Slide, Flip, Turn: Do Measurements Stay Same?

Teacher		**Class**	Grade 8
Subject	Math	**Topic**	Transformations
Date		**Room**	
Lesson length	60 minutes	**Country**	United States

Students verify that slides, flips, and turns keep size and shape. They move triangles and remeasure sides and angles to prove it.

Curriculum links

- Verify experimentally the properties of rotations, reflections, and translations
- analyze two- and three-dimensional space and figures using distance, angle, similarity, and congruence [2]

Learning objectives

- Students will verify experimentally that translations preserve side lengths and angle measures.
- Students will verify experimentally that reflections and rotations preserve side lengths and angle measures.

Success criteria

- I can move a triangle and show side lengths stayed the same.
- I can move a triangle and show angle measures stayed the same.

What students already know

Show a triangle on grid: What do side length and angle measure tell us about size and shape? Give 2 minutes for pairs to say what a ruler and protractor check.

Key words

pre-image	the original shape before a move
image	the new shape after a move
rigid	when size and shape stay the same [8]
congruent	having exactly the same size and shape [8]

Materials

- pre-cut card stock triangles with labeled vertices
- graph paper
- rulers
- protractors
- glue sticks
- classroom scissors
- slides 1-12
- video clip 2
- printed Worksheet Tasks B and C

Before the lesson

- Pre-cut identical card stock triangles with vertices labeled A, B, C and print graph paper with grid lines
- Print Worksheet Tasks B and C for pairs and test Video clip 2 (0:00-4:04) on Slide 8 with sound
- Set out rulers, protractors, glue sticks, and scissors at tables and clear space for measuring

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Lesson outline

0–7 min **Starter** 7 min · Whole class

Hook interest and recall what changes and what stays the same when a shape moves.

YOU DO

1. Show Slide 1 and say the hook: Same triangle, three different moves — will the measurements lie to us even once?
2. Show Slide 2 and read the big idea: Moving a shape does not change its size or shape.
3. Show Slide 5 and ask pairs to discuss: You slide your cell phone across a desk: what changes? What stays the same?
4. Take 3 answers and restate: position changes, size, side lengths and angle measures do not.

STUDENTS DO

1. Listen to the hook and look at Slide 1 title question.
2. Discuss the cell phone question with a partner for 1 minute.
3. Share ideas about what changes and what stays the same.

Say: Same triangle, three different moves — will the measurements lie to us even once? You slide your cell phone across a desk. Its place changes. Do its length, width, or corner angles change? Today we will prove it by measuring.

Ask: You slide your cell phone across a desk: what changes? (Its position and location change.) · What stays the same after the slide? (Length, width, angle measures, size and shape stay the same.)

Check understanding: Thumbs up if position can change while size stays the same; reteach with sliding a notebook if many are unsure.

Support: Point to the phone corners and edges while asking what stayed. **Stretch:** Ask what tool would prove length and angles did not change.

Use: Slides 1-2, 5

7–20 min **Teaching** 13 min · Whole class

Name the three rigid motions and model how to verify lengths and angles.

YOU DO

1. Show Slide 3 and name the three moves: Every point slides the same distance in the same direction, flips over a line like in a mirror, and turns around a point.
2. Show Slide 4 and define pre-image as the original shape before a move and image as the new shape after a move.
3. Play Video clip 2 on Slide 8 and ask students to spot the slide, the flip, and the turn and how each point moves.
4. Model a translation on the board and measure to show after a turn, flip or slide, the shape still has the same size, area, angles and line lengths [15].

STUDENTS DO

1. Repeat key words pre-image, image, rigid, congruent and copy the three moves.
2. Watch the video and call out slide, flip, or turn for each example.
3. Record the worked translation coordinates and measurements.

Say: Translation, reflection, and rotation are called rigid because size and shape stay the same [8]. The image is congruent to the pre-image [8]. We will check that by measuring matching sides in inches and matching angles with a protractor.

Worked example: Triangle ABC with A(1,1), B(4,1), C(1,3). Translate right 3: A'(4,1), B'(7,1), C'(4,3). Measure AB: from (1,1) to (4,1) = 3 units. Measure A'B': from (4,1) to (7,1) = 3 units. Measure angle A = 90 degrees, angle A' = 90 degrees. Lengths and angles match, so translation preserved them.

Ask: What do translation, reflection, and rotation all preserve? (They preserve distances between points, side lengths and angle measures [3].) · What changes in a translation, reflection, or rotation? (Only position and orientation in the plane change [3].)

Check understanding: Mini whiteboards: write pre-image or image for new shape after a move; reteach Slide 4 definitions if mixed.

Support: Keep a labeled triangle diagram up and point to matching sides while measuring. **Stretch:** Ask students to predict A'' coordinates after reflecting A' over the y-axis before modeling.

Use: Slides 3-4, Slide 8, Video clip 2 (0:00–4:04)

20–48 min **Main activity** 28 min · Pairs

Test all three moves by cutting, moving, and remeasuring to verify congruence.

