Grade 8 Math · Lesson 8 — The Animation Frame Sheet

Transformations · 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 8 (The Animator), by Dr. Gene A Constant.
- **Free tool:** Geometry Quest (distance, area and angles), free, no login, plays in the browser: globalsovereignuniversity.org/geometry-quest.
- **Free class:** Lesson 8 of the free Grade 8 Mathematics class: globalsovereignuniversity.org/grade-8-math-class#lesson-8.
- **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 8. Draw a coordinate grid on graph paper from −8 to 8 on both axes and set out a coin as a marker.

Why this lesson

Animators, game designers and engineers move shapes with exact rules. Translations, reflections, rotations and dilations teach a child to see geometry as motion, and the coordinate rules make that motion precise.

What the learner will be able to do

- Perform translations, reflections, and rotations.
- Identify and describe transformations.
- Understand dilations and scale factors.
- Compose multiple transformations.

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)

"Put a coin on a grid at (2, 3). Slide it 4 right, flip it over the x-axis, then turn it a quarter turn about the origin. Where does it end up?"

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 Translate (3, 5) by (4, -2) (Section 8.1) together: Add horizontal shift: 3 + 4 = 7 Add vertical shift: 5 + (-2) = 3 New point: (7, 3). Then read Reflect (5, 2) over each axis (Section 8.2) together: Over the x-axis, keep x and change the sign of y: (5, -2) Over the y-axis, change the sign of x and keep y: (-5, 2) Each image is the same distance from the mirror line as the original.

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

3 · The Talk (8 min)

1. What changes and what stays the same in a reflection over the x-axis? 2. Which transformations keep a shape the same size? 3. If the area grows by 9, what was the scale factor?

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

- Q1: x stays the same and y changes sign.
- Q2: Translations, reflections and rotations. A dilation changes the size.
- Q3: 3, because area grows by the scale factor squared.

4 · Solo Climb (12 min)

Five problems on your own, with your work shown.
1. Translate (-1, 6) by (-3, -4). New coordinates?
2. Reflect (-3, 5) over the y-axis.
3. Rotate (3, 5) 90° counterclockwise about the origin.
4. Dilate (10, 15) by scale factor 0.5 centered at origin.
5. Point (3, 2) becomes (9, 6). What was the scale factor?

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. Rotate (5, -3) 90° counterclockwise about origin.
2. Reflect (4, 7) over y = x.

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)

Slides, flips and turns keep a shape the same size. A dilation multiplies every coordinate by k. · Homework: Draw a simple shape on graph paper and give someone three moves to make. Check that their final shape matches yours.

The badge moment: finishing all five steps earns the Bronze ring of this lesson's badge, The Frame 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

- Mixing up the axes when reflecting: over the x-axis, y changes sign.
- Rotating clockwise when the problem says counterclockwise.
- Thinking a dilation keeps the size the same. Only translations, reflections and rotations do.

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: "Quiz me on the rules for 90°, 180° and 270° rotations about the origin."

Adapt It and Measure It

Differentiation

- Struggling: move a coin on the grid for each step before writing coordinates.
- Ahead: design a three-move animation and give the rules to someone else.
- Large co-op: each team animates one shape and the group checks the frames.
- Reluctant: let the child plot and move a simple drawing of their own.

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 8 BADGE — The Frame 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. (-4, 2)
2. (3, 5)
3. (-5, 3)
4. (5, 7.5)
5. k = 3

Keep It Fresh: 1. (3, 5) · 2. (7, 4)

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 8 (The Animator).

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