Name _____ Date_____

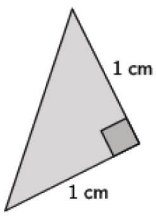
The Converse of the Pythagorean Theorem

1. Is the triangle with leg lengths of 7 mm and 7 mm and a hypotenuse of length 10 mm a right triangle? Show your work, and answer in a complete sentence.

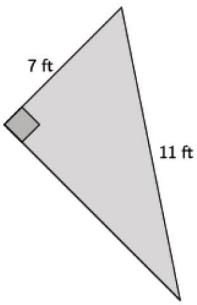
2. What would the hypotenuse need to be so that the triangle in Problem 1 would be a right triangle? Show work that leads to your answer.

3. What would one of the leg lengths need to be so that the triangle in Problem 1 would be a right triangle? Show work that leads to your answer.

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.



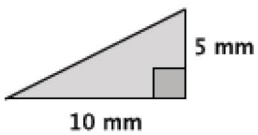
2. What is the length of the unknown side of the right triangle shown below? Show your work, and answer in a complete sentence. Provide an exact answer and an approximate answer rounded to the tenths place.



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

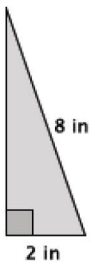
4. Is the triangle with leg lengths of $\sqrt{7}$ km, 5 km, and hypotenuse of length $\sqrt{48}$ km a right triangle? Show your work, and answer in a complete sentence.

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, 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, $\sqrt{3}$, 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, 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.

1. Is the triangle with leg lengths of 7 mm and 7 mm and a hypotenuse of length 10 mm a right triangle? Show your work, and answer in a complete sentence.

$$7^2 + 7^2 = 10^2$$
$$49 + 49 = 100$$
$$98 \neq 100$$

No, the triangle with leg lengths of 7 mm, 7 mm, and hypotenuse of length 10 mm is not a right triangle because the lengths do not satisfy the Pythagorean Theorem.

2. What would the hypotenuse need to be so that the triangle in Problem 1 would be a right triangle? Show work that leads to your answer.

Let c represent the length of the hypotenuse.

Then,

$$7^2 + 7^2 = c^2$$
$$49 + 49 = c^2$$
$$98 = c^2$$
$$\sqrt{98} = c$$

The hypotenuse would need to be $\sqrt{98}$ mm for the triangle with sides of 7 mm and 7 mm to be a right triangle.

3. What would one of the leg lengths need to be so that the triangle in Problem 1 would be a right triangle? Show work that leads to your answer.

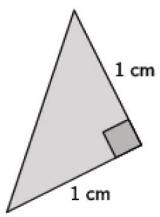
Let a represent the length of one leg.

Then,

$$a^2 + 7^2 = 10^2$$
$$a^2 + 49 = 100$$
$$a^2 + 49 - 49 = 100 - 49$$
$$a^2 = 51$$
$$a = \sqrt{51}$$

The leg length would need to be $\sqrt{51}$ mm so that the triangle with one leg length of 7 mm and the hypotenuse of 10 mm is a right triangle.

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.

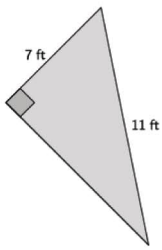


Let c represent the hypotenuse of the triangle.

$$1^2 + 1^2 = c^2$$
$$1 + 1 = c^2$$
$$2 = c^2$$
$$\sqrt{2} = \sqrt{c^2}$$
$$1.4 \approx c$$

The length of the hypotenuse is exactly $\sqrt{2}$ cm and approximately 1.4 cm.

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.**



Let x represent the unknown length of the triangle.

$$\begin{aligned} 7^2 + x^2 &= 11^2 \\ 49 + x^2 &= 121 \\ 49 - 49 + x^2 &= 121 - 49 \\ x^2 &= 72 \\ \sqrt{x^2} &= \sqrt{72} \\ x &= \sqrt{2^2} \times \sqrt{2} \times \sqrt{3^2} \\ x &= 6\sqrt{2} \\ x &\approx 8.5 \end{aligned}$$

The length of the unknown side of the triangle is exactly $6\sqrt{2}$ ft. and approximately 8.5 ft.

