

## ***Mathematics: The Language of STEM***

Lemonade Stand

Crystal Kreider

### **CONTENT AND TASK DECISIONS**

**Grade Level(s): 5th**

**Description of the Task:** Students will make lemonade and decide what amount each person in their group should receive in order to give each person an equal amount. They will work to measure and pour the lemonade while inventing a strategy that they can use to solve any division equation with unit fractions and whole numbers.

**Indiana Mathematics Content Standards:**

**5.AT.4:** Solve real-world problems involving division of unit fractions by non-zero whole numbers, and division of whole numbers by unit fractions (e.g., by using visual fraction models and equations to represent the problem).

**Indiana Mathematics Process Standards:**

**PS.1:** Make sense of problems and persevere in solving them.

**PS.7:** Look for and make use of structure.

**Mathematics Content Goals:** Students will explore how to divide liquids in order to develop a formula that helps them to solve all division equations with unit fractions and whole numbers.

**Language Objectives:** Students will articulate their thinking to their classmates by using math vocabulary such as: *whole number, unit fraction, equation and divide/division*. Higher-level EL students will be able to use these successfully since they will be talked about at the beginning of the lesson and displayed on the board. Lower-level EL students will have success using the ideas behind these words by drawing models and pictures to represent their thinking. They may begin to use some of the math vocabulary as they become more comfortable with the words. Working with peers will help all EL students to be more successful since they will hear the content vocabulary being used in appropriate language structures.

**Materials:** Lemonade mix, water, measuring cups for each group, enough 2 qt. pitchers for each group of 3-4 students, 20 oz. cups (about 6 per group to account for mistakes and spills), a large stir spoon for each group, list of students placed strategically into groups of 3-4, paper towels/spill clean-up kit, work paper.

### **THE LESSON**

**Before (7 minutes):**

- Play this song as students enter the classroom to get them engaged. Have fun with it!  
<https://www.youtube.com/watch?v=3SMsYcJSBKc> Have a chat about your favorite summer activity as a whole class. Has anyone ever had a lemonade stand before? How did it go? Share a memory about starting a lemonade stand or use this:

- *I remember when my sisters and I tried to sell lemonade one hot summer day. We lived out in the country and no one ever came past our house but we thought we would give it a go. We made the lemonade and found a small table to set out beside the road. We decided to sell our lemonade for a quarter a glass. My sister and I debated about how much we should put in each cup. She seemed to think that we needed to put a little less in each cup so that the lemonade would go further but I wanted to fill the cups to the top so that we could satisfy our customers with a nice, FULL glass of lemonade. We looked at the amount of lemonade we had and tried to divide our half gallon of lemonade evenly among the 10 cups or so that my mom had given us. We finally got ONE customer after waiting for what seemed like forever! She was our neighbor from down the street. I think she felt sorry for us, so she gave us a whole dollar! We felt like millionaires...but we never made a lemonade stand again. She had been our one and only customer.*
- **Activate prior knowledge**
  - When my sister and I were deciding how much lemonade to put in each cup, it would have been really useful if we had been able to figure out a way to use math to help us.
  - What math ideas might we have been able to use? (Accept ideas and write down a few on the board. Draw out the idea of dividing a fraction by a whole number.)
  - Build the concept of division based on students' responses. (This is not the time to teach them how to divide a unit fraction by a whole number. Don't even write the equation on the board.) Tell students that today we are going to use some words to think about splitting up our lemonade. Write and have students help you define these words on the board (or have them ready ahead of time on a PowerPoint): whole number, unit fraction, equation, divide
- **Establish clear expectations**
  - Today you are going to be working with a math team to try to evenly split up  $\frac{1}{2}$  gallon of lemonade between your group members. You will complete this task using the lemonade and cups as well as paper to prove and explain your thinking. *You need to know how many ounces are in each cup.* After you complete the task, we will talk about your different strategies and your results. Be ready to share!
  - The goal is:
    - Find out what part of a  $\frac{1}{2}$  gallon is in each cup
  - The rules are:
    - Use the paper to record your thinking
    - Be ready to share
    - BEFORE making the lemonade, talk as a group about what to do and agree on a plan of who will do what. When you hear me say "Come and get some tasty lemonade!" then you may begin to make it IF you're ready.

