Juicing Fractions

Students are asked to write and evaluate a numerical expression involving division of fractions and mixed numbers to model and solve a word problem.

General Information

Subject(s): Mathematics
Grade Level(s): 6
Intended Audience: Educators

Freely Available: Yes

Keywords: MFAS, fraction, division, divisor, dividend, quotient

Instructional Component Type(s): Formative Assessment

Resource Collection: MFAS Formative Assessments

Attachment

MFAS_JuicingFractions_Worksheet.docx

Formative Assessment Task

Instructions for Implementing the Task
This task can be implemented individually, with small groups, or with the whole class.

1. The teacher asks the student to complete the problem on the *Juicing Fractions* worksheet.
2. The teacher asks follow-up questions, as needed.

TASK RUBRIC

Getting Started

Misconception/Error

The student is unable to correctly model the problem with a division expression.

Examples of Student Work at this Level

The student does not use a division expression to model the problem. The student:

- Models the problem using multiplication and then attempts to multiply the mixed numbers given in the problem.

- Attempts to use repeated subtraction or repeated addition to solve the problem but is unsuccessful.

- Attempts to solve the problem using a trial and error strategy based on multiplication.

Questions Eliciting Thinking

Can you explain this problem in your own words?

Can you tell me why you subtracted (or added or multiplied) to find the answer?

Can you model this problem using division? What is the dividend—which number is being divided into parts? What is the divisor? How big are the parts?

Instructional Implications

Review possible interpretations of division (e.g., determining how many of the divisor will fit into the dividend, cutting the dividend up into divisor-sized pieces, or repeated subtraction of the divisor from the dividend). Relate the student's strategy to division and model how to represent the problem with a division expression. Ask the student to complete the division and provide assistance as needed.

Provide additional opportunities to solve division problems involving rational numbers given in real-world contexts. Guide the student to first model the problem with a division expression and then to consider how to complete the division. Eventually, ask the student to create word problems that require division of rational numbers.

Review the terms divisor, dividend, and quotient and their roles in real-world problems.

Moving Forward

Misconception/Error

The student is unable to implement an effective strategy for dividing mixed numbers.

Examples of Student Work at this Level

The student models the problem with a division expression by writing $4\frac{2}{3} \div 1\frac{2}{3}$ However, the student is unable to correctly complete the division. The student:

- Attempts to convert $4\frac{2}{3}$ and $1\frac{2}{3}$ to decimals and then divides using long division.
- Converts each mixed number to an improper fraction and then multiplies the fractions rather than divides them.
- Converts each mixed number to an improper fraction and is unable to continue.
- Attempts to divide the numerators, 14 and 5, while keeping the denominator of 3.
- Finds the reciprocal of the dividend instead of the divisor.
- Finds the reciprocal of both numbers instead of only the divisor.

Questions Eliciting Thinking

Why did you decide to convert this number to a decimal? What kind of decimal did you get?

Will you get an answer that is exactly right if you round?

What operation did you use - multiplication or division? How are multiplication and division related?

How do you divide fractions?

Instructional Implications

Provide the student with a rationale for fraction division. For example, explain that a fraction problem such as $\frac{4}{5} \div \frac{2}{3}$ can be thought of as answering the question, "How many two-thirds are in four-fifths?" Double tape diagrams can be used to model this problem but it can also be interpreted in terms of multiplication. For example, $\frac{4}{5} \div \frac{2}{3} = n$ can be reinterpreted as $\frac{2}{3} \times n = \frac{4}{5}$. Guide the student to observe that $\frac{2}{3}$ can be multiplied by $\frac{3}{2} \times \frac{4}{5}$ or $(3\times4)/(2\times5)$ which will result in $\frac{4}{5}$ (since $\frac{3}{2}$ is the reciprocal of $\frac{2}{3}$) so $\frac{4}{5} \div \frac{2}{3} = (3\times4)/(2\times5) = \frac{12}{10}$ or $\frac{6}{5}$. Eventually, allow the student to use the familiar division of fractions algorithm (e.g., invert and multiply) as a way to make computation simpler. Provide additional practice with fraction division.

If necessary, demonstrate to the student that the standard algorithms for basic arithmetic operations often do not easily accommodate repeating decimals while fraction algorithms can produce more precise answers with greater speed. For example, students might rewrite the fraction division as 4.6 ÷1.6. Students should be aware that this results in an approximate answer only while fraction division can produce an exact answer.

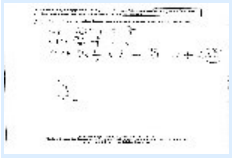
Almost There

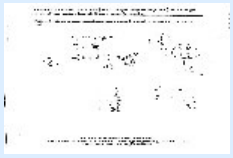
Misconception/Error

The student is unable to interpret his or her answer in terms of the problem context.

Examples of Student Work at this Level

The student provides a correct calculation of $2\frac{4}{5}$ but is unable to explain the meaning of the quotient in the context of the problem.





Questions Eliciting Thinking

In what unit is your answer given? What does your answer mean in the context of this problem?

Instructional Implications

Model the problem with whole number quantities. For example, ask the student how many days it would take to empty the container if there were 12 tons of oranges that could be processed at a rate of 4 tons per day. Allow the student to answer this question and help the student apply the same reasoning to the given problem.

Ask the student to identify the quantities described in the problem and their units (e.g., $4\frac{2}{3}$ tons of oranges, $1\frac{2}{3}$ tons of oranges per day). Then have the student review the question asked to determine the unit of the answer, "How long will it take to empty this container?" Guide the student to conclude that the answer to the question is a number of days and to explicitly say, "It will take $2\frac{4}{5}$ days to empty the container."

Provide additional opportunities to solve word problems involving division of fractions and interpret the results.

Got It

Misconception/Error

The student provides complete and correct responses to all components of the task.

Examples of Student Work at this Level

The student writes the expression $4\frac{2}{3} \div 1\frac{2}{3}$ and generates an answer of $2\frac{4}{5}$ days (67.2 hours) to empty the container.

Questions Eliciting Thinking

How did you know that you needed to divide in order to find out how long it would take to empty the container?

Can you explain how you divided these mixed numbers?

Instructional Implications

Challenge the student to justify and explain the "invert and multiply" rule for dividing fractions.

Accommodations & Recommendations

Special Materials Needed:

- *Juicing Fractions* worksheet

Source and Access Information

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District/Organization of Contributor(s): Okaloosa
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Aligned Standards

Name	Description
	Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models and equations to represent the problem. *For example, create a story context for (2/3) ÷ (3/4) and use a visual fraction model to show the quotient; use the relationship between multiplication and division to*

	explain that (2/3) ÷ (3/4) = 8/9 because 3/4 of 8/9 is 2/3. (In general, (a/b) ÷ (c/d) = ad/bc.) How much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 3/4-cup servings are in 2/3 of a cup of yogurt? How wide is a rectangular strip of land with length 3/4 mi and area 1/2 square mi?
MAFS.6.NS.1.1:	**Clarifications:** **Examples of Opportunities for In-Depth Focus** This is a culminating standard for extending multiplication and division to fractions. **Fluency Expectations or Examples of Culminating Standards** Students interpret and compute quotients of fractions and solve word problems involving division of fractions by fractions. This completes the extension of operations to fractions.