

Pythagorean Theorem Practice

GRADE 8 • FIND, CHECK, APPLY • RIGHT TRIANGLES ONLY

WHY THIS MATTERS The theorem helps us calculate diagonal distances in right-triangle models, such as a ladder against a vertical wall or a ramp above level ground.

DIRECTIONS Solve the side length problems, complete the tables, and check if the given side lengths form right-angled triangles. Note: Diagrams are not to scale. Show your equation and working on the supplied lines or extra paper. Give answers as an exact radical or rounded to the nearest tenth.

FINDING MISSING SIDE LENGTHS

Leg a • Leg b • Hypotenuse c

THE THEOREM

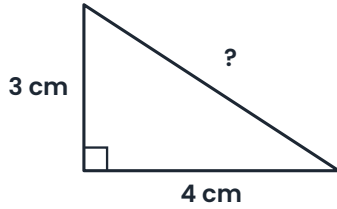
The Pythagorean Theorem states that in any right-angled triangle, the sum of the squares of the legs is equal to the square of the hypotenuse: $a^2 + b^2 = c^2$. The hypotenuse (c) is the longest side, always opposite the 90° right angle. The other two sides are the legs (a and b).

Worked Model: For a right triangle with legs $a = 3\text{cm}$ and $b = 4\text{cm}$, find the hypotenuse c :

$3^2 + 4^2 = c^2 \implies c^2 = 9 + 16 = 25$. $c = \sqrt{25} = 5\text{ cm}$. Note that the hypotenuse c (5 cm) is opposite the 90° angle and is the longest side. To find a missing leg, rearrange the formula: $a^2 = c^2 - b^2$ or $b^2 = c^2 - a^2$.

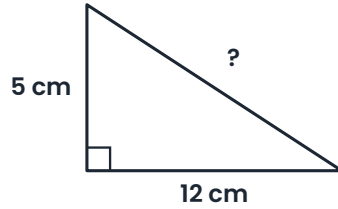
FIND THE MISSING SIDE

1



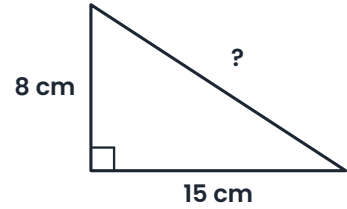
$c =$ _____

2



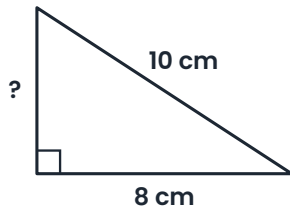
$c =$ _____

3



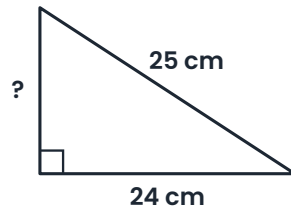
$c =$ _____

4



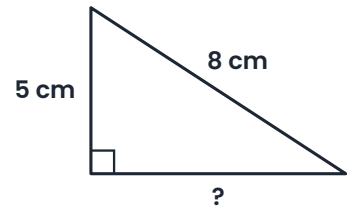
$a =$ _____

5



$a =$ _____

6



$b =$ _____

7. $a = 6$ m and $b = 8$ m. Find c .

8. $c = 13$ m and $a = 5$ m. Find b .

IS IT A RIGHT TRIANGLE?			
Sides	$a^2 + b^2$	c^2	Right?
6, 8, 10			
6, 8, 11			
9, 12, 15			

LADDER AND RAMP

9. A 10 m ladder leans against a wall, with its base 6 m away. How high does it reach?

Answer: _____

10. A ramp has a horizontal length of 12 m and a vertical rise of 9 m. Find the diagonal length.

Answer (one decimal): _____

Explanation & Exit Ticket

11. Explain why $\sqrt{9 + 16} = 5$, not $3 + 4$. Show your mathematical reasoning.
- _____
- _____
- _____
12. Exit Ticket: A right triangle has legs of length 5 cm and 12 cm. Find the length of the hypotenuse c and identify which side is the hypotenuse.
- _____
- _____
- _____

Pythagorean Theorem — Facilitator Guide

GRADE 8 · MATHEMATICS · PRACTICE AND REASONING

A focused practice worksheet on applying the Pythagorean Theorem to find missing legs and hypotenuses, verify right triangles, and solve ladder and ramp word problems.

