## Fish Tanks (IT)

### Overview

Students will use knowledge of volume to answer questions related to the volume of two fish tanks.

### Standards

**Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition.**

**5.MD.C.4** Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units.

**5.MD.C.5** Relate volume to the operations of multiplication and addition and solve real-world and mathematical problems involving volume.

a. Find the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes, and show that the volume is the same as would be found by multiplying the edge lengths, equivalently by multiplying the height by the area of the base. Represent threefold whole-number products as volumes, e.g., to represent the associative property of multiplication.

b. Apply the formulas $V = l \times w \times h$ and $V = b \times h$ for rectangular prisms to find volumes of right rectangular prisms with whole-number edge lengths in the context of solving real-world and mathematical problems.

c. Recognize volume as additive. Find volumes of solid figures composed of two non-overlapping right rectangular prisms by adding the volumes of the non-overlapping parts, applying this technique to solve real-world problems.

### Prior to the Task

***Standards Preparation***: The material in the chart below illustrates the standards and sample tasks that are pre-requisites for student success with this task's standards.

| Grade Level Standard | The Following Standards Will Prepare Them | Items to Check for Task Readiness | Sample Remediation Items |
|---|---|---|---|
| 5.MD.C.4 | • 5.MD.C.3 | 1. How many cubes fit in a rectangular prism that has a 5 cm length, a 2 cm width, and a 4 cm height?<br>a. 40 cm cubes | • http://learnzillion.com/lessonsets/364-count-unit-cubes-to-measure-volume<br>• http://learnzillion.com/lessons/1485-identify-and-label-threedimension-figures |
| 5.MD.C.5 | • 3.OA.B.5<br>• 4.MD.A.3<br>• 5.MD.C.3 | 1. Using the volume formula, what is the volume of a rectangular prism that has a length of 3 cm, a width of 10 cm, and a height of 5 cm? Show your work.<br>a. V = 150 $cm^3$<br>2. http://www.illustrativemathematics.org/illustrations/1631<br>3. http://www.illustrativemathematics.org/illustrations/1308 | • http://www.illustrativemathematics.org/illustrations/876<br>• http://learnzillion.com/lessonsets/365-relating-volume-to-the-operations-of-multiplication-and-addition<br>• http://learnzillion.com/lessonsets/284-understand-volume-as-an-attribute-of-threedimensional-figures-measure-volume-by-counting-unit-cubes-relate-volume-to-multiplication-and-addition |

**During the Task:**

- If students are having difficulty drawing the rectangular prism to model the fish tanks, provide them with centimeter grid paper or a computer program, like a word processing program, to allow them to draw the figure.
- Provide students with centimeter cubes or inch cubes that they can use to build a model of the fish tanks to determine the number of inch cubes that can be packed inside of the fish tanks they have drawn.
- Students may have difficulty with reasonable sizes for the fish tank. It may be beneficial to show them a concrete model as a reference.
- Some students may struggle when trying to determine if Lizzie's fish tank will always have a greater volume or if the two tanks can have the same volume. Have students share their drawings with each other to see if anyone in the class has created a model in which Lizzie's tank would have a lesser volume than Lonnie's. Encourage students to use the inch cubes to help answer questions 5 and 6. Have students share their process with the class as they explain their reasoning.

**After the Task:**

To connect this to the students' lives, two different-sized small fish tanks could be set up with class pets. The students could measure the tanks and discuss the volumes of the tanks. This could lead to filling the tanks with water and comparing the amount of water it took to fill them.

## Student Instructional Task

Lizzie and Lonnie are twins. Each of the twins has a small fish tank in her own bedroom big enough for one goldfish. The fish tanks are rectangular prisms. Lizzie's fish tank is longer and wider than Lonnie's fish tank, but Lonnie's tank is taller than Lizzie's.

1. Draw an example of what each of their fish tanks could look like. Include example dimensions in inches for your drawings and label each.

2. Using your drawings, give the volume of each fish tank by stating how many 1-inch unit cubes can be packed into each.

3. Show how the volume formula can be used to find the volume of each fish tank.

4. What is the combined volume of the two fish tanks? Explain how you found the combined volume.

5. Lizzie says "Because my tank is longer and wider, it will always have a larger volume than Lonnie's tank." Is this true? Explain your reasoning.

