Leapfrog Fractions

Lesson by Author Unknown
Annotation by Student Achievement Partners

GRADE LEVEL Fifth

IN THE STANDARDS 5.NF.A.1

WHAT WE LIKE ABOUT THIS LESSON

Mathematically:

- Provides students with the opportunity to use a variety of reasoning strategies about fraction equivalence to solve computation problems
- Allows for the use of visual fraction models, number lines, or equations to demonstrate thinking and solve the problem
- Builds on grade 4 understanding of fraction equivalence to add fractions with unlike denominators
- Allows for multiple solution strategies and encourages equivalent answers, without emphasizing least common denominators or lowest terms

In the classroom:

- Includes prompts and questions for the teacher to present in order to help all students engage with the mathematics of the lesson
- Provides examples of solution methods to strengthen all students' understanding of the content
- Requires students to revisit and revise their individual work
- Allows for individual, small group, and whole class work in one lesson

MAKING THE SHIFTS[1]

Focus	Belongs to the major work[2] of fifth grade
Coherence	Extends students' understanding of fraction equivalence and builds on adding fractions with like denominators
Rigor[3]	Conceptual Understanding: primary in this lesson
	Procedural Skill and Fluency: secondary in this lesson
	Application: not targeted in this lesson

[1]For more information read Shifts for Mathematics.
[2]For more information, see Focus in Grade Five.
[3]Lessons may target one or more aspect(s) of rigor.

ADDITIONAL THOUGHTS

In this lesson, students are given two fractions and must find the third fraction that will result in a sum of 1 when all three are added. The numbers chosen for each frog encourage students to apply their understanding of fractions flexibly. In one problem (Frog 4) the two given fractions already have a

common denominator, allowing students to revisit their understanding of iterating unit fractions to make a whole that was developed in grade 4. Three problems (Frogs 1, 2, and 3) provide fractions in which one denominator is a multiple of the other (e.g., $\frac{3}{5}$ and $\frac{1}{10}$). For these problems, students can create equivalent fractions using the larger denominator as the common denominator. Frog 5 provides a more challenging problem by presenting fractions with denominators that are not multiples of each other, but share a common factor other than 1. Students will have to use additional reasoning about equivalence to find the missing fraction and make a whole.

In each of these examples, students are using equivalent fractions to complete the problem. Tools such as number lines and visual fraction models can be useful for students to explain their thinking. Teachers may also use those tools with students who are struggling to find common denominators using knowledge of factors and multiples.

The structure of the lesson (beginning on page 3) is one that can be used with any mathematically worthwhile task. The cycle of giving students an opportunity to work individually, revisit and revise their work based on feedback from the teacher, and work collaboratively allows students to engage deeply with the task. Students are able to communicate their thinking to one another and combine their ideas into one, new solution. The included discussion questions facilitate this work and can easily be adapted for other tasks. Teachers and those who support teachers may find the Instructional Practice Guide: Coaching tool useful in implementing best practices in the classroom that allow all students to master the content of the lesson.

Overview of Instructional Task: Leapfrog Fractions

In this instructional task, students use fractions to solve problems.

Task Window

Within Unit 11, task window is flexible.

Task should be implemented after students have begun work on addition of fractions but before complete mastery.

Summary of Instructional Task

- One to two days before lesson, do the section titled Before Lesson.
- The lesson plan gives suggested time allotments, questions, and prompts to support students with the task. Collaborative group work, as well as whole group work, is noted.
- After the lesson, students read and revise their original responses and write what they learned.
- Analyze student responses to identify next instructional steps.

Task details are included on the following pages.

- Content/Language Objective, Standards, Background for Teachers (page 2)
- Lesson (pages 3–5)
- Student work samples (pages 6–11)
- Master for the task (pages 12–13)

Framework for Effective Teaching

I.2 Provides rigorous tasks that require critical thinking with appropriate digital and other supports to ensure student success.
I.5 Checks for understanding of content/language objectives.
I.8 Promotes student communication and collaboration using appropriate digital and other resources.

