

To Half or Half Not

Math Grows Up (Number Sense/Computation)

Objective

The students will use a geoboard to demonstrate different ways to divide a rectangle in half and then identify equivalent fractions that represent one-half.

Overview of the Lesson

Using slices of bread and geoboards as manipulatives, students explore several ways to divide a rectangle in half. Students engage in an activity where they try to outsmart an alien from the planet of Fractional who is coming to their class to take one-half of their candy. The poor alien does not really understand the concept of one-half and thinks that it means taking one piece of something no matter how many equal pieces the whole is divided. The teacher encourages the intelligent Earthlings to outsmart the devious alien by making equivalent fractions for one-half on their geoboards. When the alien arrives, he looks at the fractional pieces and is confused. He sees the geoboard divided into six pieces and takes only one, thinking that he has one-half. The Earthlings laugh because he only has one-sixth and not one-half and they have thus outsmarted the alien. Students then work at stations to gain more experiences with fractions. They play a game with a spinner and paper plate pieces to try to be the first person to make one complete plate or pizza. Students also pretend they work in a ribbon factory as they respond to customer complaints about receiving the wrong amounts of ribbon. They utilize their knowledge of fractions to correctly measure the ribbon and thus satisfy the customers.

Materials

Teacher:

- Loaf of bread
- Knife
- 12-15 sheets of geodot paper (laminated if possible)
- Marker

Each Student Pair:

- Geoboard
- Rubber bands
- Activity Sheets: “Geodots I” and “Geodots II”

Centers:

- Ribbon (several yards depending on tasks)
- Envelopes with task cards
- Spinner marked with 5 equal areas: $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{6}$, and $\frac{1}{8}$
- 4 whole paper plates
- Paper plate pieces (Use Activity Sheets: “Pizza Pieces” as a template to make four $\frac{1}{2}$ pieces, fifteen $\frac{1}{4}$ pieces, sixteen $\frac{1}{3}$ pieces, thirty $\frac{1}{8}$ pieces, and twenty $\frac{1}{6}$ pieces).
- Activity Sheet: “Ribbon Factory”

Procedure

Tell the class that you are trying to find ways to cut a peanut butter sandwich in half. Show the class a loaf of sandwich bread and a knife. Cut a piece of bread from side to side into two equal pieces. Display the two halves. If possible they could be tacked to a bulletin board or bulletin board strip. Then show the class a way to cut it in half diagonally. Display these two halves. Have the class discuss how they can prove that the bread was cut in half. (When cut in half, each piece should be the exact same size and shape). Challenge the students to explore other ways to cut the bread in half and display those ways.

Divide the class into pairs and give each pair of students a geoboard and rubber bands. Have the students outline a 3 by 2 rectangle on the geoboard. Students should find different ways to divide the rectangle into halves. On the chalkboard display sheets of laminated geodot paper. Ask students to record the different ways

they divided the rectangle in half on Activity Sheet: “Geodots I” or “Geodots II”. Caution students to avoid recording a way that has already been shown. After allowing sufficient time for exploration, have students evaluate the different ways that they divided the rectangle in half. Ask students to explain how they can determine if the shapes are truly halves. Activity Sheet: “Geodots Solutions” shows the various ways one-half could be made.

Tell the students that you were working on the computer last night when your computer suddenly began to get a message from the alien planet of Fractional. The message stated that at one-half hour before two o'clock an alien representative, also known as the one-half alien, will visit the classroom to take one-half of what they have. Next, inform the students that you had planned to give them a candy bar at the end of the day and that you fear that they will have to share one-half of it with the alien. This alien does not truly understand fractions and will only take one piece of something because it thinks that the only way to make a half is to take one of the pieces. Tell the students that they can fool the alien by finding other ways to make one-half besides showing 1 out of 2 pieces. Instruct the students to make a 3 by 2 rectangle on their geoboards and find ways to make it show one-half other than dividing it into two equal pieces. If students form equivalent fractions for $\frac{1}{2}$ ($\frac{2}{4}$; $\frac{3}{6}$; $\frac{4}{8}$...), the alien will be fooled. Encourage students to share their discoveries by recording them on geodot paper displayed on the front chalkboard. Students may divide the geoboard into sixths, eighths, twelfths, etc.

If possible, secure the help of another teacher, aid, or parent to role play the arrival of the alien. The alien will look at the geodot paper and color one piece. Encourage students to explain to the alien why he is not getting one-half of the candy bar. Note, in the video the alien took more than one piece. In reality the alien should have taken only one piece.

This lesson could be extended by having students work at centers to gain more experience in working with fractions.

CENTERS

Pizza Pieces

Use Activity Sheets: “Pizza Pieces” as a template for cutting up the paper plates. This game is designed for approximately four students. Each student begins the game by taking a whole paper plate which represents one whole pizza. Players take turns spinning a spinner with five sections on it, $\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{6}$, and $\frac{1}{8}$. In the center of the table, place the pieces of paper plates representing the fractions on the spinner. If a player spins a $\frac{1}{3}$, he or she will take a $\frac{1}{3}$ piece from the center pile. Students can choose whether they want the piece or not. Play continues until one whole pizza has been made. To win the game the pizza must be exactly equal to one whole pizza.

Ribbon Factory

Students pretend that they work in a ribbon factory answering customer complaints. Give the students envelopes containing letters from customers who did not get the correct amount of ribbon. Students will use a variety of problem solving strategies to measure the correct amounts of ribbon. They will also write letters to the customers explaining how they correctly measured the amounts of ribbon that they needed.

Extensions & Connections

Choose a mystery "alien" fraction. Give clues one at a time until students have guessed the identity of the mystery alien. For example, one clue could be, "I am greater than $\frac{1}{8}$." The next clue could be that the alien fraction is smaller than $\frac{1}{2}$. The third clue could be that the total number of pieces is eight. Students should conclude that the alien fraction is $\frac{3}{8}$.

Have students locate books about quilts and read them. Give the students a template for a quilt with rows of squares. Students color the quilt in a pattern of their choosing and give the fractional part of the quilt that each color represents.