QUICK START

Learning target: I can use the Pythagorean Theorem to find missing side lengths of right triangles and determine if three side lengths form a right triangle.

TIME	GROUPING	MATERIALS
30-40 min	Individual practice with partner check-ins	printed worksheet · pencil · paper

KEY VOCABULARY **hypotenuse** **leg** **right-angled** **converse** **diagonal**

GUIDING QUESTIONS

How do you identify which side of a right triangle is the hypotenuse, especially when looking at a word problem like the ladder or ramp?

What is the algebraic difference between solving for a missing hypotenuse versus solving for a missing leg?

FACILITATION SEQUENCE

1 LAUNCH · 5-10 MIN

Students review the definition of the Pythagorean Theorem on the worksheet, identifying that the hypotenuse is always opposite the right angle.

Watch for: Look for students who confuse the legs (a and b) with the hypotenuse (c) when setting up their initial equations.

TEACHING TIP · A useful prompt here is: "Where is the right angle in this diagram, and which side is directly across from it?"

TEACHING TIP · A useful prompt here is: "If you are given the hypotenuse, how does that change how you set up your equation?"

2 STUDENT WORK • 20 MIN

Students work independently or in pairs to solve the practice problems, filling in the missing sides, completing the Converse Check Table, and solving the ladder and ramp application problems.

Watch for: Watch for students who add the squared values when they should subtract (e.g., in the ladder problem, calculating 10 squared plus 6 squared instead of 10 squared minus 6 squared).

TEACHING TIP • A useful prompt here is: "In the ladder problem, is the 10 m ladder representing a leg or the hypotenuse?"

TEACHING TIP • A useful prompt here is: "Look at the Converse Check Table: if a squared plus b squared does not equal c squared, what does that tell you about the triangle?"

3 CONSOLIDATE & DISCUSS • 10 MIN

Students compare their answers with a partner, specifically discussing why the diagonal of the 9 m by 12 m ramp is 15 m, and how they verified if the sides 6, 8, 11 form a right triangle.

Watch for: Listen for how students explain the difference between adding side lengths directly versus squaring them first.

TEACHING TIP • A useful prompt here is: "Why is the square root of $(9 + 16)$ not equal to $3 + 4$?"

TEACHING TIP • A useful prompt here is: "How did you and your partner decide whether the sides 6, 8, and 11 form a right triangle?"

Expected answers for this worksheet, with guidance on evaluating student responses.

Note: Please review these answers before classroom use.

Q1. $\sqrt{9 + 16} = 5$ cm

Q2. $\sqrt{25 + 144} = 13$ cm

Q3. $\sqrt{64 + 225} = 17$ cm

Q4. $\sqrt{100 - 64} = 6$ cm

Q5. $\sqrt{625 - 576} = 7$ cm

Q6. $\sqrt{64 - 25} = \sqrt{39} \approx 6.2$ cm

Q7. $\sqrt{36 + 64} = 10$ m

Q8. $\sqrt{169 - 25} = 12$ m

Q9 (Ladder). $\sqrt{100 - 36} = 8$ m

Q10 (Ramp). $\sqrt{144 + 81} = 15.0$ m

Q11. Add inside the radical first: $\sqrt{25} = 5$, while $3 + 4 = 7$.

Q12 (Exit Ticket). $\sqrt{25 + 144} = 13$ cm, and side c is opposite the 90° angle.

Converse Check Table:

* **6, 8, 10:** $6^2 + 8^2 = 100$ and $10^2 = 100 \rightarrow$ **Yes** (100/100)

* **6, 8, 11:** $6^2 + 8^2 = 100$ and $11^2 = 121 \rightarrow$ **No** (100/121)

* **9, 12, 15:** $9^2 + 12^2 = 225$ and $15^2 = 225 \rightarrow$ **Yes** (225/225)

Note: The hypotenuse c is always the longest proposed side.

