Grade 8 Math · Lesson 4 — The Break-Even Report

Multi-Step Equations · ages 12 to 15 · 45 minutes · the workbook, one screen, this page, a pencil and paper

At a Glance

- **The book:** 8th Grade Math Workbook: Real-World Problem Solving, Chapter 4 (The Entrepreneur), by Dr. Gene A Constant.
- **Free tool:** Equation Explorer (solve for x, one step at a time), free, no login, plays in the browser: globalsovereignuniversity.org/equation-explorer.
- **Free class:** Lesson 4 of the free Grade 8 Mathematics class: globalsovereignuniversity.org/grade-8-math-class#lesson-4.
- **Ages and time:** Grade 8 · ages 12 to 15 · 45 minutes.
- **Prep (5 min):** read the Teaching Creed and have the workbook open to Chapter 4. Write two price offers on a card: a taxi at $5 plus $2 a mile and a ride app at $3 plus $2.50 a mile.

Why this lesson

Every business question about breaking even, comparing two offers or setting a fair price comes down to an equation with the variable on both sides. Solving them in order, and knowing when an equation has no answer, is the core habit of algebra.

What the learner will be able to do

- Solve equations with variables on both sides.
- Solve equations with parentheses and distribution.
- Identify equations with one, none, or infinite solutions.
- Write and solve equations from word problems.

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)

"A taxi charges $5 plus $2 a mile. A ride app charges $3 plus $2.50 a mile. Which is cheaper for a 3-mile ride? For a 6-mile ride?"

Say it like this: let your child do it with real objects if you can, then ask how they know their answer is right before you check it.

2 · Work It Together (15 min)

Open the workbook to the worked example Solve 5x + 3 = 2x + 15 (Section 4.1) together: Subtract 2x from both sides: 5x - 2x + 3 = 15 Simplify: 3x + 3 = 15 Subtract 3 from both sides: 3x = 12 Divide by 3: x = 4. Then read Solve 3(x + 4) = 2(x - 1) + 17 (Section 4.2) together: Distribute: 3x + 12 = 2x - 2 + 17 Simplify right side: 3x + 12 = 2x + 15 Subtract 2x: x + 12 = 15 Subtract 12: x = 3.

Read each step aloud and let your child say the next step before you read it. Then play one round of Equation Explorer.

3 · The Talk (8 min)

1. Why collect the variables on one side first? 2. What does it mean when the variables cancel and you get 6 = 8? 3. How do you check your answer?

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

- Q1: So there is only one unknown term left to undo, step by step.
- Q2: No value of x can make the equation true: it has no solution.
- Q3: Put it back into the original equation and see whether both sides match.

4 · Solo Climb (12 min)

Five problems on your own, with your work shown.
1. Solve: 9x - 5 = 4x + 15
2. Solve: 8x - 12 = 5x + 6
3. Solve: 2(3x + 5) = 4(x + 6)
4. A phone plan costs $40 + $5(g - 2) for g GB. Another costs $23 + $8(g - 1). When are they equal?
5. Solve: 5x + 10 = 5(x + 2). How many solutions?

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 the book’s Extra Practice.
1. Solve: 8x - 5 = 3x + 20
2. Cell plan A: $45 + $0.05/text. Plan B: $30 + $0.08/text. When equal?

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)

Get the variable on one side, undo the steps in reverse order, and check the answer in the original equation. · Homework: Compare two real prices with a fixed fee and a per-use cost, such as two phone plans or two gyms. Find where they cost the same.

The badge moment: finishing all five steps earns the Bronze ring of this lesson's badge, The Break-Even Finder. 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

- Forgetting to distribute to every term: 3(x + 4) is 3x + 12, not 3x + 4.
- Moving a term without changing its sign.
- Stopping at 0 = 5 or 4 = 4 without saying what it means: no solution, or infinitely many.

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: "Walk me through 2(x + 3) = 2x + 6 and tell me why it has infinitely many solutions."

Adapt It and Measure It

Differentiation

- Struggling: keep a balance-scale drawing beside each step.
- Ahead: write an equation with no solution and one with infinitely many, and explain each.
- Large co-op: each team prices two real offers and finds their break-even point.
- Reluctant: use a real price comparison the child cares about, such as two game subscriptions.

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 4 BADGE — The Break-Even Finder · 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. x = 4
2. x = 6
3. x = 7
4. At 5 GB (both cost $55)
5. 10 = 10 is true: infinite solutions

Keep It Fresh: 1. x = 5 · 2. At 500 texts

Every answer above comes from the workbook's own Answer Key. The book behind this lesson: 8th Grade Math Workbook: Real-World Problem Solving, Chapter 4 (The Entrepreneur).

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