Have students design a garden for the school. Divide the garden into equal parts using string and sticks. Students can make a map of the garden on paper. Have students research the type of plants that would grow best in their garden and draw these plants on the map. Students should then tell the fractional part of the garden that each type of plant will cover.

Resources

HyperStudio
Roger Wagner Publishing, El Cajon, California
Telephone: 619-442-0522

The Super Source™ • Geoboards • Grades 3-4
Cuisenaire Company of America, Inc. Copyright 1996
White Plains, New York

The Ribbon Factory
MCC • Mathematics Content Connections
Montgomery County Public Schools
Rockville, Maryland

Ideas for Online Discussion

(Some ideas may apply to more than one standard of the NCTM Professional Standards for Teaching Mathematics.)

Standard 3: Students' Role in Discourse

- By putting the examples on the geodot paper and displaying them, students had to evaluate and discuss other students' work. What effective techniques have you employed to aid students in assessing each other's progress?

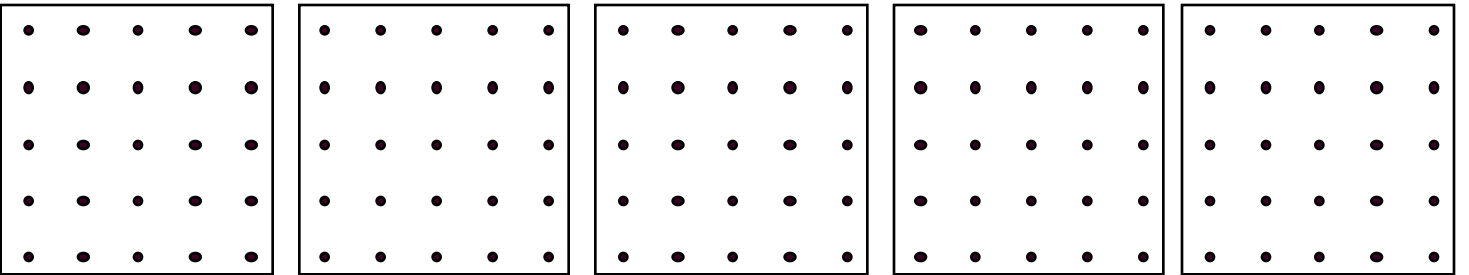
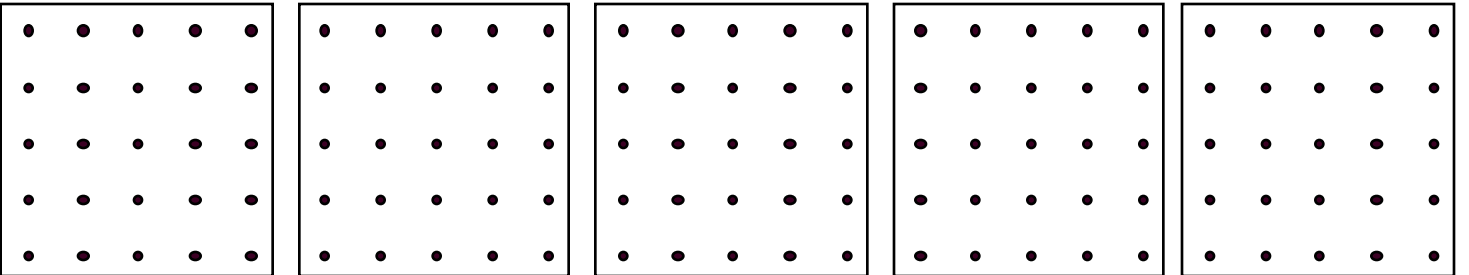
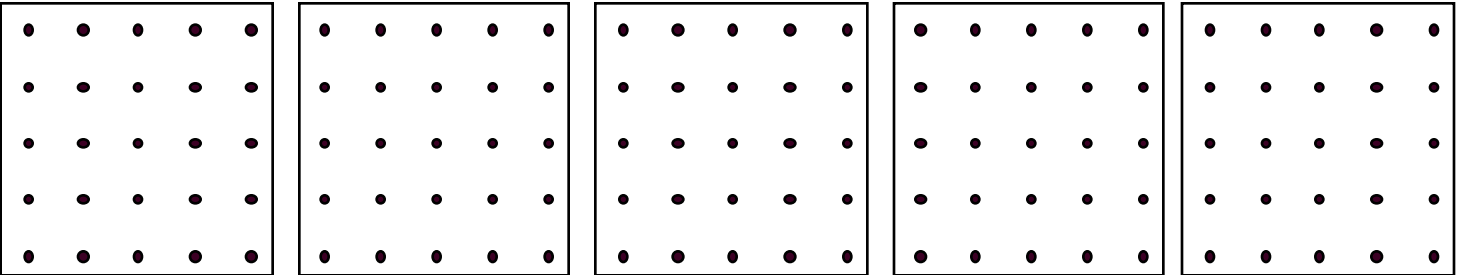
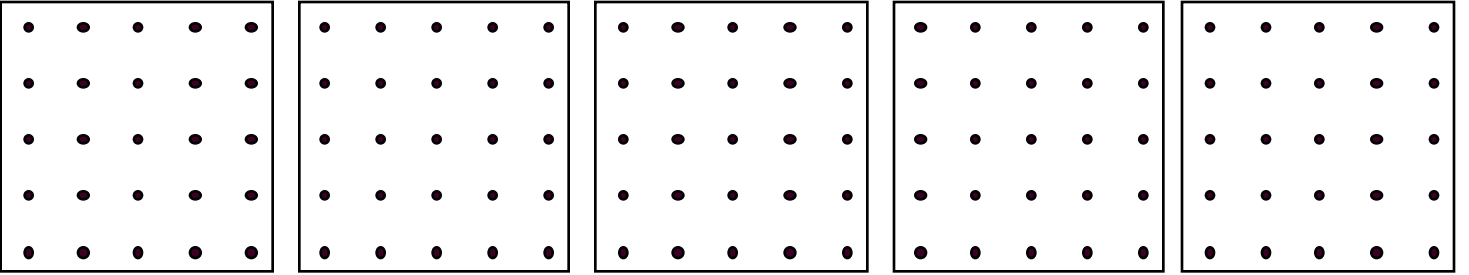
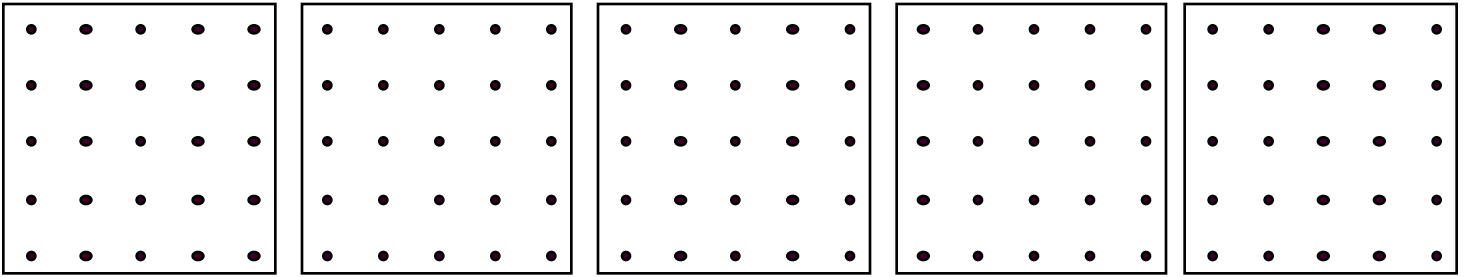
Standard 5: Learning Environment