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

$$\begin{aligned} \left(\sqrt{3}\right)^2 + 9^2 &= \left(\sqrt{84}\right)^2 \\ 3 + 81 &= 84 \\ 84 &= 84 \end{aligned}$$

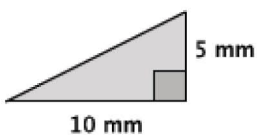
Yes, the triangle with leg lengths of $\sqrt{3}$ cm, 9 cm, and hypotenuse of length $\sqrt{84}$ cm is a right triangle because the lengths satisfy the Pythagorean Theorem.

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

$$\begin{aligned} \left(\sqrt{7}\right)^2 + 5^2 &= \left(\sqrt{48}\right)^2 \\ 7 + 25 &= 48 \\ 32 &\neq 48 \end{aligned}$$

No, the triangle with leg lengths of $\sqrt{7}$ km, 5 km, and hypotenuse of length $\sqrt{48}$ km is not a right triangle because the lengths do not satisfy the Pythagorean Theorem.

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.**



Let c represent the hypotenuse of the triangle.

$$\begin{aligned} 5^2 + 10^2 &= c^2 \\ 25 + 100 &= c^2 \\ 125 &= c^2 \\ \sqrt{125} &= \sqrt{c^2} \\ \sqrt{5^3} &= c \\ \sqrt{5^2} \times \sqrt{5} &= c \\ 5\sqrt{5} &= c \\ 11.2 &\approx c \end{aligned}$$

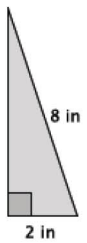
The length of the hypotenuse is exactly $5\sqrt{5}$ mm and approximately 11.2 mm.

6. **Is the triangle with leg lengths of $3, 6$, and hypotenuse of length $\sqrt{45}$ a right triangle? Show your work, and answer in a complete sentence.**

$$\begin{aligned} 3^2 + 6^2 &= \left(\sqrt{45}\right)^2 \\ 9 + 36 &= 45 \\ 45 &= 45 \end{aligned}$$

Yes, the triangle with leg lengths of $3, 6$ and hypotenuse of length $\sqrt{45}$ is a right triangle because the lengths satisfy the Pythagorean Theorem.

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.



Let x represent the unknown length of the triangle.

$$\begin{aligned} 2^2 + x^2 &= 8^2 \\ 4 + x^2 &= 64 \\ 4 - 4 + x^2 &= 64 - 4 \\ x^2 &= 60 \\ \sqrt{x^2} &= \sqrt{60} \\ x &= \sqrt{2^2} \times \sqrt{3} \times \sqrt{5} \\ x &= 2\sqrt{15} \\ x &\approx 7.7 \end{aligned}$$

The length of the unknown side of the triangle is exactly $2\sqrt{15}$ inches and approximately 7.7 inches.

8. Is the triangle with leg lengths of $1, \sqrt{3}$, and hypotenuse of length 2 a right triangle? Show your work, and answer in a complete sentence.

$$\begin{aligned} 1^2 + \left(\sqrt{3}\right)^2 &= 2^2 \\ 1 + 3 &= 4 \\ 4 &= 4 \end{aligned}$$

Yes, the triangle with leg lengths of $1, \sqrt{3}$, and hypotenuse of length 2 is a right triangle because the lengths satisfy the Pythagorean Theorem.

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, 3, and a hypotenuse of 3.61 is a right triangle. Is he correct? Explain.

No, Corey is not correct.

$$\begin{aligned} 2^2 + 3^2 &= (3.61)^2 \\ 4 + 9 &= 13.0321 \\ 13 &\neq 13.0321 \end{aligned}$$

No, the triangle with leg lengths of 2, 3, and hypotenuse of length 3.61 is not a right triangle because the lengths do not satisfy the Pythagorean Theorem.

10. Explain a proof of the Pythagorean Theorem.

Consider having students share their proof with a partner while their partner critiques their reasoning. Accept any of the three proofs that the students have seen.

11. Explain a proof of the converse of the Pythagorean Theorem.

Consider having students share their proof with a partner while their partner critiques their reasoning. Accept either of the proofs that the students have seen.