Are Fractions Numbers?

Sample task from achievethecore.org
By Student Achievement Partners

GRADE LEVEL Third

IN THE STANDARDS 3.NF.A

WHAT WE LIKE ABOUT THIS TASK

Mathematically:

- Requires students to construct a viable argument and use examples to justify their reasoning (MP3).
- Focuses on the cluster-level expectations for grade 3: "Develop understanding of fractions as numbers."
- Asks students to think about fractions as numbers without requiring that they have been taught operations with fractions.
- Addresses major misconceptions students often have with fractions.

In the classroom:

- Encourages students to talk about each other's thinking in order to improve their mathematical understanding.
- Allows teacher to gather data on student understanding and use it to plan future instruction.
- Provides opportunity for students to choose and use concrete objects or pictures to help them conceptualize and solve problems.
- Allows students to work independently or collaboratively.

This task was designed to include specific features that support access for all students and align to best practice for English Language Learner (ELL) instruction. Go here to learn more about the research behind these supports. This lesson aligns to ELL best practice in the following ways:

- Provides opportunities for students to practice and refine their use of mathematical language.
- Allows for whole class, small group, and paired discussion for the purpose of practicing with mathematical concepts and language.
- Elicits evidence of student thinking both verbally and in written form.
- Includes a mathematical routine that reflects best practices to supporting ELLs in accessing mathematical concepts.
- Provides opportunities to support students in connecting mathematical language with mathematical representations.

MAKING THE SHIFTS[1]

Focus	Belongs to the Major Work[2] of third grade
Coherence	Extends students' understanding of the number system; lays foundation for grades 4 and 5 work with fraction operations.
Rigor[3]	Conceptual Understanding: primary in this task Procedural Skill and Fluency: not targeted in this task Application: not targeted in this task

[1] For more information read Shifts for Mathematics.
[2] For more information see Focus in Grade Three.
[3] Tasks will often target only one aspect of Rigor.

For a direct link, go to: http://achievethecore.org/page/929/are-fractions-numbers

INSTRUCTIONAL ROUTINE

The steps in this routine are adapted from the Principles for the Design of Mathematics Curricula: Promoting Language and Content Development.

Engage students in the Stronger and Clearer Each Time Mathematical Language Routine to introduce this task. This will provide students with a structured, interactive opportunity to reflect on and refine their current understanding of fractions. While this task can be used at many points of the third grade year, this routine was developed as if the task was part of an introductory fraction lesson.

Part A

Begin the activity by sharing the dialog between Artie and Kay:

Artie said: "Choose a number between 1 and 10."
Kay said: "3/2."
Artie: "That's not a number! It's a fraction."
Kay: "But fractions are numbers!"

Ask students to reflect on the following questions:
Are fractions numbers? How do you know?

Begin by explaining and showing the 5 steps and sharing the title to this routine. Ensure that all students understand the purpose of this routine: listening to other students and incorporating the ideas they hear into their own thinking during the re-write. The goal is Stronger and Clearer Each Time they share and listen to a partner.

Pre-write: Have students record their initial answers to these questions, writing as a mathematician would write and using sentences and drawings as needed.

Think Time: Give students a few minutes to think about what they wrote so they will be ready to explain their thinking to other students. Given the importance of this foundational concept, the students should take their notes with them as they share.

Pair Share: Remind the students that precision is important when sharing. Pair up students and allow time for each partner to share as well as time for them to ask clarifying questions or to discuss similarities/differences.

New Partner and Repeat: Ask students to pair up with another partner and use the same routine.

Revise Pre-write: Students revise their initial answers. They may add details, examples, incorporate new language, or add any new ideas. These should show evidence of refinement in precision, communication, expression, and/or reasoning about the questions.

Part B

Hand out or show the entire task paper. Use this same routine to work on the other questions asked. The questions could be grouped and shared a few at a time.

Questions 1 & 2
Question 3
Question 4 & 5

Finally, ask students to individually write whether they agree with Artie or Kay. They should use their previous writings to write full and complete mathematical explanations.

Alternate Option: Parts A and B can be reversed using "Are fractions numbers?" as a summary of their learning after thinking about questions 1–5. This could also be used as a formative assessment.

LANGUAGE DEVELOPMENT

Ensure students have ample opportunities in instruction to read, write, speak, listen, and understand the mathematical concepts that are represented by the following terms and concepts:

- Fraction
- Whole Number
- Sum
- Equal
- Number
- Add
- Equal

Students should engage with these terms and concepts in the context of mathematical learning, not as a separate vocabulary study. Students should have access to multi-modal representations of these terms and concepts, including: pictures, diagrams, written explanations, gestures, and sharing of non-examples. These representations will encourage precise language, while prioritizing students' articulation of concepts. These terms and concepts should be reinforced in teacher instruction, classroom discussion, and student work.

TASK

TASK: ACTIONS

The teacher should prepare students to engage with this task by asking them what a number is. This dialogue will set the stage for students to begin thinking about fractions and whether or not they are numbers, based on the information they share or hear.