- What role does motivation play in the learning process? How have you provided a motivating environment for your students?

Standard 6: Analysis of Teaching and Learning

- The video teacher described the large difference in ability of his students. How do you manage your time effectively to meet the individual needs of your students?
- The video teacher discusses the amount of time it takes to plan effective lessons. Do you have any suggestions that help you to use your planning time more efficiently?

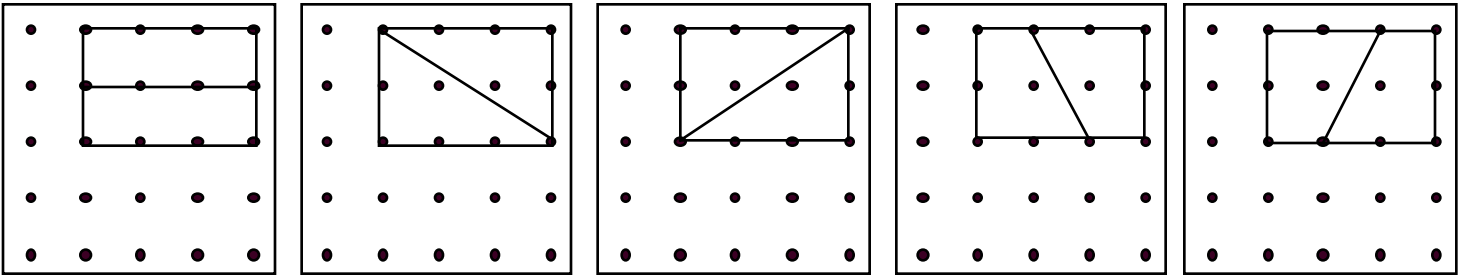
GEODOTS II



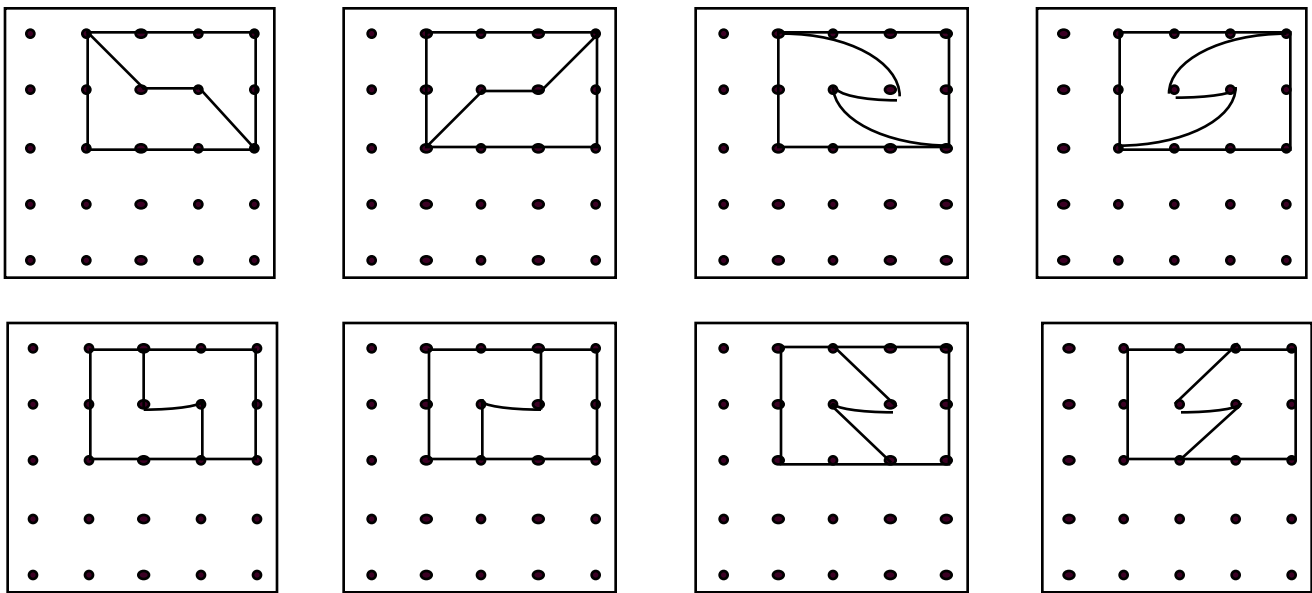
GEODOTS

Solutions

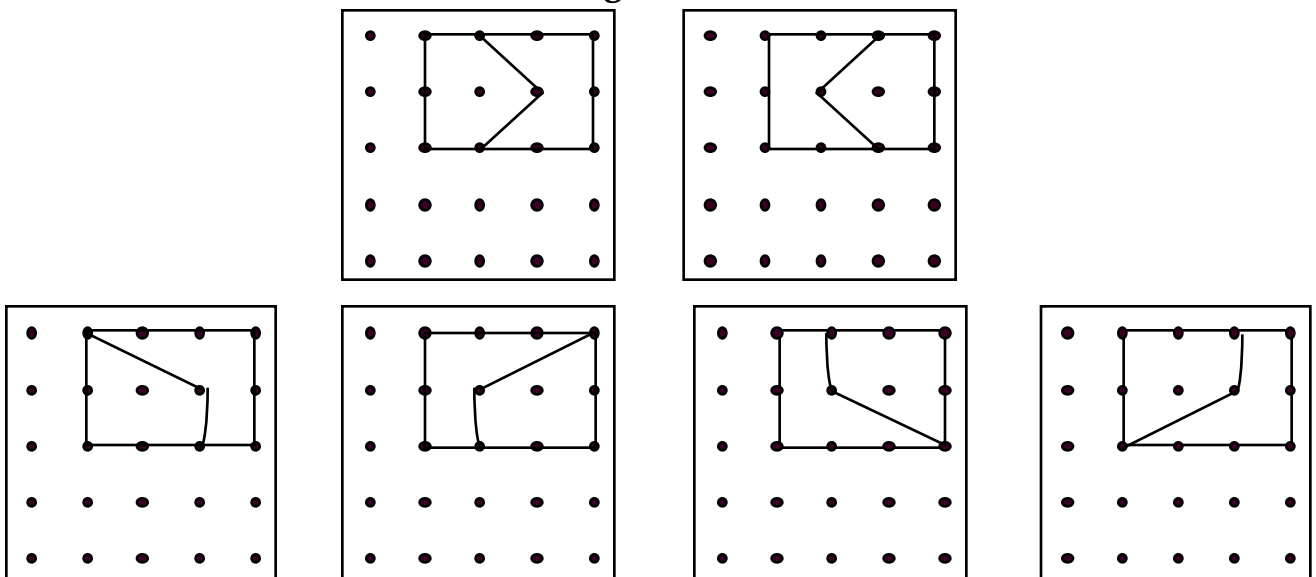
Congruent halves made with a straight cut



