

$$a^2 + b^2 = c^2 \text{ for right triangles}$$

### Lesson 16: Converse of the Pythagorean Theorem

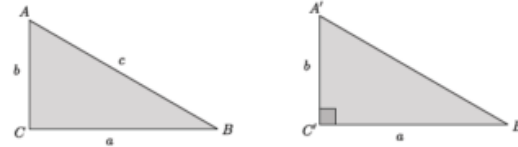
If  $a^2 + b^2$  does not equal  $c^2$ , the triangle is not right.

#### Classwork

Proof of the Converse of the Pythagorean Theorem

$$c^2 < a^2 + b^2 : \text{Acute}$$

$$c^2 > a^2 + b^2 : \text{Obtuse}$$



#### Exercises 1–7

1. Is the triangle with leg lengths of 3 mi. and 8 mi. and hypotenuse of length  $\sqrt{73}$  mi. a right triangle? Show your work, and answer in a complete sentence.

$$a^2 + b^2 \stackrel{?}{=} c^2$$

$$3^2 + 8^2 \stackrel{?}{=} (\sqrt{73})^2$$

$$9 + 64 = 73$$

$$73 = 73$$

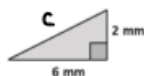
yes, this is  
a right triangle.

2. What is the length of the unknown side of the right triangle shown below? Show your work, and answer in a complete sentence. Provide an exact answer and an approximate answer rounded to the tenths place.



$$\begin{aligned} a^2 + b^2 &= c^2 \\ 4^2 + 1^2 &= c^2 \\ 16 + 1 &= c^2 \\ 17 &= c^2 \\ \sqrt{17} &= c \end{aligned}$$

3. What is the length of the unknown side of the right triangle shown below? Show your work, and answer in a complete sentence. Provide an exact answer and an approximate answer rounded to the tenths place.



4. Is the triangle with leg lengths of 9 in. and 9 in. and hypotenuse of length  $\sqrt{175}$  in. a right triangle? Show your work, and answer in a complete sentence.

$$\begin{aligned} a^2 + b^2 &\stackrel{?}{=} c^2 \\ 9^2 + 9^2 &\stackrel{?}{=} (\sqrt{175})^2 \\ 81 + 81 &= 175 \\ 162 &\neq 175 \end{aligned}$$

5. Is the triangle with leg lengths of  $\sqrt{28}$  cm and 6 cm and hypotenuse of length 8 cm a right triangle? Show your work, and answer in a complete sentence.

$$a^2 + b^2 \stackrel{?}{=} c^2$$

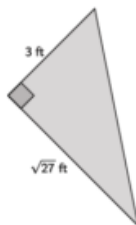
$$6^2 + (\sqrt{28})^2 \stackrel{?}{=} 8^2$$

$$36 + 28 \stackrel{?}{=} 64$$

$$64 = 64$$

yes, this is  
a right triangle

6. What is the length of the unknown side of the right triangle shown below? Show your work, and answer in a complete sentence.



7. The triangle shown below is an isosceles right triangle. Determine the length of the legs of the triangle. Show your work, and answer in a complete sentence.



Lesson Summary

The converse of the Pythagorean theorem states that if a triangle with side lengths  $a$ ,  $b$ , and  $c$  satisfies  $a^2 + b^2 = c^2$ , then the triangle is a right triangle.  
The converse can be proven using concepts related to congruence.

Problem Set

1. What is the length of the unknown side of the right triangle shown below? Show your work, and answer in a complete sentence. Provide an exact answer and an approximate answer rounded to the tenths place.



2. What is the length of the unknown side of the right triangle shown below? Show your work, and answer in a complete sentence. Provide an exact answer and an approximate answer rounded to the tenths place.



3. Is the triangle with leg lengths of  $\sqrt{3}$  cm and 9 cm and hypotenuse of length  $\sqrt{84}$  cm a right triangle? Show your work, and answer in a complete sentence.

$$a^2 + b^2 \stackrel{?}{=} c^2$$

$$(\sqrt{3})^2 + 9^2 \stackrel{?}{=} (\sqrt{84})^2$$

$$3 + 81 = 84$$

$$84 = 84$$

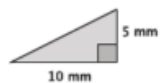
4. Is the triangle with leg lengths of  $\sqrt{7}$  km and 5 km and hypotenuse of length  $\sqrt{48}$  km a right triangle? Show your work, and answer in a complete sentence.

$$(\sqrt{7})^2 + 5^2 \stackrel{?}{=} (\sqrt{48})^2$$

$$7 + 25 = 48$$

$$32 \neq 48$$

5. What is the length of the unknown side of the right triangle shown below? Show your work, and answer in a complete sentence. Provide an exact answer and an approximate answer rounded to the tenths place.



6. Is the triangle with leg lengths of 3 and 6 and hypotenuse of length  $\sqrt{45}$  a right triangle? Show your work, and answer in a complete sentence.
7. What is the length of the unknown side of the right triangle shown below? Show your work, and answer in a complete sentence. Provide an exact answer and an approximate answer rounded to the tenths place.



8. Is the triangle with leg lengths of 1 and  $\sqrt{3}$  and hypotenuse of length 2 a right triangle? Show your work, and answer in a complete sentence.
9. Corey found the hypotenuse of a right triangle with leg lengths of 2 and 3 to be  $\sqrt{13}$ . Corey claims that since  $\sqrt{13} = 3.61$  when estimating to two decimal digits, that a triangle with leg lengths of 2 and 3 and a hypotenuse of 3.61 is a right triangle. Is he correct? Explain.
10. Explain a proof of the Pythagorean theorem.
11. Explain a proof of the converse of the Pythagorean theorem.