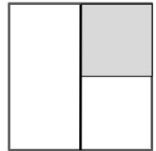


Facilitator Guide: Non-Congruent Shapes

Lesson Overview:

Big Idea: Non-congruent shapes or unequal parts of a whole can still represent fractions of that whole. Students develop strategies for finding the fractional value of an area cut into non-congruent shapes. Students construct viable arguments to justify how they know, for example, that the figure on the right is cut into $\frac{1}{2}$ and two $\frac{1}{4}$. Identify misconception that the square on the right is not cut into thirds because the pieces are not equal or equivalent in area.



Lesson Flow: Students begin solving puzzles by filling whole squares with non-congruent shapes and then solve and discuss a set of puzzles as a whole class identifying the fractional value of each part. Then students estimate in pairs the fractions represented on a problem sheet before discussing a problem as a whole class. Finally, students use fractions to identify and discuss shaded areas of whole squares partitioned into non-congruent shapes.

Warm Up: Non-Congruent Tiling Game

Part 1: Students play Non-Congruent Tiling Game on their own (8 min)

- Students fill whole squares using a set of non-congruent shapes
- *Monitor:* Encourage students to be creative and explore different combinations
 - Will any combination of these shapes work to fill the whole square? Justify

Part 2: Discuss 1 puzzle as a class (5 min)

- Ask students to think on their own and discuss with a partner different ways to fill the whole square with the given shapes before discussing specific solutions as a class
 - “Will any combination of these shapes work to fill the whole square?” Justify
 - “What fraction of the whole does this shape represent? Explain”
- Have students look for combinations that will work and that will not work and ask them to explain their thinking
- *Big Idea:* Patterns and relationships among the shapes and between the shapes and the whole build students’ conceptual understanding of unit fractions. If a small square is half of a rectangle and the rectangle is half of the whole square, then the rectangle and two small squares will fill the whole

Activity One: Estimate Shapes

Part 1: Students solve **Shape Estimate Problem Sheet** in pairs (8 min)

- Students estimate the area of a whole square filled by irregular curves.
 - There are no exact answers
 - The visuals are benchmarked to 0, $\frac{1}{2}$, or 1
 - Students should use fraction values that reflect that benchmark
- *Big Idea:* Estimation helps develop conceptual understanding of fractions
 - If an area is close to 0, $\frac{1}{8}$ or $\frac{1}{10}$ is a better estimate than $\frac{1}{3}$ or $\frac{1}{4}$

Part 2: Discuss a puzzle as a class (5 min)

- Have students think on their own and share with a partner before discussing as a class
 - If appropriate, invite students to the board to share how they estimated
- Recognize that the area shaded is near zero
- Reasonable estimates would be less than $\frac{1}{3}$ or $\frac{1}{4}$
- Trying to tile the circle with the shaded area will not be effective because of its irregular shape.

Questions

- What do you think would be an estimate that is too large/too small? Explain
- Can we accept more than 1 correct estimate? Why?
 - Yes, because we don't know the exact fraction and there can be two estimates that are very close like $\frac{1}{8}$ and $\frac{1}{9}$

Activity Two: Non-Congruent Shapes Problem Sheet

Part 1: Students solve **Shape Fill Problem Sheet** in pairs (8 min)

- Students find the fraction of a whole square shaded in
 - These problems can be solved using part-whole reasoning

Part 2: Discuss a problem as a class (5 min)

- Have students think on their own and share with a partner before discussing as a class
- *Strategies*
 - Partition the whole so that all pieces are congruent (same size and shape)
 - Reason about relationships between the pieces

Questions

- How can you figure out the fraction of the whole area that is shaded?
- Can we find the unit fraction just by counting the number of parts? Explain
 - No, because the parts are not equal
 - We have to create equal parts to know the unit fraction each different part represents