

Pythagorean Calculations and Order of Operations

MASTERING SQUARES, SQUARE ROOTS, AND OPERATIONS FOR RIGHT TRIANGLES

WHY THIS MATTERS Calculating squares and square roots accurately lets you find the exact diagonal distance across a sports field or design stable structures like ramps and roofs.

DIRECTIONS Focus on accuracy and follow the correct order of operations to solve each expression.

ORDER OF OPERATIONS — REFERENCE

Exponents and Roots First: Always calculate powers like 3^2 and square roots like $\sqrt{16}$ before multiplying, dividing, adding, or subtracting.

Order of Operations: Perform operations inside parentheses first, then exponents/roots, then multiplication/division, and finally addition/subtraction.

PART A • SQUARES AND ROOTS FLUENCY

Evaluate each expression using the correct order of operations.

- | | | |
|------------------------------|-------------------------------------|----------------------------|
| 1. $5^2 + 12^2 =$ _____ | 2. $8^2 + 15^2 =$ _____ | 3. $10^2 - 6^2 =$ _____ |
| 4. $13^2 - 5^2 =$ _____ | 5. $\sqrt{81} + \sqrt{144} =$ _____ | 6. $\sqrt{9 + 16} =$ _____ |
| 7. $\sqrt{100 - 64} =$ _____ | 8. $3^2 \times 2 =$ _____ | 9. $6^2 \div 4 =$ _____ |

PART B • MULTI-STEP TRIANGLE CALCULATIONS

Simplify each expression step-by-step to find the final value.

10. $\sqrt{6^2 + 8^2}$

STEP 1 _____

STEP 2 _____

ANSWER _____

11. $\sqrt{15^2 - 9^2}$

STEP 1 _____

STEP 2 _____

ANSWER _____

12. $\sqrt{12^2 + 16^2}$

STEP 1 _____

STEP 2 _____

13. $\sqrt{20^2 - 16^2}$

STEP 1 _____

STEP 2 _____

ANSWER _____

ANSWER _____

PART C • FIND AND CORRECT THE ERROR

A student evaluated this expression. Find the mistake, explain it, and give the correct answer.

STUDENT WORK

Problem: Calculate: $3^2 + 4^2$

Student wrote: $3^2 + 4^2 = (3 + 4)^2 = 7^2 = 49$

What did the student do wrong? _____

The correct answer is: _____

★ CHALLENGE

Evaluate the expression: $\sqrt{\sqrt{81} + 5^2 + 10^2 \div 4}$

Computation Practice — Facilitator Guide

GRADES 6–8 • MATH • COMPUTATION PRACTICE

Students practice evaluating squares, square roots, and multi-step operations to build the computational fluency needed for the Pythagorean theorem.

QUICK START

WHY THIS MATTERS • Learning target: Evaluate numerical expressions involving squares, square roots, and the order of operations accurately.

TIME	GROUPING	MATERIALS
20–25 min	Individual practice with partner sharing	Pythagorean Calculations and Order of Operations worksheet

KEY VOCABULARY exponent square root order of operations evaluate

GUIDING QUESTIONS How does the radical symbol act like parentheses in expressions like $\sqrt{9 + 16}$?
Why does $3^2 + 4^2$ not equal $(3 + 4)^2$?

Prerequisite knowledge: Familiarity with basic multiplication facts and the concept of squaring a number.

FACILITATION SEQUENCE

1 LAUNCH • 5 MIN

Students analyze the error analysis problem ($3^2 + 4^2 = 49$) and discuss why the student's method is incorrect.

Watch for: Whether students recognize that exponents must be evaluated before adding the bases.

A useful prompt here is: "How does evaluating the exponents first change the final value?"

A useful prompt here is: "What rule from our worksheet did the student violate in the error analyse

ANSWER KEY & HOW TO APPROACH FOR THE TEACHER

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

ITEM	EXPECTED ANSWER	HOW TO APPROACH / ACCEPT
Part A – items 1–9	169, 289, 64, 144, 21, 5, 6, 18, 9	Do exponents and roots before + or -; the radical groups like parentheses.

Part B – items 10–13	10, 12, 20, 12	Square inside the radical, add or subtract, then take the root.
Part C – error analysis	Correct: $9 + 16 = 25$ (student wrote $(3 + 4)$ then squared $= 49$)	Explanation must name the rule: square each term first, then add.

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...
Add the bases before squaring, as seen in $3^2 + 4^2 = 7^2 = 49$.	They believe addition can be grouped before exponentiation without parentheses.	Have the student evaluate 3^2 and 4^2 separately first, write down those values, and then add them.
Evaluate $\sqrt{9 + 16}$ as $\sqrt{9} + \sqrt{16} = 3 + 4 = 7$.	They are applying a distributive-like property to square roots over addition.	Ask the student to find the sum of 9 and 16 first, and then find the square root of that sum.

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 calculating exact diagonal distances is used in practical design tasks like building ramps or sports fields in their own communities.

SEL

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

Support students in building frustration tolerance when tackling multi-step expressions like the challenge problem by focusing on celebrating correct individual steps rather than just the final answer.

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 to the first fluency set with a partner before submitting their work to the teacher.

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 physical or digital grid to model squares (e.g., showing a 3x3 grid and a 4x4 grid to visualize $3^2 + 4^2$).

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 create their own multi-step radical expression that simplifies to a whole number, using at least three different operations.

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 partner discussion: 'First, I evaluated the exponent because...' and 'The radical symbol acts like parentheses, so I must first...'

ASSESSMENT LOOK-FORS AND NEXT STEPS

WHAT TO LOOK FOR

CRITERIA	EMERGING	DEVELOPING	PROFICIENT	EXTENDING
Computational fluency	Frequent errors, no strategy	Accurate with support or extra time	Accurate and independent	Accurate, efficient, self-checks
Showing work	Answers only	Work shown sporadically	Work shown for every multi-step item	Work annotated; errors self-corrected

Reteach signal: If more than half the class evaluates $3^2 + 4^2$ as 49 or $\sqrt{9 + 16}$ as 7, pause and model the difference between evaluating operations inside a radical versus evaluating individual square roots.