Instructional Task: Leapfrog Fractions

Content/Language Objective

Students add fractions to make the sum of one whole and explain their thinking orally and in writing, using nouns (e.g., equation, sum) and supports such as:

a. **fraction bars, drawings, and other classroom manipulatives,**
b. **sentence stems (e.g., I added _____ to total 1.), and/or**
c. **sentence stems (e.g., I used equivalent fractions, _____, to get the sum of 1 whole.)**

Common Core State Standards

This instructional task emphasizes the following Standards for Mathematical Practice.

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique others' reasoning.
4. Model with mathematics.
1. Attend to precision.

This instructional task also asks students to select and apply mathematical content from the following Common Core State Standard.

5.NF.1: Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce equivalent sums or differences of fractions with like denominators.

Background for Teachers

In this task, students add fractions to make the sum of one whole.

- Before the lesson, students attempt the task individually. Review their work and formulate questions for students to answer to improve their solutions.
- At the start of the lesson, students work alone answering teacher questions about the same task.
- Then students are grouped and engage in collaborative discussions of the same task.
- In the same small groups, students are given student work samples to comment on and evaluate.
- In a whole class discussion, students explain and compare alternative solution strategies they have seen and used.
- Finally, students revise their original solutions and comment on what they learned.

Required Materials

- Copies of task, Leapfrog Fractions, for students (pages 12–13)
- Fractions bars, pattern blocks, or any other manipulatives students have been using to solve problems involving fractions

Time

- Before lesson: 10–15 minutes
- Lesson: 60 minutes

Total Time: 70–75 minutes

Before Lesson

Initial Exploration Before Providing Student Feedback (10–15 minutes)

Before the lesson, have students read the Leapfrog Fractions task (pages 12–13) individually and record what information they know and questions they have about solving the task. Make available for student use fractions bars, pattern blocks, or any other manipulatives students have been using for problems involving fractions.

Have students work on the task individually for ten minutes. Collect students' responses to the task. Make notes on what their work reveals about their current levels of understanding and their different problem-solving approaches.

Do not score students' work. Research shows that it is counterproductive, as it encourages students to compare their scores and distracts their attention from what they can do to improve their mathematics.

Instead, help students make further progress by summarizing their difficulties as a series of questions, such as the suggestions below. Write a list of your own open-ended questions, based on your students' work. You may write questions on each student's work or select and write few questions on the board at the beginning of the lesson that will help the majority of students. You may also note students with particular issues, so you can ask them about their difficulties in the formative lesson.

Common Issues	Suggested Questions and Prompts
Student has difficulty getting started.	• *What do you know?* • *What do you need to find out?*
Student has difficulty understanding the problem.	• *In your own words, tell me what the task is asking you to do.*
Student has difficulty adding fractions.	• *What tools would help you see and model the fractions you need to add?*
Student has difficulty understanding how to add fractions with unlike denominators to equal the sum of one whole.	• *What do you know about adding fractions?* • *What do you know about equivalent fractions?*
Student works unsystematically.	• *Can you organize your work in a different way?* • *What would drawing pictures show in your solution?*
Student presents work poorly.	• *Would someone unfamiliar with your type of solution easily understand your work?* • *Have you explained how you arrived at your answer?*
Student produces correct solution. Student needs extension task.	• *Make your own leapfrog game using different fractions. Your sum could be one whole or a mixed number.*

Suggested Lesson Outline

Improve Individual Solutions to Instructional Task (10 minutes)

> *Recall what we looked at yesterday. What was the task? I have read the work you have done, and I have some questions about your work. I would like you to work on your own to answer my questions for about ten minutes.*

Small Group Collaborative Work (10 minutes)

Organize the class into small groups of two or three students and distribute a blank Leapfrog Fractions task (pages 12–13) to each group. Ask students to try the task again; this time combining their ideas.

> *Put your own work aside until later in the lesson. I want you to work in groups now. Your task is to produce a complete solution that expands on your individual solutions.*

While students work in small groups, note different student approaches to the task and support student problem solving.

