

IMPROVING TEACHER QUALITY PROGRAM
Mathematics Within: Algebraic Processes and Its Connections to Geometry

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Broad Topic: Division **Subtopic:** Division by fractions (Part Two)

Grade level: 4-6 **Time:** 30 minutes

Aim: To gain new understanding of dividing by fractions by comparing them to division by natural numbers.

Note: There are a number of ways that one can illustrate division by fractions—area models are very useful for example; a rectangle of area 6 with a height of $\frac{1}{2}$ will need a length of 12.

However, in this lesson, I'm using the array because there is the perception out there that arrays are simple, concrete and easy to understand. But when used to illustrate division by fractions, arrays can become very confusing and inadequate. My hope is that the difficulties the children face dealing with arrays will challenge their preconceived notions about division and in the end lead to a deeper, broader understanding of division.

Specific Objective(s)

- Investigate division by fractions through the use of array models.
- Use area models to compare division as sharing with division as grouping.
- Evaluate the usefulness and limitations of the two array models.

Materials/Supplies

- Index cards
- Array model charts (see pp. 3-4)

References: (text/handouts, etc.)

- Sample area model charts (teacher reference, pp. 3-4)
- Manipulatives

Lesson Two:

- **Introduction**
 - On the blackboard write and the following:
 "Ours is not to wonder why, just invert and multiply."
 - Ask the students: Have you ever heard this little bit of advice? What does it refer to?
 - Teachers and parents are all about helping children learn and understand. Why would anyone want to say something like this?

- Suggest to the class that simply with skills they already have, they can find out how dividing by fractions actually works.
- **Body**
 - Pass out the array model charts (pp. 3-4) for Part Two.
 - Review yesterday's lesson: Ask two students to come up and draw one model for $6 \div 2 = 3$ as an example of sharing and another as a model of grouping. Discuss differences similarities, etc.
 - Together as a class, have students look at the trends from the previous lesson (chart on the wall and/or students' work in notebooks – see Part One of this lesson). Based on the patterns they see as the divisor gets smaller, challenge students to draw a model for $6 \div \frac{1}{2} = 12$, and write a story to go with it.
 - Note: It is likely that something like “half a dog” will show up in the stories. This should be explored in class. What kind of things can exist as halves— why or why not?
 - Which model works well with dividing by fractions? What problems arise when you use the sharing model? Why? How can this be resolved?
 - Have students complete the array model charts in small groups. Do the patterns continue as smaller and smaller fractions are used? Are the patterns in fraction models consistent with the natural numbers?
- **Close**
Discuss in class:
 - As the divisor gets smaller, what happens to the quotient? Can the quotient ever be bigger than the dividend?
 - Which area model works best for dividing by fractions? Why?
 - Has your thinking about division changed any after these activities? Explain.
- **Application/assessment**
 - In the area charts, have students individually write an original fraction problem with the model and story.
 - Challenge students to come up with an alternative to “Ours is not to wonder why...” that helps explain division by fractions.
 - *When dividing by fractions, here's a tip--try using array models and avoid the flip!*

Page 4—Array Model Chart

Number Sentence	Sharing	Grouping	Notes
$6 \div 2 = 3$	Model: Example:	Model: Example:	
$6 \div 1 = 6$	Model: Example:	Model: Example:	
$6 \div 1/2 = 12$	Model: Example:	Model: Example:	
	Model: Example:	Model: Example:	