Grade 6 Math · Lesson 3 — Wrap It and Fill It

Surface area, nets and volume · ages 10 to 13 · 45 minutes · the workbook, one screen, this page, a pencil and paper

At a Glance

- **The book:** 6th Grade Math Workbook: Real-World Problem Solving, Chapter 3 (The Architect), by Dr. Gene A Constant.
- **Free tool:** Geometry Quest (perimeter, area and angles), free, no login, plays in the browser: globalsovereignuniversity.org/geometry-quest.
- **Ages and time:** Grade 6 · ages 10 to 13 · 45 minutes.
- **Prep (5 min):** read the Teaching Creed and have the workbook open to Chapter 3. Find a small cardboard box (a cereal or tissue box) and a ruler, plus scissors and tape.

Why this lesson

Surface area is what you buy to cover something: paint, siding, wrapping paper. Volume is what fits inside: concrete, water, soil. Children mix them up when they only see formulas. When they cut a real box open into a flat net, the six rectangles of surface area are right in front of them.

What the learner will be able to do

- Find the surface area of a rectangular prism.
- Draw and read the net of a box.
- Find volume when the edges are fractions.
- Decide whether a job needs surface area or volume.

The 45-Minute Climb

How to read this: the gold box in each step is your lesson, word for word. Run it as written. The notes beneath are optional support. "The group" means your family; "host" means you.

1 · The Hook (5 min)

"If I want to paint this box, what do I need to know? If I want to fill it with rice, what do I need to know? Are those the same number?"

Say it like this: Let your child guess. Most will say yes. Keep the box nearby; the scissors will settle it.

2 · Work It Together (15 min)

Cut the real box open along its edges and lay it flat: that is a net. Measure each rectangle and add the six areas. Then open the workbook to Painting a Storage Building and read it aloud: 600 + 400 + 300 = 1,300 square feet. Finish with A Planter Box: 4.5 × 2 × 1.5 = 13.5 cubic feet.

Check: does your box's net have three matching pairs? Then play one level of Geometry Quest for face areas.

3 · The Talk (8 min)

1. Why does a box have three pairs of matching faces? 2. Why is volume measured in cubic units and surface area in square units? 3. Paint or concrete: which one is surface area?

You are not fishing for one right answer. You are listening for understanding:

- Q1: Top and bottom match, front and back match, and the two ends match. That is why the formula doubles each area.
- Q2: Surface area covers flat faces with squares. Volume fills the space with cubes.
- Q3: Paint covers the outside, so it is surface area. Concrete fills a space, so it is volume.

4 · Solo Climb (12 min)

Five problems on your own, with your work shown.
1. Find the surface area of a cube with 5 cm sides.
2. A room is 12 ft × 10 ft × 8 ft. Find the area of the four walls only.
3. A net is made of 6 equal squares, each with an area of 16 sq in. What is the side length of the cube?
4. A concrete slab is 10 ft × 8 ft × ½ ft. How many cubic feet of concrete does it need?
5. A shipping crate is 5½ ft × 4 ft × 3½ ft. Find its volume.

Why solo: a test, a job and real life ask you to work alone. Five problems rehearse exactly that. The answers are at the end of this plan.

Keep It Fresh (5 min, the next day)

Two review problems from earlier chapters.
1. Find: (−8) − (−12)
2. A 6-ounce chicken breast has 42 grams of protein. How many grams of protein per ounce?

Ready to move on? Four of the five Solo Climb problems right, with work shown, means this skill is solid. If not, reread the worked examples together and try two more problems from the chapter before the next lesson. Short review of old skills keeps them from fading.

5 · The Takeaway (5 min)

“The outside is what you wrap. The inside is what you fill. Wrap with square units; fill with cubic units.” · Homework: Measure one real box or room at home. Find how much paper would wrap it and how much it would hold.

The badge moment: finishing all five steps earns the Bronze ring of this lesson’s badge, The Builder. Mark it on the Climber’s Passport now; the homework is how Silver and Gold are earned during the week.

Common Mistakes to Watch For

- Adding only three faces instead of all six.
- Using square units for volume or cubic units for area.

- Multiplying mixed numbers without changing them to decimals or improper fractions first.

The Teaching Creed

> **You are not the expert; the book and the method are. Your job is to ask "how do you know?" one more time than feels natural, and to celebrate wrong answers out loud. In here, a wrong answer is where the lesson lives.**

GENO, GSU's free tutor, can explain any step a second way, any hour, in 83 languages, with no login: globalsovereignuniversity.org/free-tutor. A prompt for the host: Ask GENO: "My child found the surface area of a 10 × 8 × 7 box as 560. Help them see what they found instead, without giving the answer."

Adapt It and Measure It

Differentiation

- Struggling: work only with whole-number boxes until the net makes sense.
- Ahead: design a box that holds 64 cubic inches with the least cardboard.
- Large co-op: each team measures a different box and the group ranks them by volume.
- Reluctant: wrap a real gift and predict the paper needed before cutting.

Evidence of learning (no exam)

Look for three things. **Tried**: finished all five Solo Climb problems with work shown. **Noticed**: can name the mistake in Common Mistakes that they almost made. **Changed**: the next day, solves one new problem from the same chapter without help. Those three words are the whole rubric, and they match the badge tiers below.

Gamify It — The Campus Climb

Every GSU lesson is one badge on the Climber's Passport, earned at four depths: Bronze, Silver, Gold and Platinum.

> **LESSON 3 BADGE — The Builder · Bronze — The Climb: finished the 45-minute lesson, all five steps. · Silver — The Try: did the homework and explained it to the host. · Gold — The Proof: completed the chapter's Action Report in the workbook with every answer checked against the Answer Key. · Platinum — The Teacher: ran this lesson as host for someone else. The harvest of a teacher is teachers.**

Answers for the Host

1. 150 sq cm
2. 352 sq ft
3. 4 in
4. 40 cubic feet
5. 77 cubic feet

Keep It Fresh: 1. 4 · 2. 7 grams per ounce

Every answer above comes from the workbook's own Answer Key. The book behind this lesson: 6th Grade Math Workbook: Real-World Problem Solving, Chapter 3 (The Architect).

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