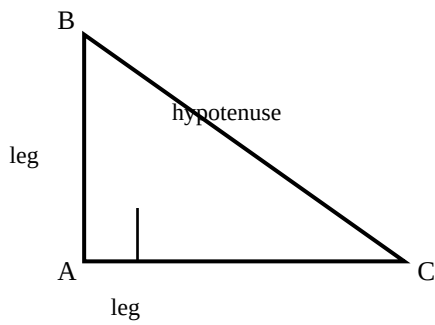


GRADE 8 MATHEMATICS

PYTHAGORAS & RIGHT-ANGLED TRIANGLES

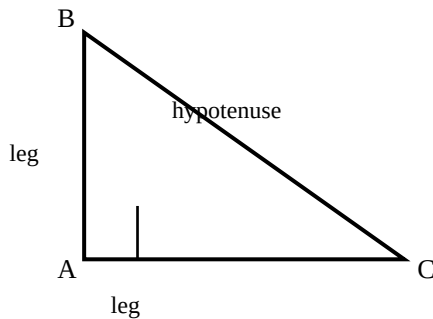


6 worksheets + 6 answer keys • Print-friendly mathematical notation

The Pythagorean theorem • Missing sides • Real-life applications • Converse • Challenge

Worksheet 1 - Recognising Right-Angled Triangles & the Theorem

Show your working. Round decimal answers to the nearest hundredth when needed.



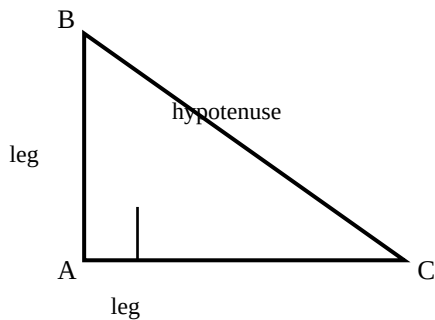
1. State the Pythagorean theorem in words.
2. Which side is the hypotenuse in a right-angled triangle?
3. Check whether 6 cm, 8 cm and 10 cm can form a right-angled triangle.
4. Check whether 7 cm, 9 cm and 12 cm form a right-angled triangle.
5. A right triangle has legs 5 cm and 12 cm. Find the hypotenuse.
6. A right triangle has legs 9 cm and 12 cm. Find the hypotenuse.
7. A triangle has sides 10 cm, 24 cm and 26 cm. Is it right-angled?
8. A triangle has sides 8 cm, 10 cm and 13 cm. Is it right-angled?
9. Explain why the longest side of a right triangle is the hypotenuse.
10. Challenge: A triangle has sides 12 cm, 16 cm and 20 cm. Explain two ways to show it is right-angled.

Answer Key 1 - Recognising Right-Angled Triangles & the Theorem

1. In a right-angled triangle, the square of the hypotenuse equals the sum of the squares of the two legs.
2. The side opposite the 90-degree angle.
3. Yes; $6^2 + 8^2 = 10^2$.
4. No; $7^2 + 9^2 = 130$, not $12^2 = 144$.
5. 13 cm.
6. 15 cm.
7. Yes; $10^2 + 24^2 = 26^2$.
8. No; $8^2 + 10^2 = 164$, not $13^2 = 169$.
9. It lies opposite the 90-degree angle and is longer than either leg.
10. Use $12^2 + 16^2 = 20^2$; or recognise it as 3:4:5 scaled by 4.

Worksheet 2 - Finding a Missing Hypotenuse

Show your working. Round decimal answers to the nearest hundredth when needed.



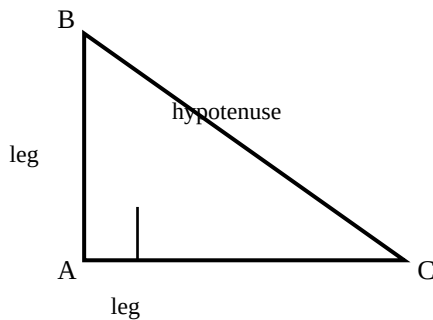
1. Find the hypotenuse when the legs are 7 cm and 24 cm.
2. Find the hypotenuse when the legs are 8 cm and 15 cm.
3. Find the hypotenuse when the legs are 20 cm and 21 cm.
4. Find the hypotenuse when the legs are 12 cm and 35 cm.
5. A ladder has a vertical height of 9 m and its foot is 12 m from a wall. Find the ladder length.
6. A rectangular field is 28 m by 45 m. Find the diagonal.
7. A TV screen is 16 cm wide and 12 cm high. Find its diagonal.
8. A ramp rises 1.5 m over a horizontal distance of 2 m. Find its length.
9. A square has side 10 cm. Find its diagonal.
10. Challenge: A rectangular garden has diagonal 65 m and width 33 m. Find its length.

