LESSON MAKER PRO

Right Triangle Detective

Use squares of side lengths to test and solve triangles.

GRADE 8 · NY-8.G.6

NY-8.G.6 "Understand a proof of the Pythagorean Theorem and its converse."

NAME _____ DATE _____

THE BIG IDEA

For a right triangle, the squares of the two leg lengths add to the square of the hypotenuse length. The converse is also true: if the two smaller squared lengths add to the largest squared length, the triangle is a right triangle. An area proof shows this relationship by comparing the area of a large square with the areas of shapes inside it.

WORKED EXAMPLE

A right triangle has leg lengths of 18 cm and 24 cm. Find the hypotenuse, x.

1. Use $18^2 + 24^2 = x^2$.
2. $324 + 576 = x^2$.
3. $900 = x^2$, so $x = 30$.

Answer: x = 30 cm

PRACTICE 6 problems

1 A right triangle has legs that are 6 cm and 8 cm long. Find the hypotenuse, x.

ANSWER _____

2 A right triangle has a hypotenuse of 13 cm and one leg of 5 cm. Find the other leg, x.

ANSWER _____

3 Use the converse of the Pythagorean Theorem. Is a triangle with side lengths 9 cm, 12 cm, and 15 cm a right triangle? Show the equation that proves your answer.

ANSWER _____

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4 Use the converse of the Pythagorean Theorem. Is a triangle with side lengths 7 cm, 8 cm, and 11 cm a right triangle? Show the equation that proves your answer.

ANSWER _____

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5 A right triangle has legs that are 20 m and 21 m long. Find the hypotenuse, x.

ANSWER _____

6 A right triangle has a hypotenuse of 17 in. and one leg of 8 in. Find the other leg, x.

ANSWER _____

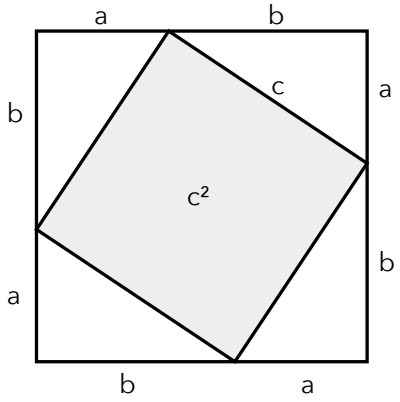
APPLY IT Show your work

1 A skate park ramp goes from the ground to a platform 14 ft above the ground. The bottom of the ramp is 48 ft from the platform. How long is the ramp?

2 A robotics team builds a triangular support with metal rods measuring 11 cm, 60 cm, and 61 cm. Will the rods make a right triangle? Explain using the converse.

CHALLENGE One step up

An area proof puts four congruent right triangles inside a large square. Each triangle has the same two leg lengths, and the uncovered center is a square whose side is the hypotenuse. Explain why subtracting the areas of the four triangles from the large square proves that the sum of the leg squares equals the hypotenuse square. Use the actual dissection. Justify why each central angle is90°(the two acute triangle angles sum to90°), so the center truly is a square. Then prove the converse by constructing a right triangle with legs a,b and using SSS.



ANSWER KEY

Right Triangle Detective

GRADE 8 · NY-8.G.6

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	A right triangle has legs that are 6 cm and 8 cm long. Find the hypotenuse, x.	**x = 10 cm**
2	A right triangle has a hypotenuse of 13 cm and one leg of 5 cm. Find the other leg, x.	**x = 12 cm**
3	Use the converse of the Pythagorean Theorem. Is a triangle with side lengths 9 cm, 12 cm, and 15 cm a right triangle? Show the equation that proves your answer.	**Yes. $9^2 + 12^2 = 15^2$ because 81 + 144 = 225.**
4	Use the converse of the Pythagorean Theorem. Is a triangle with side lengths 7 cm, 8 cm, and 11 cm a right triangle? Show the equation that proves your answer.	**No. $7^2 + 8^2 = 113$, not $11^2 = 121$.**
5	A right triangle has legs that are 20 m and 21 m long. Find the hypotenuse, x.	**x = 29 m**
6	A right triangle has a hypotenuse of 17 in. and one leg of 8 in. Find the other leg, x.	**x = 15 in.**

PART 2 · APPLY IT

1. **50 ft** The vertical platform and ground form a right angle. Calculate $14^2 + 48^2 = 2500$, so the ramp length is 50 ft.
2. **Yes. $11^2 + 60^2 = 61^2$ because 121 + 3600 = 3721.** Compare the squares of the two shorter rods to the square of the longest rod. Since their sum is equal, the converse proves the support is a right triangle.

CHALLENGE

The large square has area (leg 1 + leg 2)^2. The four triangles have total area 2(leg 1)(leg 2), so the uncovered area is leg 1^2 + leg 2^2. Since the uncovered center is a square with side length equal to the hypotenuse, its area is hypotenuse^2. Therefore, leg 1^2 + leg 2^2 = hypotenuse^2. At a central vertex, the two adjacent acute angles total90°, leaving90°on the straight side. All four central sides equal c; hence the center is a square. For the converse, if $a^2+b^2=c^2$,construct a right triangle with legs a,b. Its hypotenuse d satisfies $d^2=a^2+b^2=c^2$,so d=c>0. SSS makes the given triangle congruent to this right triangle.

Accept equivalent equations and arithmetic work for the theorem and its converse. For the challenge, accept a clear area comparison that identifies the center square's area as the hypotenuse squared.