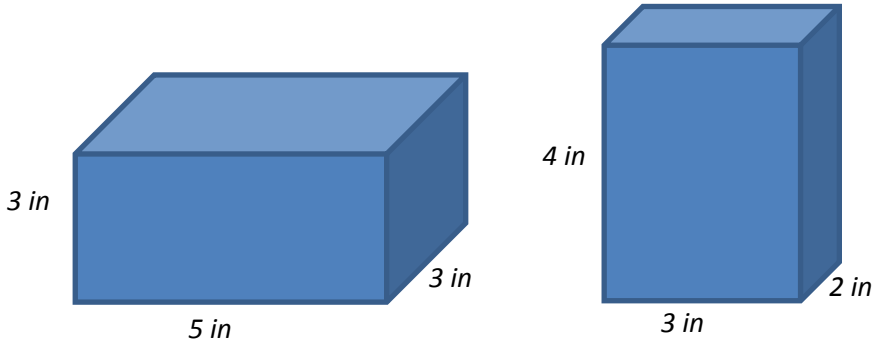
6. Is it possible for the two fish tanks to have the same volume if Lizzie's tank is always longer and wider and Lonnie's tank is always taller? Explain your reasoning. Use drawings to support your explanation.

## Instructional Task Exemplar Response

Lizzie and Lonnie are twins. Each of the twins has a small fish tank in her own bedroom big enough for one goldfish. The fish tanks are rectangular prisms. Lizzie's fish tank is longer and wider than Lonnie's fish tank, but Lonnie's tank is taller than Lizzie's.

1. Draw an example of what each of their fish tanks could look like. Include example dimensions in inches for your drawings and label each.

   *Sample answer: (not drawn to scale)*




*Lizzie's fish tank* *Lonnie's fish tank*

2. Using your drawings, give the volume of each fish tank by stating how many 1-inch unit cubes can be packed into each**.**

   *Sample answer based on the sample figures:*

   *Lizzie's fish tank would hold 45 1-inch unit cubes. Lonnie's fish tank would hold 24 1-inch unit cubes.*

3. Show how the volume formula can be used to find the volume of each fish tank.

   *Sample answer based on the sample figures:*

   *Volume can also be found by using the volume formula, V = l x w x h. For Lizzie's, 5 in x 3 in x 3 in, which is 45 $in^3$. For Lonnie's, 3 in x 2 in x 4 in, which is 24 $in.^3$.*

4. What is the combined volume of the two fish tanks? Explain how you found the combined volume.

   *Sample answer based on the sample figures:*

   *45 $in^3$ + 24 $in^3$ = 69 $in^3$*

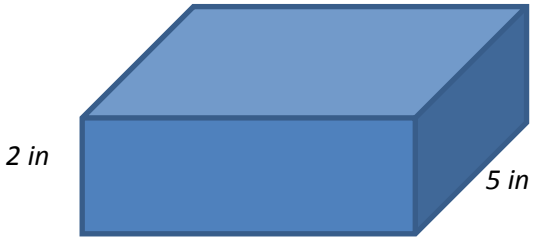
   *To find the combined volume, I added the volume of Lizzie's tank to the volume of Lonnie's tank.*

5. Lizzie says "Because my tank is longer and wider, it will always have a larger volume than Lonnie's tank." Is this true? Explain your reasoning.

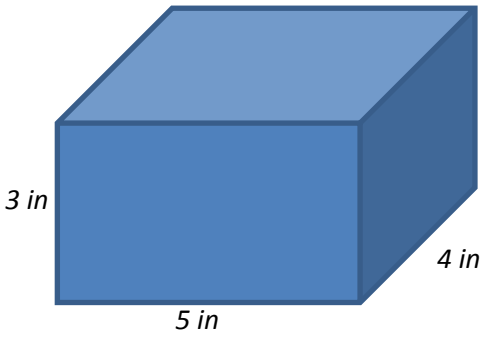
   *It is not true. For example, Lizzie could have a tank that has a length of 6 in, a width of 5 in, and a height of 2 in with a volume of 60 $in^3$. Lonnie could have a tank that has a length of 5 in, a width of 4 in, and a height of 4 in with a volume of 80 $in^3$.*

6. Is it possible for the two fish tanks to have the same volume if Lizzie's tank is always longer and wider and Lonnie's tank is always taller? Explain your reasoning. Use drawings to support your explanation.