Answer Key 2 - Finding a Missing Hypotenuse

1. 25 cm.
2. 17 cm.
3. 29 cm.
4. 37 cm.
5. 15 m.
6. 53 m.
7. 20 cm.
8. 2.5 m.
9. $10\sqrt{2}$ cm, approximately 14.14 cm.
10. 56 m.

Worksheet 3 - Finding a Missing Leg

Show your working. Round decimal answers to the nearest hundredth when needed.



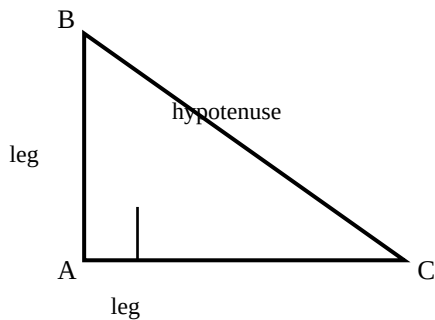
1. The hypotenuse is 13 cm and one leg is 5 cm. Find the other leg.
2. The hypotenuse is 17 cm and one leg is 8 cm. Find the other leg.
3. The hypotenuse is 25 cm and one leg is 7 cm. Find the other leg.
4. The hypotenuse is 29 cm and one leg is 20 cm. Find the other leg.
5. A ladder is 10 m long and reaches 8 m up a wall. How far is its foot from the wall?
6. A rectangular screen has diagonal 25 cm and height 7 cm. Find its width.
7. A cable is 26 m long and spans a horizontal distance of 10 m. Find its vertical height.
8. A right triangle has hypotenuse 15 cm and one leg 9 cm. Find the other leg.
9. A square has diagonal 18 cm. Find its side length exactly.
10. Challenge: A rectangle has diagonal 41 cm and length 40 cm. Find its width.

Answer Key 3 - Finding a Missing Leg

1. 12 cm.
2. 15 cm.
3. 24 cm.
4. 21 cm.
5. 6 m.
6. 24 cm.
7. 24 m.
8. 12 cm.
9. $9\sqrt{2}$ cm, approximately 12.73 cm.
10. 9 cm.

Worksheet 4 - Pythagoras in Real-Life Problems

Show your working. Round decimal answers to the nearest hundredth when needed.



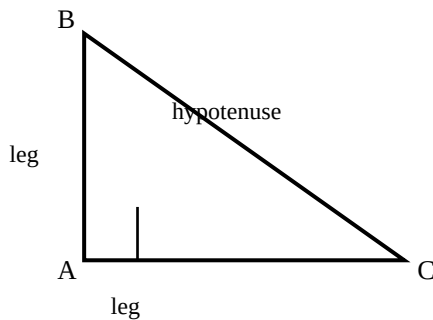
1. A firefighter's ladder is 17 m long and reaches 15 m up a building. How far is the base from the building?
2. A cyclist travels 9 km east and then 12 km north. What is the straight-line distance from the starting point?
3. A drone is 24 m horizontally from a point and 10 m above it. Find its direct distance from the point.
4. A wheelchair ramp is 13 m long with a horizontal run of 12 m. Find the vertical rise.
5. A rectangular swimming pool is 30 m long and 16 m wide. Find the diagonal distance across it.
6. A guy wire is 25 m long and anchored 7 m from the base of a pole. How high up the pole is it attached?
7. A hiker walks 15 km east and 20 km north. How far is the hiker from the starting point?
8. A roof brace forms a right triangle with legs 3.6 m and 4.8 m. Find the brace length.
9. A 10 m ramp rises 6 m. Find its horizontal run.
10. Challenge: A rectangular park is 72 m by 96 m. A path runs diagonally across it. How much shorter is the diagonal than walking along two sides?