YOU DO

1. Hand out three identical pre-cut triangles, graph paper with arrows for moves, glue sticks, rulers, and protractors.
2. Demo one translation, one flip over a line, and one turn around a point, gluing each result on graph paper.
3. Direct pairs to make a three-column chart labeled slide, flip, turn and write starting and ending coordinates under each point.
4. Circulate while pairs complete Worksheet Tasks B and C, prompting remeasure of all three sides in inches and all three angles.

STUDENTS DO

1. Do one translation, one reflection, and one rotation with the paper triangles and glue images on graph paper.
2. Measure corresponding sides in inches and angles and record equal signs between matches in the chart.
3. Complete Worksheet Tasks B and C to verify what stayed the same after each move.

Say: Take your three matching triangles. Slide one, flip one over the line, turn one around the point, and glue each image down. Measure each matching side and angle. If the numbers match, you have verified the move kept it congruent.

Worked example: Original: AB = 2.5 inches, BC = 2 inches, AC = 1.5 inches, angles 90 degrees, about 53 degrees, about 37 degrees. After slide right 4 and down 2: A'B' = 2.5 inches, B'C' = 2 inches, A'C' = 1.5 inches, angles 90 degrees, about 53 degrees, about 37 degrees. After flip and after turn, same matching numbers. All three images are congruent to the pre-image [8] because translation, reflection and rotations are called isometric transformations because the image is the same size and shape as the original object [20].

Ask: After your slide, what are your matching side lengths? (They are equal, for example 2.5 inches and 2.5 inches.) · After your flip and turn, what happened to angle measures and parallel sides? (Angle measures stayed the same and lines stayed straight and parallel.)

Check understanding: Collect chart check: hold up equal signs for all three columns; pull a small group to remeasure one side together if mismatched.

Support: Give pre-cut triangles with vertices labeled and grid paper with the moves written as arrows so counting squares is easy. **Stretch:** Have students do a translation followed by a reflection and check if the final image is still congruent to the start.

Use: Slide 9, Worksheet Tasks B-C

48–60 min **Plenary** 12 min · Whole class

Confirm that slides, flips, and turns keep lines straight, parallel, and congruent.

YOU DO

1. Show Slide 10 and demo sliding a notebook: ruled lines stay parallel after the slide.
2. Show Slide 11 mystery: This shape turned around a fixed point and all side lengths still match. Which move happened?
3. Show Slide 12 quiz and take votes on segment length and 40-degree angle after reflection.
4. Return to success criteria and have students state yes or no whether lengths and angles matched in all three moves.

STUDENTS DO

1. Watch the notebook slide and explain why lines stayed parallel.
2. Answer the mystery and quiz questions and justify with measurements.
3. Self-assess against success criteria with thumbs up or down.

Say: Slides, flips, and turns keep lines straight and parallel. A rotation around a fixed point turns position but size stays the same. If side lengths and angles match, the image is congruent to the pre-image.

Ask: You translate a segment 3 units right. What happens to its length? (It stays the same.) · You reflect a 40-degree angle over a line. What is its new measure? (40 degrees.) · This shape turned around a fixed point and all side lengths still match. Which move happened? (A rotation around a fixed point — position turned, size stayed the same.)

Check understanding: Exit tickets Q1-Q3; if many miss, remeasure one class example on the board before dismissal.

Support: Provide the sentence frame: The side went from __ inches to __ inches, so __. **Stretch:** Ask groups to debate whether a 180-degree rotation looks like a flip and how vertex order proves the difference.

Use: Slides 10-12

Common mistakes

Mistake	How to spot it	How to fix it
Thinking a flip or turn makes the shape bigger or smaller	Student says reflected triangle has longer sides	Remeasure matching sides side-by-side to show after a turn, flip or slide, the shape still has the same size, area, angles and line lengths [15].
Confusing changed orientation with changed size	Student says rotated triangle is not congruent because it points another way	Check side lengths and angles match and note rigid transformations preserve the distances between points and only position and orientation change [3].
Matching wrong vertices when measuring image	Lengths do not match because A is compared to B'	Label A'B'C' in order and track each point from pre-image to image before measuring.

Support

- Give pre-cut triangles with vertices labeled and grid paper with the moves written as arrows.

Stretch

- Have students do a translation followed by a reflection and check if the final image is still congruent to the start.

For the LSE or teaching assistant

Stay with target pairs in main activity: help line up ruler at zero, read protractor, and check A matches A' before recording.

Safety

- Use classroom scissors safely, cut away from fingers, and return scissors after cutting.

Check for understanding

Question	Answer
You translate a triangle 4 units right and 2 units down. What happens to its side lengths and angles?	They stay the same; image is congruent to pre-image.
You reflect a 40-degree angle over a line. What is the image angle measure?	40 degrees.
You rotate a segment 90 degrees about the origin. What happens to its length?	Length stays the same because rotation is rigid.

Homework

Draw a small triangle, translate it right 3, and list matching side lengths to show they are equal.

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