Note Different Student Approaches to Task

Use this information to focus a whole class discussion towards the end of the lesson. In particular, note any common mistakes.

Support Student Problem Solving

Try not to make suggestions that move students toward a particular approach to this task. Instead, ask questions that help students clarify their thinking. To help students really struggling with the task, use the questions on the previous page to support your questioning. In particular, if students find it difficult to get started, these prompts may be useful.

- *What information do you have to help you solve the problem?*
- *Put the questions in your own words.*

If the whole class struggles with the same issue, write relevant questions on the board. You could also ask students who performed well on the task to help struggling students. If students are having difficulty making any progress at all, hand out student work samples (pages 6–11) to model problem-solving methods.

Collaborative Analysis of Student Work Samples (20 minutes)

After students have had sufficient time to attempt the task, give each small group of students copies of the student work samples (pages 6–11) and ask for written comments. This step gives students the opportunity to evaluate a variety of possible approaches to the task, without providing a complete solution strategy.

> *Imagine you are the teacher and have to assess this work. Correct the work and write comments on the accuracy and organization of each response.*

Each student work sample poses specific questions for students to answer. In addition to these questions, you could ask students to evaluate and compare responses. To help them do more than check if the answer is correct, you may ask the following questions.

- *How did this student organize his or her work?*
- *What mistakes have been made?*
- *What isn't clear?*
- *What questions would you like to ask this student?*
- *In what ways might the work be improved?*

Every group may not have enough time to work through all student work sample questions. If so, be selective about what you hand out. For example, groups that successfully completed the task using one method might benefit from looking at different approaches. Other groups that struggled with a particular approach may benefit from seeing a student version of the same strategy.

During small group work, support students as before. Note similarities and differences between students' approaches during small group work and student work sample approaches. Also check which methods students have difficulties understanding to focus the next activity, a whole class discussion.

Whole Class Discussion: Compare Different Approaches (10 minutes)

Organize a whole class discussion to consider different approaches used in the student work samples. Focus the discussion on those parts of the small group tasks that students found difficult. Ask students to compare different solution methods.

- *Which approach did you find easiest to understand? Why?*
- *Which approach did you find most difficult to understand? Why?*

Review Original Solutions to Task (10 minutes)

Ask students to read their original responses to the task.

> *Read your original solutions and think about your work on this task. Write down what you learned. Which method would you prefer to use if you were doing the task again? Why?*

Encourage students to compare new approaches they learned during the task with their original methods.

Solutions

Fractions that are equivalent and not in lowest terms would also be correct.

