EXPLORE-FIRST LESSON

The Fence Around the Garden

Area and perimeter — why two gardens can use the same fence and hold different amounts

Teacher	Elementary Teacher	**School**	Sample Elementary School
Subject	Elementary Mathematics	**Grade**	4
Class / Period	Math block	**Date**	_____
Block length	55 minutes	**Framework**	Danielson Framework for Teaching

Phase times are targets, not stopwatches.

Framework: Danielson Framework for Teaching, 2013 component language. If your district uses the 2022 edition the component names differ — 1e is Planning Coherent Instruction and 1f is Designing and Analyzing Assessments.

Standards & Objectives

1c Setting Instructional Outcomes

Standard (as published)	Student-facing "I Can"	Language objective
CCSS.MATH.CONTENT.4.MD.A.3 Apply the area and perimeter formulas for rectangles in real world and mathematical problems.	I can find the area and the perimeter of a rectangle, and I know which one the problem is asking for.	Students will use area, perimeter, square units and dimensions when they talk and write. **Frames:** "The perimeter is ___ because ___." · "The area is ___ square units."
CCSS.MATH.PRACTICE.MP3 Construct viable arguments and critique the reasoning of others.	I can explain why my answer works, and listen to somebody who did it differently.	**Frame:** "I think ___ because ___. What did you get?"

Who Does This Work — and Who Got the Credit

1b Demonstrating Knowledge of Students

Who was measuring land first. People were working out how much land a fence would go around, and how much would grow inside it, thousands of years before anybody wrote a formula. Farmers along the Nile in ancient Egypt remeasured their fields every single year, because the river flooded and washed the boundary markers away. They got very good at it. The word geometry comes from Greek words meaning earth measuring — and the Greeks learned a great deal of it from the Egyptians.

Something worth telling fourth graders plainly. When people write about who invented mathematics, the names that come up are usually Greek. But the Egyptians were doing this first, and so were people in Babylon, in India and in China. They were all working it out at the same time, in different places, without knowing about each other.

Who does this work now. Anybody who has to know how much of something to buy. **Carpenters** and **flooring installers** work out area before they order material — and get it wrong at their own expense. **Landscapers** price a job by square feet. **Painters** count wall area to know how many cans. **Fence builders** measure perimeter. **Farmers** still measure fields. Most of these are learned on the job or through an apprenticeship, and the people who are quickest at this mathematics get paid more for it.

Ask the class: "The river washed the markers away every year and they had to measure it all again. What would you have invented?"

The Problem

3c Engaging Students in Learning

Two families are each building a garden. Both have exactly 24 feet of fence — not one inch more. The first family builds a garden 2 feet wide and 10 feet long. The second builds one 6 feet by 6 feet. The first family says the gardens are the same because they used the same fence.

Driving question students are working to answer:

Same fence. Is it the same garden?

Key Questions

3b Using Questioning and Discussion Techniques

Question, exactly as I ask it	Level	Where	Strong answer sounds like
"Both families used all 24 feet. So what could possibly be different?"	DOK 2	Launch	Says the shape is different, or the inside is different — not just that the numbers are different.
"Show me on your grid where the fence is. Now show me where the vegetables go."	DOK 2	Explore — to a stuck group	Distinguishes the boundary from the inside. This is the whole lesson.
"Two groups drew different gardens with the same fence. How is that possible?"	DOK 3	Synthesize	Explains that the fence is the edge and the growing space is inside, and they do not have to change together.
"If you had 24 feet of fence, what garden would you build — and why?"	DOK 3	Assess	Chooses a shape and justifies it. Some will pick the biggest area; some will have a reason for a long thin one. Both can be right.

Accountable-talk stems, posted at each table: "I got ___ because…" · "I drew mine differently — look…" · "Can you show me on your grid?"

Wait time: count to seven before calling on anyone. It will feel long. Do it anyway.

Materials & Prep

1d Demonstrating Knowledge of Resources

Prepare before the bell	Copies / quantity
Garden Grid organizer (Appendix A) on centimeter grid paper	24
Build Your Own card (Appendix B)	24
Square tiles or unit cubes — at least 40 per table	6 sets
Loops of string or yarn cut to 24 units, one per table — the fence, made real	6
Chart paper and markers, one per group	6 sheets
Anchor chart headed: The fence goes AROUND · The garden is INSIDE	before the bell
Bilingual vocabulary cards — area, perimeter, square units	Spanish / English

The string matters. Children who can hold 24 units of fence in their hands and reshape it stop guessing and start reasoning. It is the cheapest manipulative in this lesson and the most important one.