LIKELY STUDENT RESPONSES, MISCONCEPTIONS, AND HELPFUL TEACHER MOVES

Anticipate these — and the response that moves thinking forward.

STUDENTS MAY...	WHAT THAT MIGHT MEAN...	A HELPFUL NEXT MOVE...
Write $6 + 8 = c$ instead of squaring the terms first, resulting in $c = 14$ instead of $c = 10$.	The student is treating the theorem as a linear relationship rather than an area-based relationship of the squares of the sides.	Ask the student to draw a 3-4-5 triangle on grid paper and physically count the unit squares INSIDE the squares built on each side, not along the sides, to visualize why we must square the lengths.
Set up the ladder problem as 10 squared + 6 squared = c squared.	The student assumes any two given numbers in a word problem must be legs 'a' and 'b' and always solves for 'c'.	Have the student sketch the wall, ground, and ladder, then label which physical object represents the slanted diagonal (hypotenuse).

EQUITY, SEL, AND TRAUMA-INFORMED PROMPTS

EQUITY

Perspective invitations you can offer students — a second context, a missing voice, a different lived reality.

Invite students to discuss how diagonal measurements are used in local construction, carpentry, or ramp building in their own neighborhoods to make the math concrete.

SEL

The emotional and interpersonal demands of this task — confidence, disagreement, frustration points, collaboration.

Normalize making errors when squaring and square-rooting by encouraging students to share their 'favorite mistakes' during the Converse Check Table portion.

TRAUMA-INFORMED

Participation safety and predictability — a private response option, lower-stakes sharing, predictable structure.

Provide a low-stakes environment by allowing students to check their answers against a partner's work before submitting, reducing performance anxiety around multi-step calculations.

UDL, DIFFERENTIATION, AND LANGUAGE SUPPORTS

IF STUDENTS NEED MORE SUPPORT

Scaffolds for the same core thinking: oral rehearsal first, sketch or sort before writing, a worked example, chunked steps.

Provide a list of perfect squares (1 to 225) on the board to reduce the cognitive load of mental arithmetic so students can focus on the geometric relationships.

IF STUDENTS ARE READY FOR MORE

Extensions that add complexity, not busywork: compare two approaches, justify a choice, transfer to a new context.

Ask students to find another set of three whole numbers (a Pythagorean triple) not listed on the worksheet and prove algebraically why they form a right triangle. Worked example: 20, 21, 29, where $20^2 + 21^2 = 400 + 441 = 841 = 29^2$.

LANGUAGE SUPPORTS

Name the language function (explain, compare, argue, justify) with sentence frames and oral rehearsal.

Name the language function: Explain. Provide sentence frames for the conceptual question: 'The square root of $(9 + 16)$ is not equal to $3 + 4$ because we must first _____ before we _____.'

ASSESSMENT LOOK-FORS AND NEXT STEPS

WHAT TO LOOK FOR

CRITERION	WHAT IT LOOKS LIKE HERE	POSSIBLE EVIDENCE	HELPFUL NEXT STEP
Hypotenuse Identification	Correctly identifying 'c' as the longest side opposite the right angle in both diagrams and word problems.	Labeling the 10 m ladder as 'c' and the 6 m distance as 'b' in the ladder problem.	Prompt the student to trace the right angle and draw an arrow directly opposite it to locate the hypotenuse.

CRITERION	WHAT IT LOOKS LIKE HERE	POSSIBLE EVIDENCE	HELPFUL NEXT STEP
Algebraic Application	Using subtraction when solving for a missing leg and addition when solving for a missing hypotenuse.	Writing $a^2 = 25^2 - 24^2$ for Q5.	Ask the student to compare the sizes of the sides to ensure the hypotenuse remains the longest side.

Reteach signal: If more than half the class struggles to solve for a missing leg (such as finding 'a' when given 'b' and 'c'), pause and conduct a brief guided re-engagement focusing on isolating variables in the equation $a^2 + b^2 = c^2$.