1. Frog 1: $1/4$

   Frog 2: $1/6$

   Frog 3: $3/10$

   Frog 4: $6/8$

   Frog 5: $1/3$

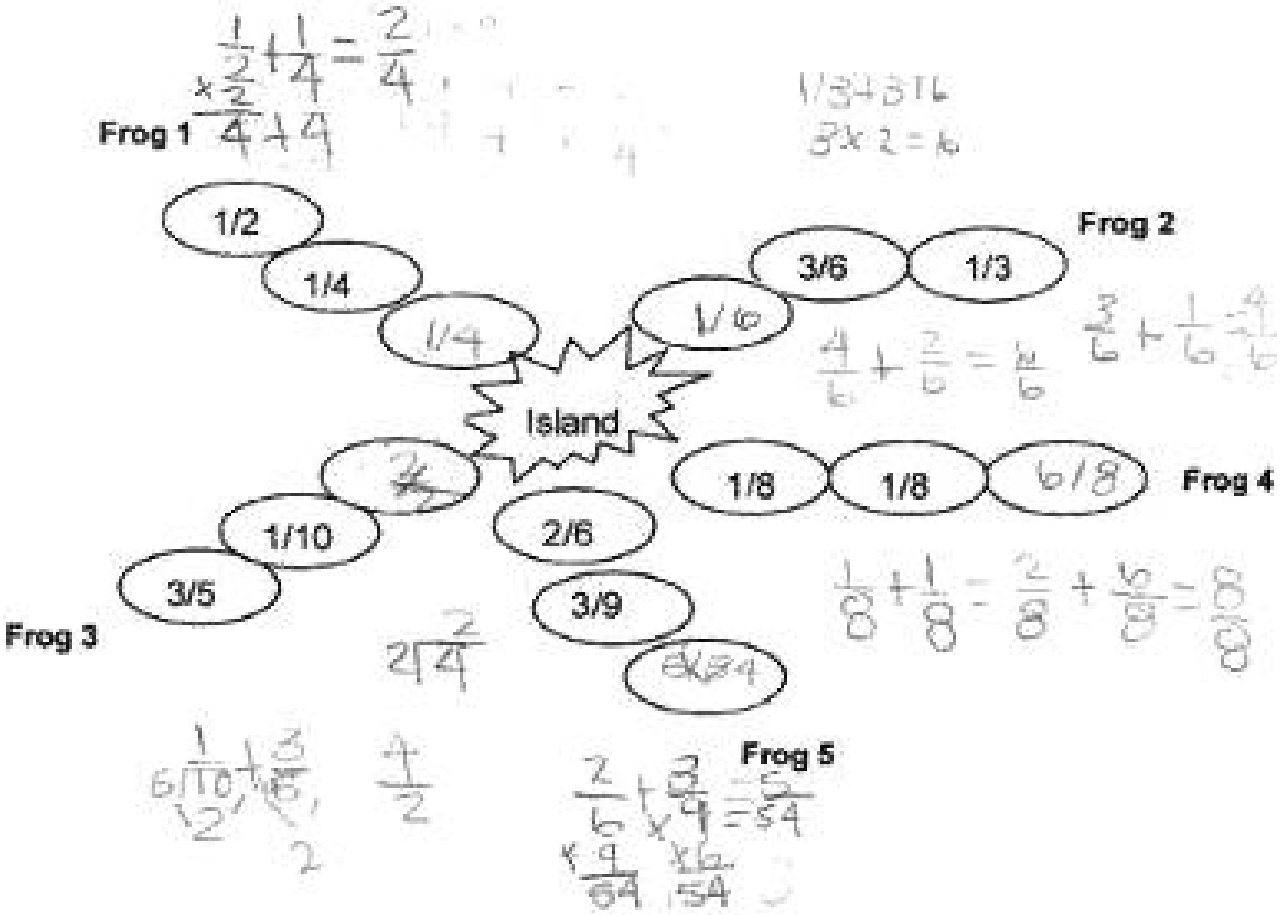
2. No, and shows work such as:

   $\frac{1}{4} = \frac{5}{20}$ $\frac{1}{5} = \frac{4}{20}$

   $\frac{5}{20} + \frac{4}{20} + \frac{10}{20} = \frac{19}{20}$

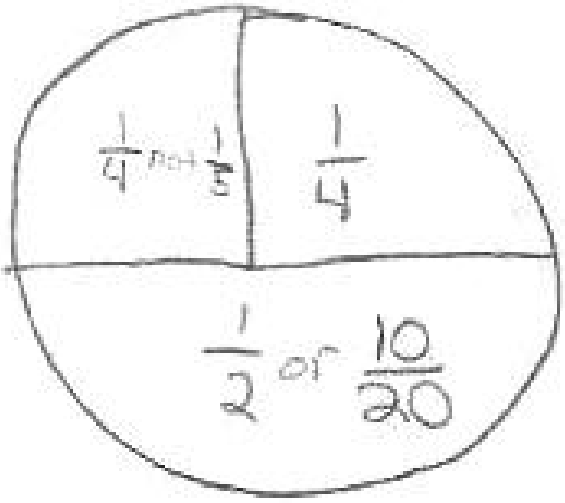
   So Frog 6 is short.

Sample 1: Student A



1.