Grouping Plan

1b Demonstrating Knowledge of Students

Six mixed groups of four. Mixed grouping fits because there is no procedure to execute correctly here — children are building an idea, and the groups that draw different gardens are what makes the synthesis work.

Group	Composition	Notes
Tables 1–6	Four children, mixed confidence with multiplication	Every table gets the same string, tiles and grid

How the support lanes work: three versions of the organizer sit at every table — one with the first garden already drawn, the core version, and one with an extra challenge on the back. Children choose and may switch. Nobody is handed a version.

Seating and access principles:

- Seat children still learning English beside someone who will talk to them, each with a vocabulary card. This lesson can be entered by building before it is entered by words.
- Children who are not yet fluent with multiplication can count tiles. Counting is a legitimate method today — the standard is about area and perimeter, not about times tables.
- Spread confident builders across tables rather than seating them together.

Forming groups in under a minute: name cards on the tables before the children come in.

Anticipated Student Responses

Ordered deliberately — least sophisticated first, building toward the idea.

1a Demonstrating Knowledge of Content and Pedagogy

What children will try	Why they will try it	When I call on it
"They are the same, they both used 24." (productive wrong turn)	Same fence, same number, so same garden. It is the first family's argument and it is reasonable.	**FIRST.** The whole lesson turns on why this is not right. Let the room take it apart.
Counting the squares inside, one by one	Children who do not yet reach for multiplication.	**SECOND.** Completely correct and slow. Praise it, then ask if there is a faster way.
Counting rows of squares — 6 and 6 and 6	The step between counting and multiplying.	**THIRD.** The bridge. Repeated addition is where multiplying comes from and children should see that.
2 × 10 = 20 and 6 × 6 = 36	Children who see the array immediately.	**FOURTH.** The target. Now name it: area, in square units.
Adding the sides to check the fence: 2+10+2+10	Children checking the problem is honest — an excellent instinct.	**FIFTH.** Name it: perimeter. Now both words are on the chart, from their work.
"What if you make it 1 by 11?"	Somebody always tries the extreme case.	**LAST.** Hand it straight into Phase 4. That child has invented the next question.

Adults in the Room

1e Designing Coherent Instruction

Phase	Lead Teacher	Paraprofessional
1 Launch	Sets the problem, hands out the string, stops talking	Places tiles and grids; checks every table has started
2 Explore	Rotates tables 1→2→3→4→5→6. Withholds all method. Asks only questions. Logs which table drew what	Rotates the opposite direction; steadies the string for children building, without suggesting a shape
3 Synthesize	Calls tables in the sequenced order; writes only what a child has said	Holds up each table's grid so the room can see it
4 Apply	Circulates; confers first with children who said the gardens were the same	Sits with anyone who has not started
5 Assess	Circulates; takes dictation from children who draw rather than write	Collects by table

The rule both adults hold in Phase 2: if we show them the method, the lesson is over.

PHASE 1 — LAUNCH (about 7 minutes)

Set the problem. Do NOT show a method.

3c Engaging Students in Learning

Time	Teacher steps & script	Student action
0:00–7:00	1. Hold up the loop of string. Say: **"This is 24 feet of fence. It is all the fence there is. Nobody is going to the shop for more."** 2. Say: **"Two families each got 24 feet. One built a garden 2 feet wide and 10 feet long. The other built one 6 feet by 6 feet."** Draw both quickly on the board, roughly. 3. Say: **"The first family says they are the same gardens, because they used the same fence. Are they right?"** 4. Ask: **"Both families used all 24 feet. So what could possibly be different?"** Take two answers. Write both. Say whether neither is right. 5. Say: **"You have string, tiles and grid paper. Eighteen minutes. Your table needs an answer and something on**	• Watch the string being shaped • Two children answer aloud • Take string, tiles and grid • Begin building at the table

Time	Teacher steps & script	Student action
	paper that proves it. Go." 6. Check every table has the string out and someone building before stepping away.	

PHASE 2 — EXPLORE (about 18 minutes) Level: DOK 2 · Skills & Concepts

Children find it before being shown. Questions only.