Students work to answer each question in the task. While the students work, the teacher should circulate and ask students about their mathematical thinking. The teacher may take anecdotal notes as a formative assessment of students' understanding of fractions as numbers. Questions the teacher may ask students while working include, but are not limited to:

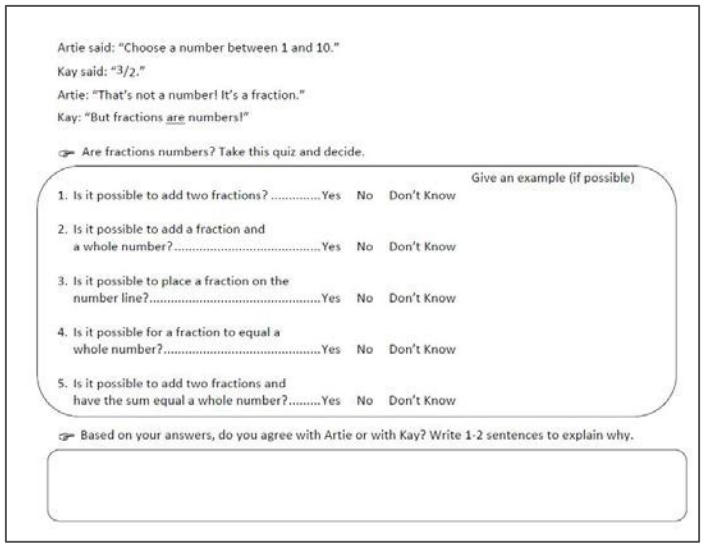
- How do you know? Tell me more.
- What do you have questions about?
- What in the classroom could you use to help you solve the problem?
- Can you explain how that drawing/model supports your answer?
- Tell me why that is a good model/example for this question.

After students have had time to work, the teacher leads a whole-class discussion, focused on highlighting specific reasoning or examples students have used to justify their answers. If possible, the teacher should call on a few students so a variety of solution methods are shared with the class. Some questions the teacher may ask during this discussion could include, but are not limited to:

- Can someone explain that in another way?
- Who can show us a different way to support that same answer?
- Can you show an example of that?
- How do you know that answer makes sense?
- What models convinced you that fractions are or are not numbers?
- Why do you agree/disagree with what your classmate said?

The teacher summarizes the mathematics of the task by highlighting student work and the class discussion with the conclusion that fractions are indeed numbers.

TASK: MATERIALS



Artie said: "Choose a number between 1 and 10."
Kay said: "3/2."
Artie: "That's not a number! It's a fraction."
Kay: "But fractions are numbers!"

☞ Are fractions numbers? Take this quiz and decide.

				Give an example (if possible)
1. Is it possible to add two fractions?	Yes	No	Don't Know	
2. Is it possible to add a fraction and a whole number?	Yes	No	Don't Know	
3. Is it possible to place a fraction on the number line?	Yes	No	Don't Know	
4. Is it possible for a fraction to equal a whole number?	Yes	No	Don't Know	
5. Is it possible to add two fractions and have the sum equal a whole number?	Yes	No	Don't Know	

☞ Based on your answers, do you agree with Artie or with Kay? Write 1-2 sentences to explain why.

Are Fractions Numbers? Handout

COMMENTARY

There are a number of ways this task could be used in a grade 3 or 4 classroom. This task could be used in third grade in the beginning of a unit of study on fractions. It gives teachers an idea of their students' number sense as it relates to fractions. While teachers would not expect their students to have a deep understanding of fractions (yet), some students may apply their knowledge of whole numbers or their experience from real life situations, in order to correctly answer some or all of the questions on the task.

This task may also be used as a pre-assessment in fourth grade to determine what level of understanding students have about fractions from third grade. Alternatively, instructors may choose to use this task towards the end of a study of fractions – either in third or fourth grade – as a mini-assessment of the work students have done with fractions. Once teachers are able to pinpoint the strengths and weaknesses in their students' understanding of fractions, they can plan focused lessons for future instruction.

This task may be used as an activity that starts with independent work and then transitions into partners or small groups. This allows students to create their own ideas and generate examples to support their thinking, without being influenced by the ideas of others. Once students have had time to think about and work with the questions on their own, encourage them to work together. Some of the most profound learning comes from discussions around students' developing thinking, sharing various student solution methods, and asking students to justify their reasoning.

ADDITIONAL THOUGHTS

As part of the Major Work of third grade, this task can enhance classroom discussion about the concept of fractions as numbers (3.NF.A). Number line diagrams are important representations for students as they make the connection between fractions and whole numbers. Understanding fractions as numbers means, first and foremost, seeing fractions as useful for describing quantities. This is the focus of fraction work in grade 3. Then, in grades 4 through 6, students learn how to compute with fractions and solve problems involving arithmetic with fractional quantities.

The work students do with fractions in third grade is predominantly conceptual, as can be seen at the cluster and standard level. The word "understand" is used in the standards to set explicit expectations for conceptual

understanding. Similarly, when standards call for students to "explain" a concept, there needs to be a deep level of understanding in order to arrive at a meaningful explanation. It is important for teachers to carve out sufficient time for students to be able to develop a deep conceptual understanding of fractions in third grade, so they have a strong foundation on which they can build their skills using fractions.

Understanding a fraction (and whole numbers) as a point on the number line and understanding the properties of operations on fractions (and whole numbers) are two key concepts students develop in K–5 in order to understand the rational numbers as a number system (6–8, NS). For more information on the specific expectations for students working with fractions in grade 3, read pages 3–5 in the progression document, *Number and Operations–Fractions*, available at www.achievethecore.org/progressions.

Artie said: “Choose a number between 1 and 10.” Kay said: “3/2.” Artie: “That’s not a number! It’s a fraction.” Kay: “But fractions <u>are</u> numbers!”

☞ Are fractions numbers? Take this quiz and decide.

				Give an example (if possible)
1. Is it possible to add two fractions?	Yes	No	Don’t Know	
2. Is it possible to add a fraction and a whole number?	Yes	No	Don’t Know	
3. Is it possible to place a fraction on the number line?	Yes	No	Don’t Know	
4. Is it possible for a fraction to equal a whole number?	Yes	No	Don’t Know	
5. Is it possible to add two fractions and have the sum equal a whole number?	Yes	No	Don’t Know	

☞ Based on your answers, do you agree with Artie or with Kay? Write 1-2 sentences to explain why.