NO



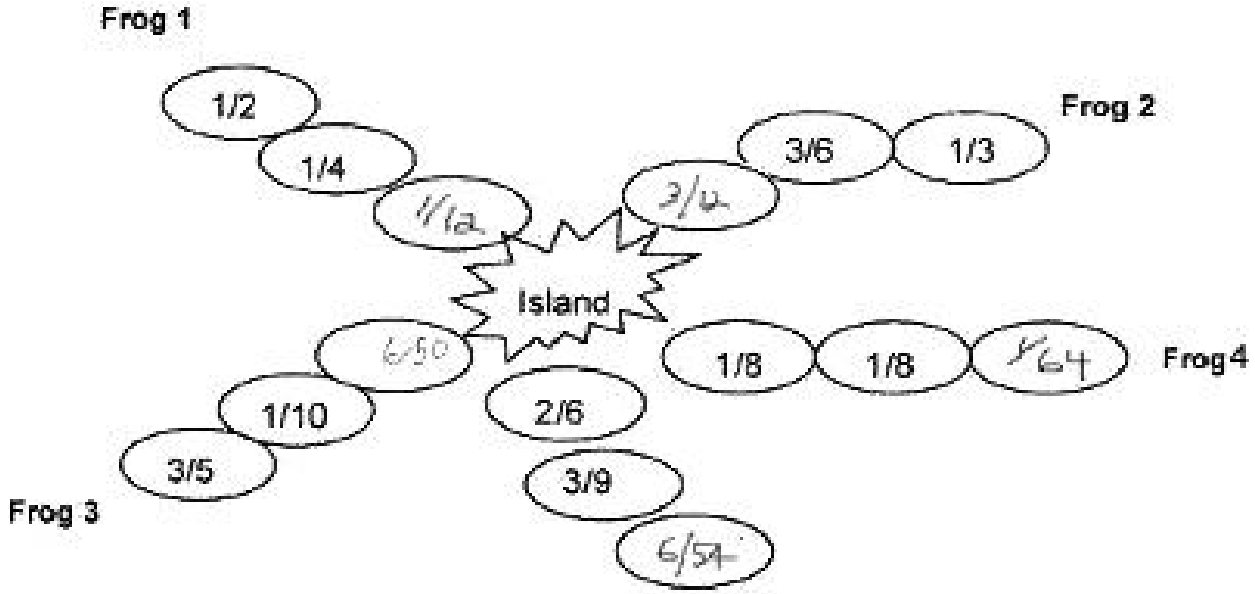
10/20 is $\frac{1}{2}$ So that took up half the Circle then $\frac{1}{4} + \frac{1}{4}$ equals $\frac{1}{2}$ not $\frac{1}{4} + \frac{1}{5}$ that does not equal $\frac{1}{2}$. So no he can not make it

2.

What questions would you ask this student?

If this student was your partner, what would help him or her understand adding fractions?

Sample 2: Student B



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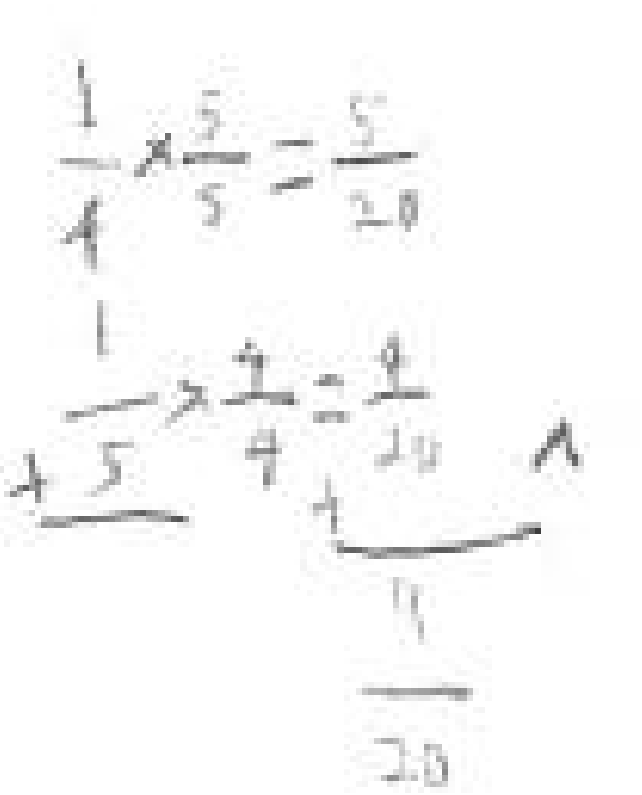


2.