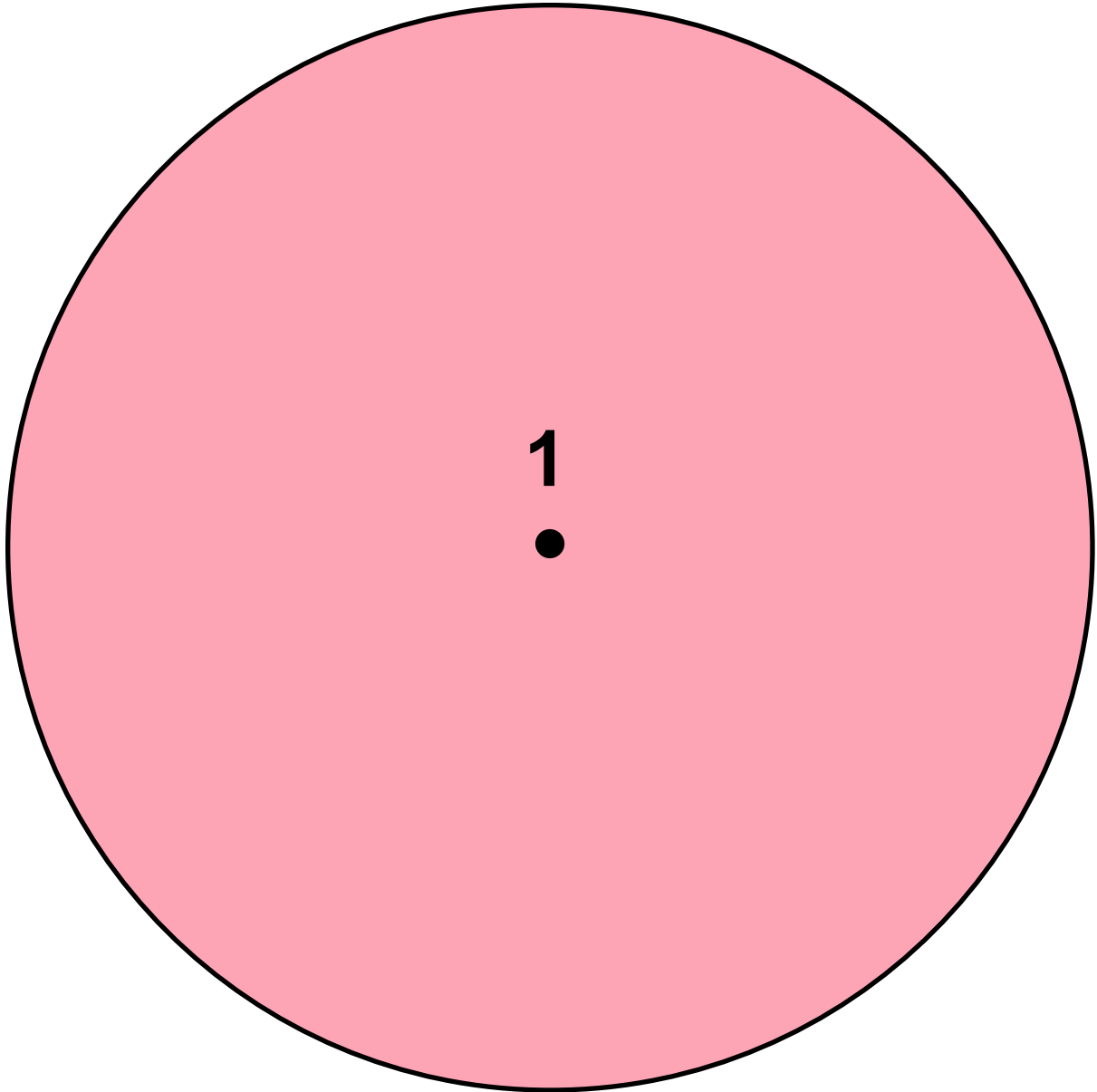
Congruent halves made with a zigzag cut



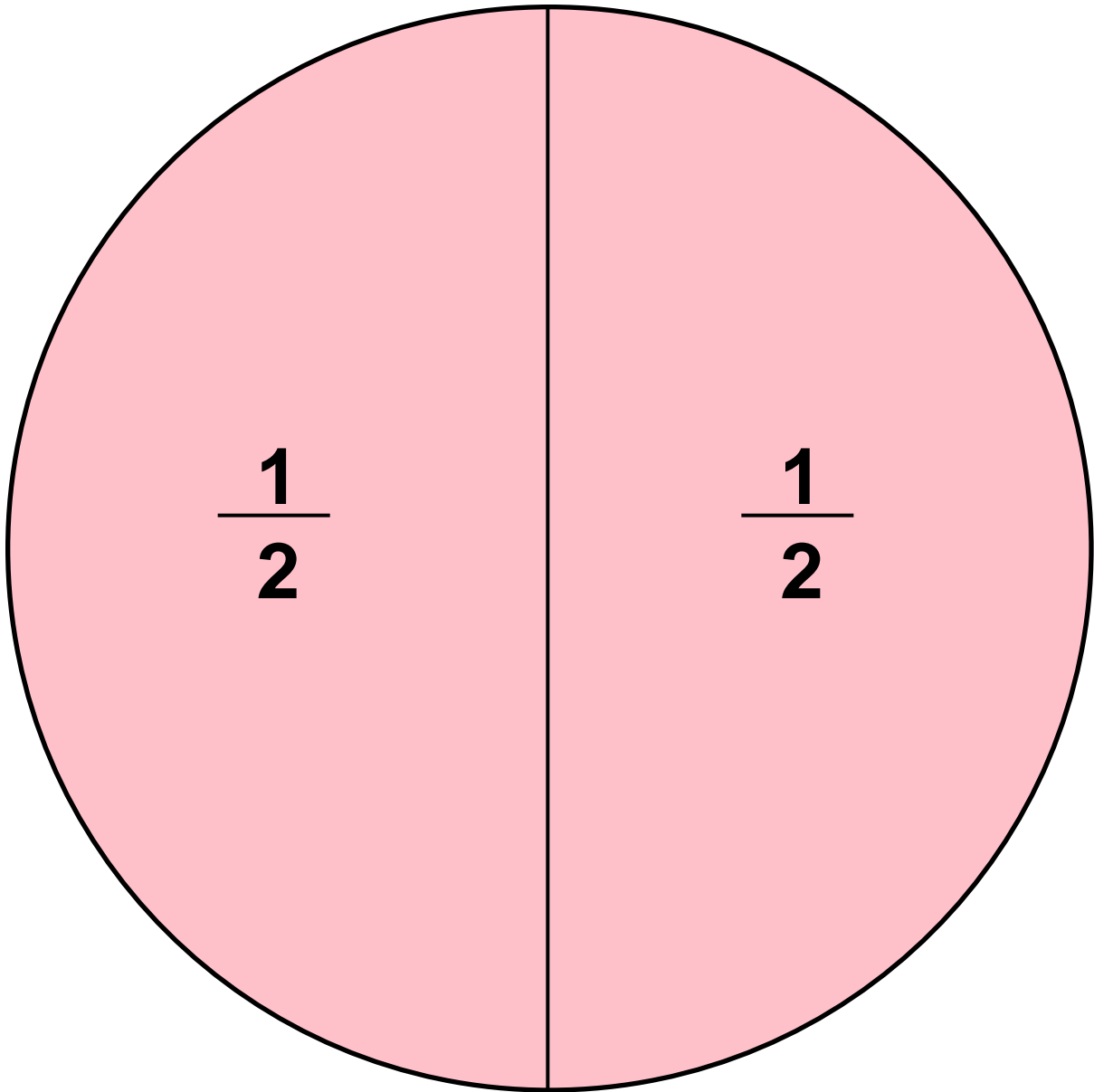