Answer Key 4 - Pythagoras in Real-Life Problems

1. 8 m.
2. 15 km.
3. 26 m.
4. 5 m.
5. 34 m.
6. 24 m.
7. 25 km.
8. 6 m.
9. 8 m.
10. Diagonal = 120 m; two sides = 168 m; it is 48 m shorter.

Worksheet 5 - Converse of Pythagoras & Problem Solving

Show your working. Round decimal answers to the nearest hundredth when needed.



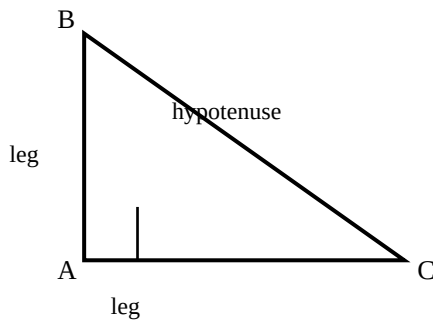
1. State the converse of the Pythagorean theorem.
2. Do 9, 40 and 41 form a right triangle? Show the test.
3. Do 11, 60 and 61 form a right triangle?
4. Do 12, 35 and 39 form a right triangle?
5. A triangle has sides 20, 21 and 29. Classify it using the converse.
6. A triangle has sides 10, 11 and 15. Is it right-angled?
7. A student tests 6, 8 and 10 using $6^2 + 8^2 = 10^2$. What conclusion is justified?
8. Why must the longest side be tested as the possible hypotenuse?
9. Find an integer right-triangle triple with hypotenuse 25.
10. Challenge: A triangle has sides 16, 30 and 34. Prove it is right-angled and identify the legs.

Answer Key 5 - Converse of Pythagoras & Problem Solving

1. If the square of the longest side equals the sum of the squares of the other two sides, the triangle is right-angled.
2. Yes; $9^2 + 40^2 = 41^2$.
3. Yes; $11^2 + 60^2 = 61^2$.
4. No; $12^2 + 35^2 = 1369$, while $39^2 = 1521$.
5. Right-angled.
6. No; $10^2 + 11^2 = 221$, not 225.
7. The triangle is right-angled.
8. The hypotenuse is always opposite the right angle and therefore is the longest side.
9. 7, 24, 25.
10. $16^2 + 30^2 = 34^2$; therefore it is right-angled, with legs 16 and 30.

Worksheet 6 - Challenge: Multi-Step Pythagoras

Show your working. Round decimal answers to the nearest hundredth when needed.



1. A 13 m ladder reaches 12 m up a wall. The base is moved 5 m farther from the wall. If the ladder remains 13 m, how high does it now reach?
2. A rectangular field has area $1,920 \text{ m}^2$ and length 60 m. Find its width and diagonal.
3. A square courtyard has diagonal $20\sqrt{2} \text{ m}$. Find its side and perimeter.
4. A right triangle has hypotenuse 34 cm and one leg 16 cm. Find the other leg and perimeter.
5. A ladder is 25 m long. It reaches a point 24 m high. If the foot is moved 8 m farther from the wall, how high will it reach?
6. A rectangular room measures 9 m by 12 m. Find the diagonal and compare it with a 14 m cable.
7. A right triangle has legs x and $x+7$, with hypotenuse 13. Find x .
8. A square has area 162 cm^2 . Find its side and diagonal.
9. A rectangular screen has diagonal 50 cm and width 40 cm. Find its height and area.
10. Final challenge: A 15 m ladder reaches 12 m up a wall. A second ladder reaches the same height but has its foot 9 m from the wall. Which ladder is longer, and by how much?

Answer Key 6 - Challenge: Multi-Step Pythagoras

1. 12 m initially gives base 5 m. Moving 5 m farther gives base 10 m; new height = $\sqrt{69} \approx 8.31$ m.
2. Width = 32 m; diagonal = 68 m.
3. Side = 20 m; perimeter = 80 m.
4. Other leg = 30 cm; perimeter = 80 cm.
5. New base = $\sqrt{(25^2 - 8^2)} = \sqrt{561} \approx 23.69$ m.
6. Diagonal = 15 m; the cable is 1 m too short.
7. $x=5$; legs are 5 cm and 12 cm.
8. Side = $9\sqrt{2}$ cm; diagonal = 18 cm.
9. Height = 30 cm; area = 1,200 cm².
10. Second ladder = 15 m; both are 15 m, so the difference is 0 m.