



NCEA Math Lesson Plan

Grade: 3

Subject: Mathematics

Domain: Geometry
Standard Number(s) and Description: 3.G.2 Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole.
Vocabulary to be Highlighted: Half, quarter, fourth, third, sixth, eighth, equal, partition, congruent, fraction, numerator, denominator
Mathematical Practices (#): <ol style="list-style-type: none">1. Make sense of problems and persevere in solving them.2. Reason abstractly and quantitatively.3. Construct viable arguments and critique the reasoning of others.4. Model with mathematics.6. Attend to precision. Essential Questions: The first way I tried didn't work. What can I try next? How does the name of the fraction relate to the pieces I have created? How can I prove that the pieces I have created are equal and fair? What drawing can I use to represent the real situations? Have I created my parts in an exact way? Does my origami fit together?
Materials/Tools (include technology): Whiteboard Objects to help with visualization of partitions (circle, cloth, book, cross, stained glass window photos) Snap cubes Worksheets (see Resources) Tracing paper Rulers Origami paper
Connections to Other Math Domains: Fractions—define denominator in terms of parts needed to make a whole, relate the partition of a bar shaped object to the number line representation
Connections to Other Subject Areas: Art Religion Physical education

Health
Science (depending upon examples generated)

Catholic Identity Component:

Fairness
Individuality and creativity (respect for others' ideas and confidence in one's own)
Relation to religious objects commonly seen in the Mass
Appreciation of beauty in the creation of origami in various colors, and the inherent order of how things fit together

Resources (attachments):

Worksheet for identifying equal and unequal partitions
Worksheet with blank figures for students to partition in particular ways. Both available at:
<http://www.commoncoresheets.com/SortedByGrade.php?Sorted=3g2>

Crazy cakes worksheet (available at <http://midcentral-coop.org/uploads/Crazy%20Cakes%20for%202%20Activity.pdf> or other places)

Origami directions: <http://www.instructables.com/id/Origami-octahedron/>

Activities/Timeline:

1. On whiteboard, present 4-5 examples of partitions of rectangles, circles, and other shapes, some of which are equal partitions and some of which are not. Lead a discussion with the students about which are fair and which are unfair. If some students are unclear about the concept, it may help to ask when looking at a shape, "If this were made of chocolate (or whatever else they like), which piece would you like to receive?" If the student is able to make a choice because one piece appears larger, point out that there is not an equal partition. If the student is unable to decide because all pieces are the same, the partition is fair/equal. When a partition is fair, talk about how many pieces are made and how to name the fractional part, relating the denominator of the fraction to the number of equal parts needed to make the whole.
2. Do at least one example where a partition is fair, but with non-congruent pieces. Have the students describe how they know the partition is fair? (Can they imagine sliding, rotating, flipping pieces or parts of pieces to match?)
3. Distribute the worksheet with similar problems, and have students work in pairs to decide which are equal or unequal partitions. Add the direction to name the parts that the figure is partitioned into, if that is not already on the worksheet. Discuss any problems that give students difficulty as a whole class.

Lesson 2

1. Present students with real world examples of things that are equally partitioned. There are excellent examples from the Mass. The host that Father uses generally is scored in fourths, if not eighths. The purificators are usually folded (our church folds them in sixths). An open Bible is a nice example of a half. Stained glass windows have varied partitions to discuss. Talk about each, talk about the fairness of the partitions, and name the fractions involved as a review and warm up for the next activity.
2. Now that students have seen fair and unfair partitions, they get the chance to partition their own figures. Distribute the worksheet for this activity. Ask students how to name the pieces they create. Invite the students to create multiple answers, if possible, by copying the shape and doing a second or third version of the requested partition. Students can work alone or in groups.

3. While students work, make notes about all the different partitions. Make note of which shapes have many answers, and which have few. Choose an example of each to discuss with the class. Highlight unusual but correct partitions, and during discussion have the class prove the partition is equal. Look for examples where rectangular shapes are partitioned vertically, and make the connection to the number line, if desired. Bring all this into a class discussion format, calling on particular students to present their partitions for discussion. Try to let the students do the speaking, and allow the presenter to call on students to question and verify their partition.

Lesson 3

1. Use the directions for the origami octahedron to lead the children through folding and building the figure. Each unit piece will be folded into halves, fourths, and then eighths. A great discussion is to stop after they've done the fourths but only one fold on the diagonal (on the way to eighths), and talk about the unfairness of the parts created, and also to see if they can see the relationship between the larger and smaller pieces (not critical, but interesting).

Formative Assessment (what to look for, how/when to look):

Watch for students to recognize that same-size, same-shape pieces are equal. Many students will not want to name irregular partitions as fair. Watch for this.

Observe how students prove that shapes are equal. Are they using careful measuring, or merely estimating? Are they careful not to stretch/shrink their fingers as they measure from one length to another? Could they be scaffolded with some tracing paper?

Are students making the connection between the denominator and the number of pieces of that size that it takes to make a whole? Do you have students who are ready to count up to the whole ($1/4$, $2/4$, $3/4$, $4/4$)?

While students are partitioning their own figures, walk around and note the various methods by which they do this. Make sure students are making fair partitions. Note which students are creating multiple answers for the same shape/partition, and which students are doing unusual but correct partitions.

Are students able to cut the Crazy Cakes? Are they stuck on symmetry? Can these students understand the answers of those who cut usual shapes?

Are students folding the origami steps very carefully? Can they name the shapes/fractions they are making?

Summative Assessment:

Ask students to partition a regular shape fairly and name the parts. Ask them to do it multiple ways.

Ask students to partition an irregular shape fairly.