Non-congruent halves



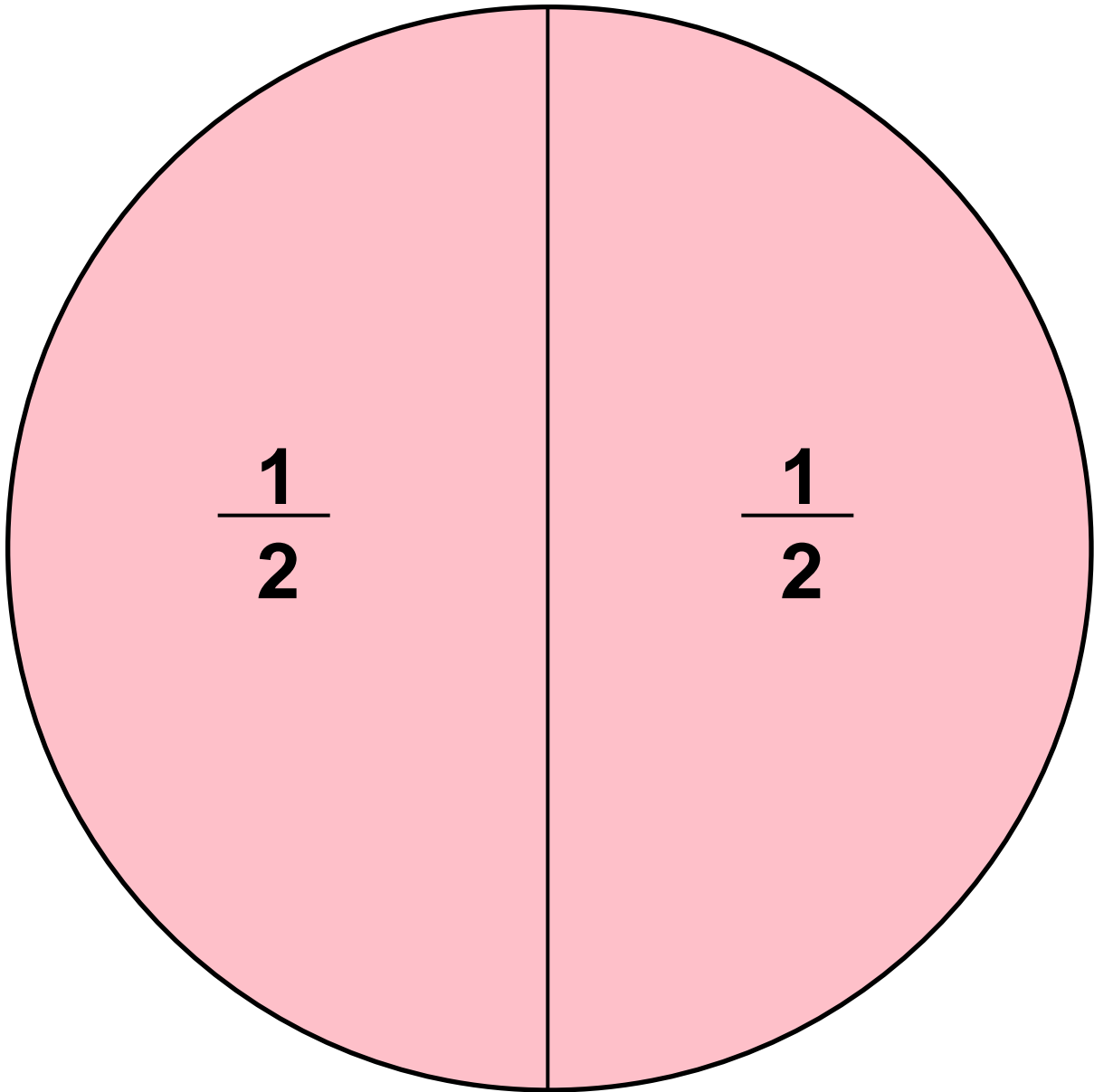
PIZZA PIECES