3b Using Questioning and Discussion Techniques

Time	Teacher steps & script	What I am listening for
7:00–25:00	1. Fixed route, tables 1 through 6, about ninety seconds each, repeating. 2. To a stalled table: **"Make the first garden with your string. Now make the second one. Look at your hands."** 3. To a table saying they are the same: **"Show me on your grid where the fence is. Now show me where the vegetables go."** 4. To a table counting squares: **"You are right. Is there a faster way to count them?"** 5. To a table that has multiplied: **"What does 36 mean? Thirty-six what?"** 6. To a table that asks if they are right: **"I am not going to tell you. What would convince the first family?"** 7. To a table that finished early: **"Now find me the biggest garden you can make with the same 24 feet."** 8. At 21:00: **"Four minutes. Your paper needs a drawing and a number, and somebody needs to be able to explain it."** 9. Log which table drew what. No teaching moves in this phase.	• Which tables count, add rows, or multiply — I need all three for the synthesis • **Any table that adds the four sides to check the fence.** That is perimeter arriving on its own and I want it in the room. • Children saying inside and around — the words before the vocabulary • Whether anyone tries a 1 by 11 garden • Which children are building well but not writing — noted for Phase 4

PHASE 3 — SYNTHESIZE (about 13 minutes)

Name it from their work. Short.

3a Communicating with Students

Time	Teacher steps & script	Check for understanding
25:00–38:00	1. Say: **"Different tables got different answers. We are going through them in order."** 2. Call the **they are the same** table first. Ask the room: **"Who disagrees, and can you prove it with your grid?"** Let a child do the correcting, not me. 3. Call the **counting** table. Say: **"Every single square, counted. That is completely correct and it is slow. Who found a faster way?"** 4. Call the **rows** table. Say: **"Six, and six, and six. That is where multiplying comes from."** 5. Call the **multiplying** table. Write 2 × 10 = 20 and 6 × 6 = 36. Then name it: **AREA**, and say **"square units — because we counted squares."** 6. Call the **adding the sides** table. Write 2+10+2+10 = 24. Name it: **PERIMETER**. Say: **"The fence goes around. The garden is inside. Same fence, different insides."** 7. Say: **"Both those words came off your papers. I only wrote them down."**	• Whiteboard hold-up: draw any rectangle and write its area. Scanning for square units written, not just a number • Cold call, no hands up, two children: **"Which one is the fence — area or perimeter?"** • Watching whether children learning English are pointing to their grids while they speak

PHASE 4 — APPLY (about 10 minutes) Level: DOK 3 · Strategic Thinking

A question they have not been asked.

3c Engaging Students in Learning

Time	Teacher steps & script	Differentiated accommodations
38:00–48:00	1. Distribute Appendix B. 2. Say: **"Still 24 feet of fence. Your job is to find the garden that grows the most — and prove nobody can beat you."** 3. Say: **"Use the string. Use the tiles. Draw it on the grid. Write the area with the units."** 4. Circulate; confer first with children who said the gardens were the same. Ask: **"Which number is the fence and which is the inside?"** 5. At 46:00: **"Two minutes. Everybody needs a drawing and a number."**	**Scaffolded Access** 1. Card with three gardens already drawn; the child finds the area of each and circles the biggest. 2. Tiles stay on the table — building the answer and counting it is a complete method. **Core Task** Child tries several rectangles, records each area, and states which is biggest. Accessible as written. **Extension** 1. Find the smallest area you can make with 24 feet, and explain why it is so thin. 2. Write what you notice about the shape that grows the most. Say it as a rule. *All three sit on every table. Children choose and may switch.*

PHASE 5 — ASSESS (about 7 minutes)

On their own.

1f Designing Student Assessments

Time	Assessment task	Success criteria
48:00–55:00	1. Say: **"Just you now. No table talk."** 2. Display: **"A garden is 4 feet by 7 feet. How much fence goes around it? How much space is inside? Label which is which."** 3. Circulate. Take dictation from children who draw — a drawn answer with a spoken explanation is complete. 4. Say as they pack: **"Tomorrow: what if the garden is not a rectangle?"**	**Full credit:** 22 feet of fence and 28 square feet inside, each labeled correctly, with square units written for the area. **Partial:** both numbers correct but the labels swapped, or square units missing. **Reteach:** one number given for both, or the two confused. These children come to the small table tomorrow with tiles.

Phase 6 — Post-Lesson Reflection

Completed by hand after teaching.

4a Reflecting on Teaching

What worked well?

What would I change?

Student evidence of mastery:

Adjustments for next lesson:

Appendix A — Garden Grid

Print one per child on grid paper.

Family 1 — 2 feet by 10 feet	Family 2 — 6 feet by 6 feet
Fence around it: _____ feet	**Fence around it: _____ feet**
Space inside: _____ square feet	**Space inside: _____ square feet**

Are they the same garden? How do you know?

Appendix B — Build Your Own

Print one per child on grid paper.

You still have exactly 24 feet of fence. Find the garden that grows the most.

Long	Wide	Fence used	Space inside

The biggest garden I found was _____ by _____ and it holds _____ square feet.

What do you notice about its shape?
