NAME _____ DATE _____ PERIOD _____

Score ____ / ____

Applying the Pythagorean Theorem in the Real World

USING RIGHT TRIANGLES TO SOLVE REAL-WORLD DISTANCE AND BUDGETING PROBLEMS

WHY THIS MATTERS Architects and city planners use the Pythagorean theorem to calculate precise diagonal distances, ensuring they order the exact amount of building materials needed for construction projects.

DIRECTIONS First, restate the problem in your own words. Next, use the grid space to sketch the scenario and calculate your solution. Finally, write a justification using the vocabulary words provided and tackle the challenge question.

MATH SCENARIO

A city park is planning a new diagonal walking path. The park is a rectangle that measures 80 meters wide and 150 meters long. The new path will cut directly from the southwest corner to the northeast corner. If it costs $12 per meter to pave the path, how much will it cost the city to construct the new diagonal walkway?

STEP 1 · EXPLAIN THE PROBLEM IN YOUR OWN WORDS

Restate the problem so that someone who hasn't read it would understand what you need to solve.

STEP 2 · SHOW YOUR WORK

Organise your work in the grid. Show each step, including any formulas or equations you use.

SHOW YOUR WORK

STEP 3 · JUSTIFY YOUR ANSWER

Use mathematical vocabulary to explain WHY your solution works. Reference specific steps in your work.

WHAT IF…? EXTENSION

What if the park's width is doubled to 160 meters while the length remains 150 meters? Explain how this change affects the length of the diagonal path and calculate the new paving cost.

MATH VOCABULARY BANK hypotenuse legs right angle Pythagorean theorem square root square sum diagonal right triangle dimension

Mathematical Thinking — Facilitator Guide

GRADES 6-8 · MATH · MATH PROBLEM SOLVING

Students apply the Pythagorean theorem to calculate the diagonal path length and total paving cost of a rectangular city park, then analyze how doubling the park's width impacts the diagonal length and budget.

QUICK START

> ***WHY THIS MATTERS*** *· Learning target: I can use the Pythagorean theorem to solve real-world distance and budgeting problems involving right triangles.*

TIME	GROUPING	MATERIALS
25-30 min	Pairs, then whole class	Classroom worksheet: Applying the Pythagorean Theorem in the Real World

KEY VOCABULARY **hypotenuse** **legs** **right angle** **Pythagorean theorem** **square root** **diagonal**

GUIDING QUESTIONS

How does the rectangular shape of the park relate to the right triangles we use in the Pythagorean theorem?

Why does doubling the width of the park not double the length of the diagonal path?

Prerequisite knowledge: Students must know how to identify the legs and hypotenuse of a right triangle and be familiar with squaring numbers and finding square roots.

FACILITATION SEQUENCE

1 LAUNCH · 5 MIN

Students read the prompt about the city park walking path, identify the dimensions (80m by 150m), and sketch the rectangular park with its diagonal path on their grid space.

Watch for: Watch for whether students correctly label the 80m and 150m dimensions as the legs and the diagonal path as the hypotenuse.

A useful prompt here is: "Where is the right angle in your sketch of the park, and which side is opposite to it?"

A useful prompt here is: "How can we represent the diagonal path using a variable in our equation?"

2

2 STUDENT WORK · 15 MIN

Students work in pairs to calculate the path length (170m) and the total paving cost ($2,040), write their justification, and tackle the challenge question where the width is doubled to 160m.

Watch for: Watch for students who double the final diagonal length instead of doubling the width in the Pythagorean theorem formula.

A useful prompt here is: "If we double the width to 160 meters, what are the new values for our legs in the theorem?"

A useful prompt here is: "How does the cost per meter relate to the total length of the path we calculated?"

3 CONSOLIDATE & DISCUSS · 10 MIN

Students share their calculations and justifications with the class, comparing how they solved the challenge question and explaining why the diagonal length did not simply double.

Watch for: Listen for students using key vocabulary terms like 'hypotenuse', 'legs', and 'square root' to justify their mathematical steps.

A useful prompt here is: "Why didn't doubling the width from 80m to 160m double the diagonal path length from 170m to 340m?"

A useful prompt here is: "How did you use the square root to find the final length of the path?"

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
Step 1 restatement	The problem in the student's own words, naming what must be found	Copying the problem text verbatim doesn't show understanding — look for re-phrasing.
Calculation	Diagonal = square root of ($80^2 + 150^2$) = 170 m; cost = 170 × $12 = $2,040	Look for $80^2 + 150^2 = c^2$, so c = 170 (not 80 + 150).

Justification	An explanation that uses math vocabulary and references the work shown	"I just knew it" earns a prompt: which step proves it?
What If…?	A correct re-computation plus an explanation of WHY the answer changes	The why matters more than the new number.

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 legs together (80 + 150 = 230) and multiply by $12 instead of using the Pythagorean theorem.	They are confusing the perimeter of the park or the sum of the paths with the diagonal shortcut.	Ask the student to trace the actual path of the diagonal and compare it visually to walking along both sides of the park.
Double the diagonal path length to 340 meters for the challenge question because the width was doubled.	They assume a linear relationship exists between one leg of a right triangle and its hypotenuse.	Prompt them to calculate the square root of (160 squared + 150 squared) to see if it equals 340.

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 who decides where paths are paved in public spaces and how budgeting constraints like the $12 per meter cost might affect park planning in different neighborhoods.

SEL

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

Support students' confidence when working with large numbers (like 28,900) by encouraging them to use calculators and focus on the step-by-step process of the theorem rather than mental arithmetic.

TRAUMA-INFORMED

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

Provide a low-stakes environment by allowing students to sketch and check their initial calculations with a partner before writing down their final justifications on the worksheet.

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 model of a right triangle where students can physically label the legs as 80m and 150m and the hypotenuse as the diagonal path.

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 calculate how much money the city saves by paving the diagonal path instead of paving a path that goes along the entire perimeter of the width and length.

LANGUAGE SUPPORTS

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

Name the language function: Justify. Provide sentence frames for the justification section: 'Since the park is a rectangle, the diagonal path forms a...'; 'I used the Pythagorean theorem to find the hypotenuse by first squaring... and then taking the...'

ASSESSMENT LOOK-FORS AND NEXT STEPS

WHAT TO LOOK FOR

CRITERION	WHAT IT LOOKS LIKE HERE	POSSIBLE EVIDENCE	HELPFUL NEXT STEP
Application of Pythagorean Theorem	Correctly identifying 80m and 150m as legs and solving for the hypotenuse.	Student work shows 80^2 + 150^2 = c^2, leading to c = 170.	Prompt the student to move on to calculating the paving cost.

Reteach signal: If more than half the class struggles to find the square root of 28,900 or incorrectly adds 80 and 150 before squaring, pause and conduct a brief mini-lesson on the order of operations within the Pythagorean theorem.