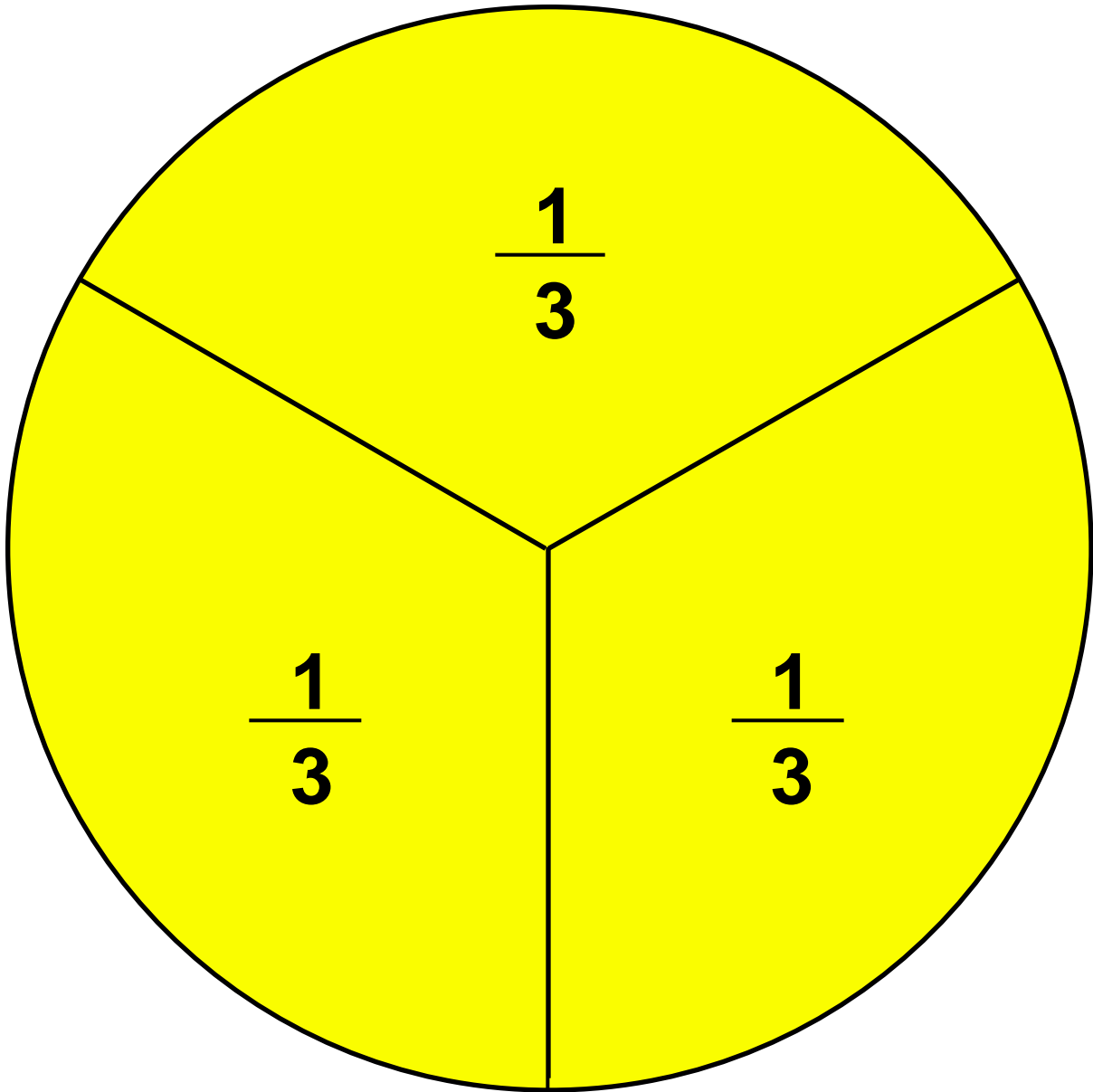
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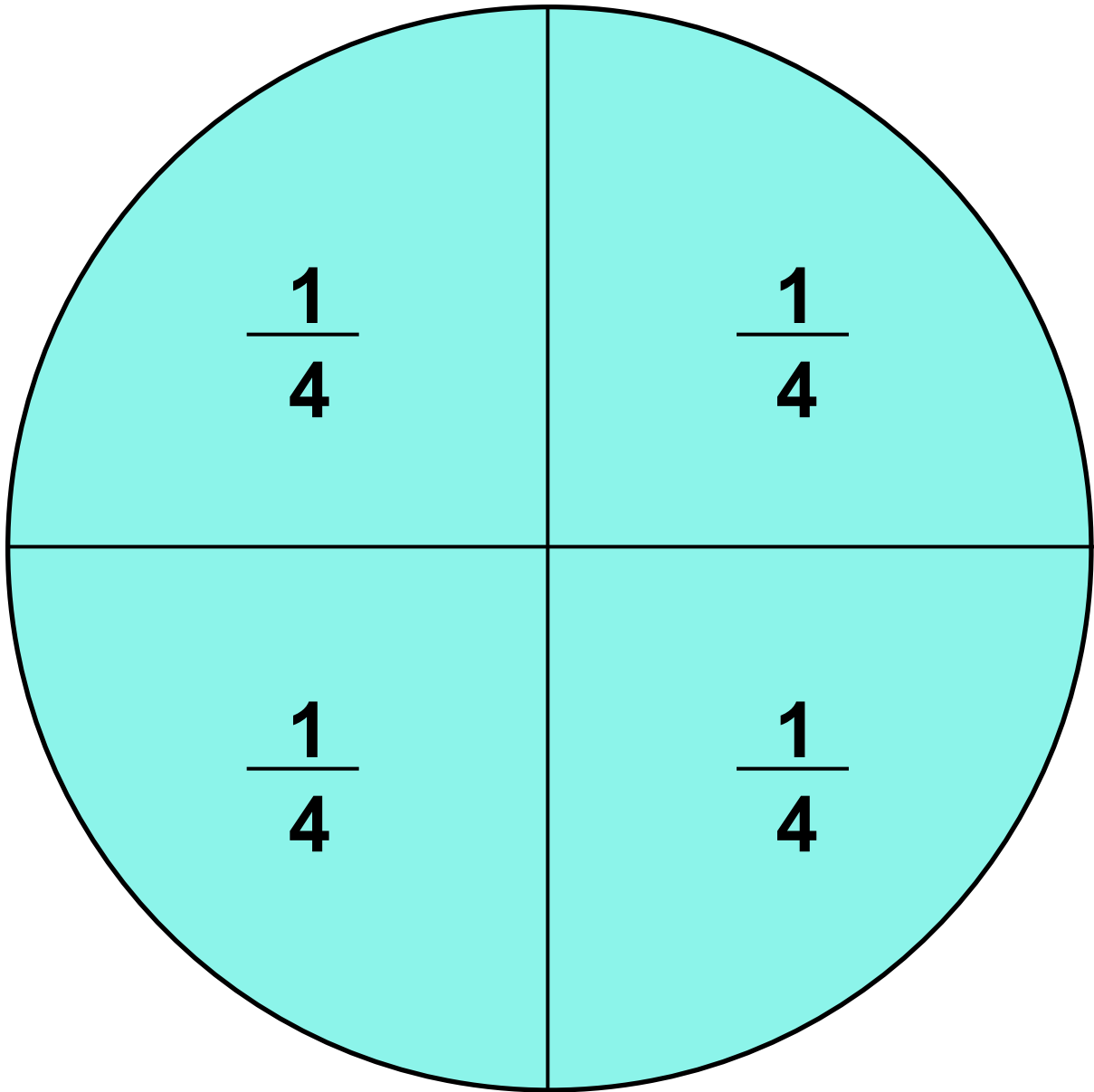
