 45°-45°-90° triangle is 10. What is the length of one leg?

13. Will the length of the leg be *greater than* or *less than* 10? Explain.

14. Use the justifications to find the length of one leg.

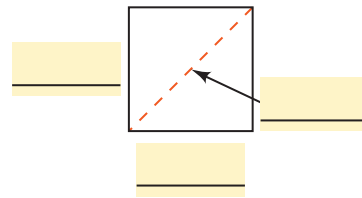
$$\begin{aligned} \text{hypotenuse} &= \sqrt{2} \cdot \text{leg} && 45^\circ\text{-}45^\circ\text{-}90^\circ \text{ Triangle Theorem} \\ \text{input} &= \sqrt{2} \cdot \text{leg} && \text{Substitute.} \\ \frac{\text{input}}{\sqrt{2}} &= \frac{\sqrt{2}}{\sqrt{2}} \cdot \text{leg} && \text{Divide each side by } \sqrt{2}. \\ \text{leg} &= \frac{\text{input}}{\sqrt{2}} && \text{Simplify.} \\ \text{leg} &= \frac{\text{input}}{\sqrt{2}} \cdot \frac{\text{input}}{\sqrt{2}} && \text{Multiply by a form of 1 to rationalize the denominator.} \\ \text{leg} &= \frac{\text{input}}{2} && \text{Simplify.} \\ \text{leg} &= \text{input} && \text{Divide by 2.} \end{aligned}$$



Problem 3 Finding Distance

Got It? You plan to build a path along one diagonal of a 100 ft-by-100 ft square garden. To the nearest foot, how long will the path be?

15. Use the words *path*, *height*, and *width* to complete the diagram.
16. Write L for *leg* or H for *hypotenuse* to identify each part of the right triangle in the diagram.



path height width

17. Substitute for hypotenuse and leg. Let h = the length of the hypotenuse.

$$\text{hypotenuse} = \sqrt{2} \cdot \text{leg}$$

$$\text{} = \sqrt{2} \cdot \text{}$$

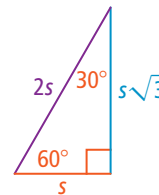
18. Solve the equation. Use a calculator to find the length of the path.

19. To the nearest foot, the length of the path will be feet.

Take note

Theorem 8-6 30°-60°-90° Triangle Theorem

In a 30°-60°-90° triangle, the length of the **hypotenuse** is twice the length of the **shorter leg**. The length of the **longer leg** is $\sqrt{3}$ times the length of the **shorter leg**.



Complete each statement for a 30°-60°-90° triangle.

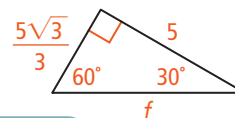
20. **hypotenuse** = · **shorter leg**
21. **longer leg** = · **shorter leg**



Problem 4 Using the Length of One Side

Got It? What is the value of f in simplest radical form?

22. Complete the reasoning model below.

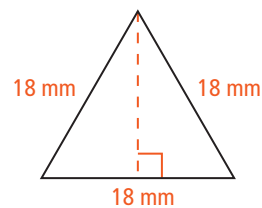


Think	Write
f is the length of the hypotenuse. I can write an equation relating the hypotenuse and the shorter leg $\frac{5\sqrt{3}}{3}$ of the 30°-60°-90° triangle.	hypotenuse = <input type="text"/> · shorter leg $f = \text{} \cdot \frac{\text{}}{\text{}}$
Now I can solve for f .	$f = \frac{\text{}}{\text{}}$



Problem 5 Applying the 30°-60°-90° Triangle Theorem

Got It? Jewelry Making An artisan makes pendants in the shape of equilateral triangles. Suppose the sides of a pendant are 18 mm long. What is the height of the pendant to the nearest tenth of a millimeter?



23. Circle the formula you can use to find the height of the pendant.

hypotenuse = $2 \cdot$ shorter leg longer leg = $\sqrt{3} \cdot$ shorter leg

24. Find the height of the pendant.

25. To the nearest tenth of a millimeter, the height of the pendant is mm.



Lesson Check • Do you UNDERSTAND?

Reasoning A test question asks you to find two side lengths of a 45°-45°-90° triangle. You know that the length of one leg is 6, but you forgot the special formula for 45°-45°-90° triangles. Explain how you can still determine the other side lengths. What are the other side lengths?

26. Underline the correct word(s) to complete the sentence. In a 45°-45°-90° triangle, the lengths of the legs are different / the same.

27. Use the Pythagorean Theorem to find the length of the longest side.

28. The other two side lengths are and .



Math Success

Check off the vocabulary words that you understand.

leg

hypotenuse

right triangle

Pythagorean Theorem

Rate how well you can use the properties of special right triangles.