What questions would you ask this student?

If this student was your partner, what would help him or her understand adding fractions?

Leapfrog Fractions

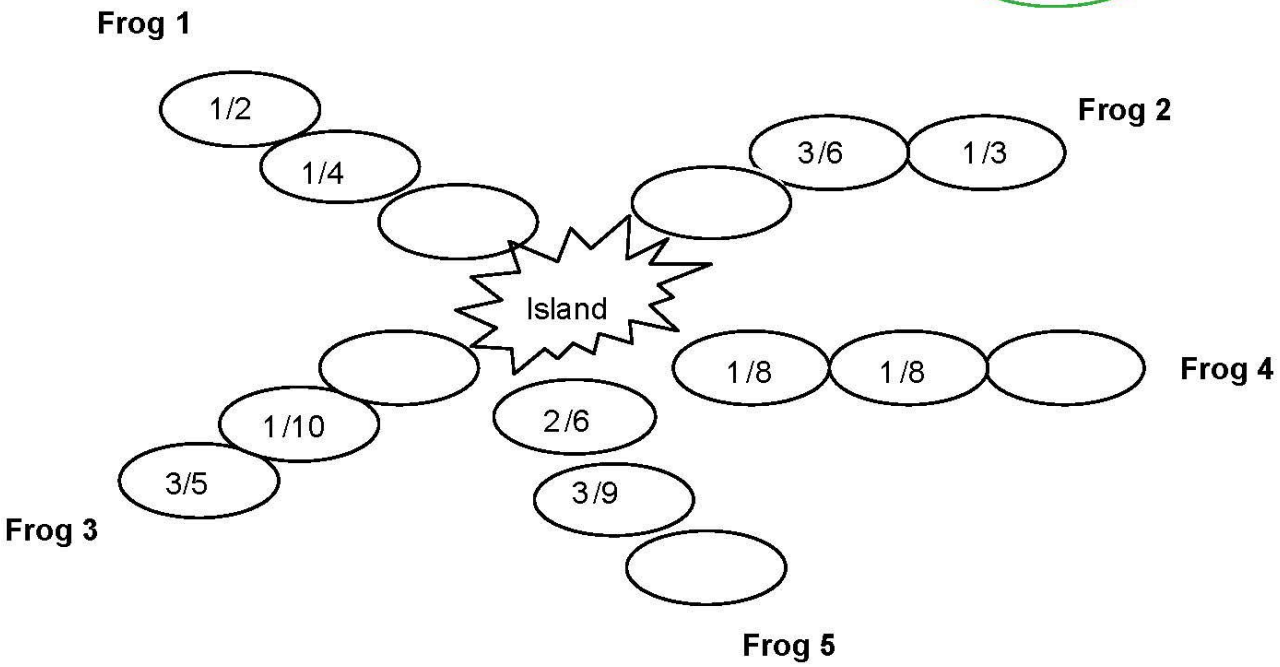
This problem gives you the chance to:
- use fractions to solve problems

These leaping frogs are playing a fraction game.
They leap from lily pad to lily pad adding up the fractions as they go.

They have just three lily pads each.

When they have counted up to one whole, and no more,
they can reach the island in the center of the lake.

1. Complete the lily pad fractions so that these five frogs can get to the island.
   Write your answers on the empty lily pads.
   Show your thinking with numbers, equations, or drawings.



2. Frog number 6 wants to join his friends on the island.
   His three lily pads are:

   $$1/4 + 1/5 + 10/20$$

   Can he make it?
   Show how you figured this out.