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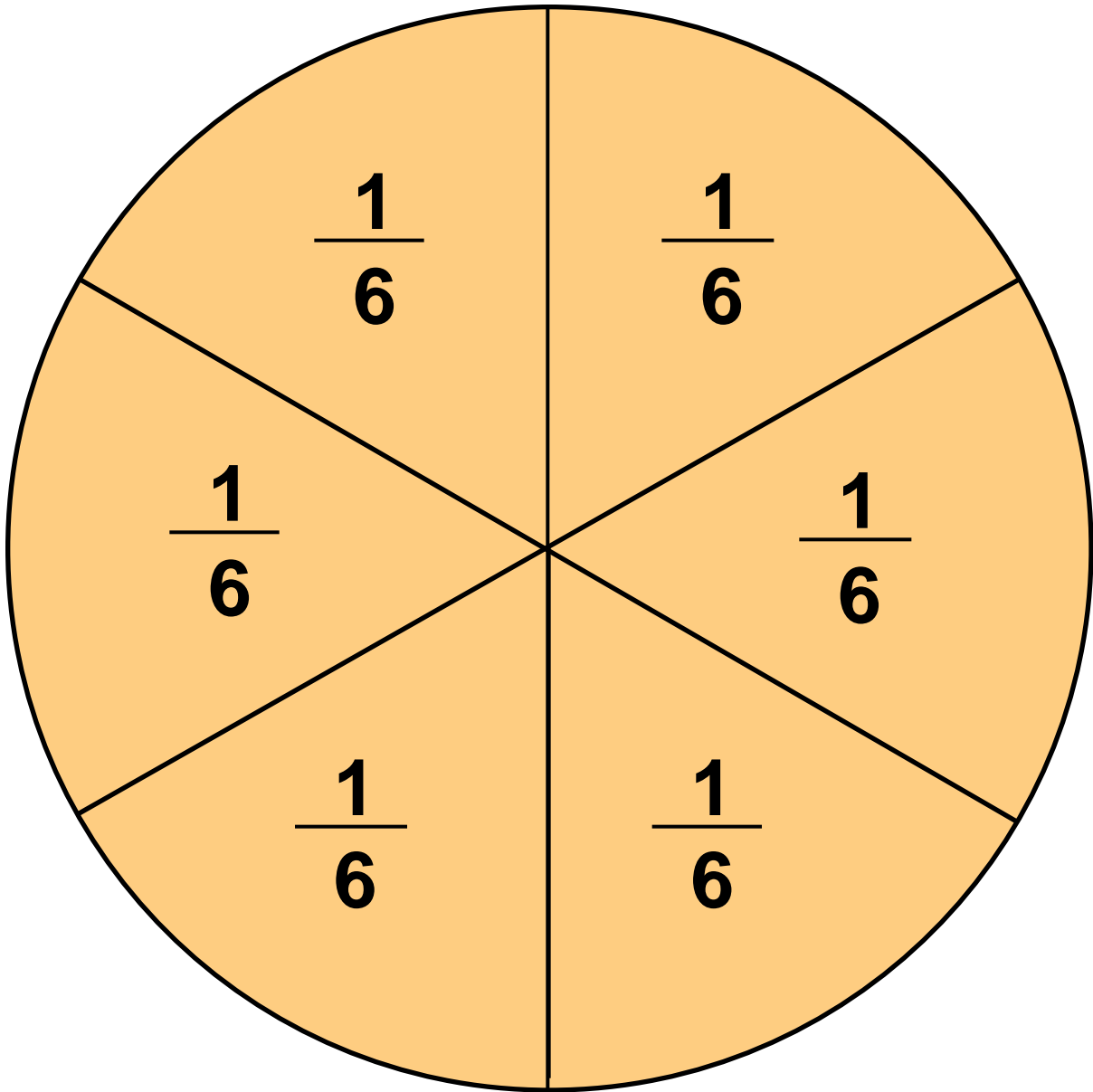
PIZZA PIECES