**During (15-20 minutes):**

- **Let go**
  - Allow students to develop a plan for their lemonade, listening is as they do. When most groups are ready, let them begin.
  - Allow students to explore the activity and make their lemonade. Allow them to struggle with measurements and volume of water but make sure their lemonade is pretty close to the original recipe so that it tastes good enough to drink and is not wasted.
- **Listen actively**
  - Listen for how students are deciding how to split up their lemonade. Ask questions as needed like:

- What do you think of \_\_\_\_\_'s strategy?
  - What is another way that you can use what you know about math?
  - Explain to me how you divided up your lemonade.
  - How can you figure out how much is in each cup?
- **Provide appropriate support**
  - If students are struggling and cannot make progress begin to “help” them by asking them these questions
    - What amounts of liquids are you working with? (1/2 gallon)
    - How did you know how to split them up? What might that look like if we tried to draw it or represent it with numbers?
    - What possibilities has your group discussed for dividing the lemonade?
    - Have you made sure that everyone's opinion is heard? I don't know that you've considered \_\_\_\_\_'s idea and he/she had some very good math thoughts about this problem.
    - How much does the pitcher hold? How much does each cup hold?
    - What do you need to know to solve this problem?
- **Provide worthwhile extensions**
  - Students can work to convert measurements from gallons to quarts or gallons to ounces, etc. (students may need to look up how many ounces are in a gallon if they don't know that there are 64)
  - Students can try to determine the amount each person in the class would get if they started with 2 quarts of lemonade
  - Students can attempt to explain/create a process to follow for dividing unit fractions by whole numbers.
  - Students can use an iPad app like Google Slides, Notability (paid app), or one of their own choosing to represent their thinking.

**After (30-35 minutes):**

- **Promote a mathematical community of learners**
  - As groups are finished, have students pair up with a partner that wasn't at their group. Have them discuss what they found and how they solved the problem. They will come back to their group and share what they learned so it is important that they pay attention and possibly take notes.
  - Allow students time to share with their groups what they learned. Walk around and monitor conversations and ask questions as needed.
  - Pull the students back together and show the work of a group or a student. The work you choose should have some emerging ideas about dividing unit fractions and whole numbers as a point to dive into for discussion. *If you cannot find this work among the students then ask them this question. “How can we take what we learned about splitting up the lemonade and use it to help us solve other division equations and whole numbers?” Allow them a few more minutes to think as a group then take volunteers and show their work.*
  - Look for work with models that represent  $\frac{1}{2} \div 4 = \frac{1}{8}$  as this will help students to see how the numbers and symbols work together.
- **Listen actively without evaluation**
  - As students present their thinking, you should step to the side or the back of the classroom. Encourage discussion among the students and draw out good thinking while integrating more questions that will lead them to understand how to divide a whole

- number by a unit fraction. *(If you used the 2 quart pitchers and 20 oz.cups, the students should be guided to  $\frac{1}{2}$  gal.  $\div$  4 (number of group members) =  $\frac{1}{8}$  gallon (or 16 oz.)*
- The students should be the ones getting the mental workout as they present their information.
  - **Make connections**
    - How did we start with half of a gallon, break it into 4 pieces and end up with a denominator of 8? That seems impossible! Can someone help us make sense of it?
    - What ways can we get from 4 to 8? (Make sure you have the equation  $\frac{1}{2} \div 4 = \frac{1}{8}$  on the board at this point.)
    - What do we know that could help up to solve this problem? (Refer back to students' work and models)
    - Let students have a few moments to think and write on their own on their work page.
    - Monitor students as they make the connection that they could multiply by the multiplicative inverse instead of divide. Share a student's work that displays clear thinking and a good process for solving the equation.
  - **Summarize main ideas**
    - Reiterate the learning from the students' examples and re-explain how mathematicians use this shortcut to division.
    - Explain clearly to the students how to solve the problem by flipping the second fraction.
    - If there is time, allow students to practice their newfound strategy today. If not, make sure to revisit it and practice tomorrow!

## ASSESSMENT

### Observe:

- As students are working, look for students who are using weak math reasoning and critical thinking and challenge them with deeper questions that are listed in the lesson.
- Collect the students' work and analyze the second page to see how they are applying their understanding of dividing unit fractions by whole numbers. Those that need a lot of support and scaffolding would be a great small group to work with at the beginning of class the next day. Pair up the rest of the students to practice their new skill as you work with these students.
- For students who seem to grasp this concept quickly, challenge them to figure out how to divide a fraction by a fraction or a whole number by a unit fraction.

### Ask:

- Students will complete the work pages below as they move through the lesson.
- How do you divide a unit fraction by a whole number?
- Does your answer make sense? Can you prove it to me?

Mathematician:

Date:

# Lemonade Stand

How did your group decide to divide the lemonade? (Use words and numbers. You can add pictures if you want to.)

---

---

---

---

---

---

How many ounces are in the cup? \_\_\_\_\_ What part of a gallon is in the cup? \_\_\_\_\_

---

My partner tried this...

---

---

---

---

# Lemonade Stand

Explain how you think this problem is solved using words and numbers:  $\frac{1}{2} \div 4 = \frac{1}{8}$

---

---

---

---

Does the same strategy you tried for the problem above work with the equation:  $\frac{1}{4} \div 3 = \frac{1}{12}$  ? Prove it!

---

---

---

---