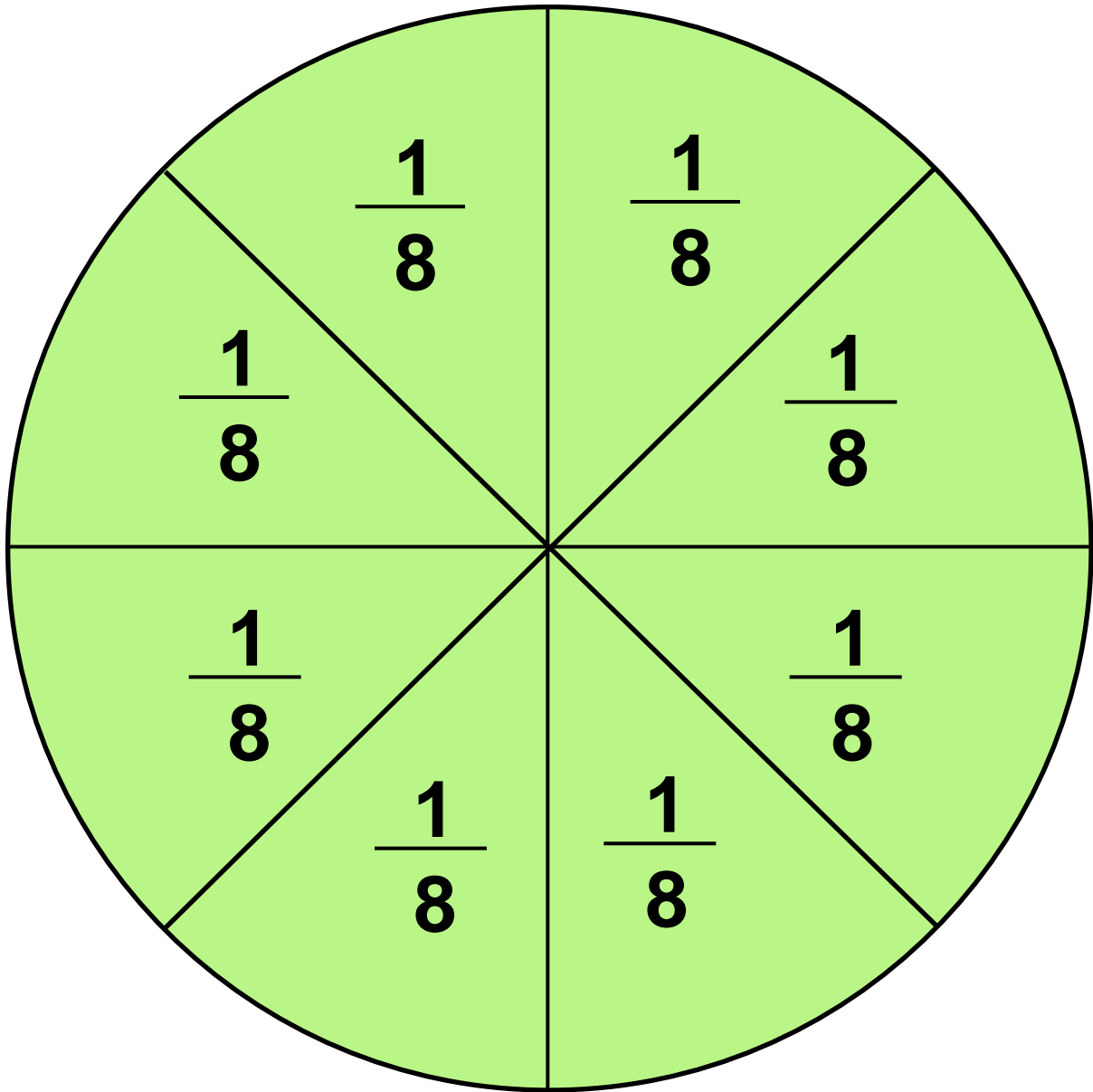
PIZZA PIECES



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PIZZA PIECES



RIBBON FACTORY

Customer Complaint #1:

Ribbon A _____

“This ribbon is not what I ordered. It is one half as ($1/2$) long as it should be. Please send the correct length as soon as possible.”



Customer Complaint #2:

Ribbon B _____

“You messed up my order again! The ribbon I ordered is twice as long as this ribbon. Please send me the correct ribbon.”



Customer Complaint #3:

Ribbon C _____

“I have just about had it with you making mistakes. Please replace this ribbon with one that is three fourths ($3/4$) as long as this!”



RIBBON FACTORY

Customer Complaint #4:

Ribbon D _____

“This is absolutely ridiculous! This ribbon is way too short! It should be six and one half ($6 \frac{1}{2}$) times as long as this tiny little thing!”



Customer Complaint #5:

Ribbon E _____

“What is this, some kind of joke? This ribbon is way to big. The one I wanted was one eighth ($\frac{1}{8}$) the size of this. Send my new ribbon NOW!!!



GEODOTS I