*Yes, it is possible for the two tanks to have the same volume. For example, Lizzie could have a tank that has a length of 6 in, a width of 5 in, and a height of 2 in with a volume of 60 $in^3$. Lonnie could have a tank that has a length of 5 in, a width of 4 in, and a height of 3 in with a volume of 60 $in^3$.*




*Lizzie's fish tank*




*Lonnie's fish tank*

## Number Cards (IT)

### Overview

Students will create decimal numbers using cards numbered 0-9. Students will compare and order the numbers, round the numbers to the nearest hundredth, and write the numbers in various forms.

### Standards

**Understand the place value system.**

**5.NBT.A.3** Read, write, and compare decimals to thousandths.

a. Read and write decimals to thousandths using base-ten numerals, number names, and expanded form, e.g., 347.392=3 x 100 +4 x 10 + 7 x 1 + 3 x (1/10) + 9 x (1/100) + 2 x (1/1000).
b. Compare two decimals to thousandths based on meanings of the digits in each place, using >, =, and < symbols to record the results of the comparisons.

**5.NBT.A.4** Use place value understanding to round decimals to any place.

### Prior to the Task

***Standards Preparation***: The material in the chart below illustrates the standards and sample tasks that are pre-requisites for student success with this task's standards.

| Grade Level Standard | The Following Standards Will Prepare Them | Items to Check for Task Readiness | Sample Remediation Items |
|---|---|---|---|
| 5.NBT.A.3 | • 4.NBT.A.3<br>• 4.NF.B.7<br>• 5.NBT.A.1 | 1. Write the word form of 112.5.<br>a. one hundred twelve and five-tenths<br>2. Which is larger 256.34 or 25.63?<br>a. 256.34 is larger.<br>3. http://www.illustrativemathematics.org/illustrations/1813<br>4. http://www.illustrativemathematics.org/illustrations/1801 | • http://www.illustrativemathematics.org/illustrations/1807<br>• http://www.illustrativemathematics.org/illustrations/182<br>• http://www.illustrativemathematics.org/illustrations/1562<br>• http://learnzillion.com/lessonsets/735-read-and-write-decimals-to-thousandths-using-baseten-numerals<br>• http://learnzillion.com/lessonsets/638-read-and-write-decimals-to-the-thousandths<br>• http://learnzillion.com/lessonsets/134-read-and-write-decimals-to-the-thousandths-in-numeric-word-and-expanded-form<br>• http://learnzillion.com/lessonsets/234-compare-two-decimals-to-thousandths-using-and- |

| Grade Level Standard | The Following Standards Will Prepare Them | Items to Check for Task Readiness | Sample Remediation Items |
|---|---|---|---|
| 5.NBT.A.4 | • 4.NBT.B.4<br>• 5.NBT.A.1<br>• 5.NBT.A.3 | 1. Round 358.75 to the nearest tenths.<br>a. 358.8<br>2. Round 255.1 to the nearest ones.<br>a. 255<br>3. Round 1563.785 to the nearest thousandths.<br>a. 1563.79 | • http://www.illustrativemathematics.org/illustrations/1800<br>• http://www.illustrativemathematics.org/illustrations/1799<br>• http://learnzillion.com/lessonsets/416-round-decimals-to-any-place<br>• http://learnzillion.com/lessonsets/212-round-decimals-to-any-place-using-number-lines |

**During the Task:**

- Students may have difficulty comparing the numbers they have created. Grid paper may be helpful in lining up the decimals in order to compare the place values.
- When writing the decimal numbers in expanded form, students may attempt to use 0.1, 0.01, and 0.001 instead of the fractions. Encourage students to change the decimal form to the fraction when writing in expanded form.
- Have students exchange the lists they created for problem 1 to critique each other's reasoning of how they ordered the numbers before proceeding to problem 2. This will help students identify what is incorrect with the reasoning provided in problem 2.

**After the Task:**

Give students the opportunity to play an actual card game with numeral and decimal cards. Have students randomly pick six numeral cards from their stacks. Then challenge students to make the largest number possible with a given number of places after the decimal or the smallest number with a given number of places after the decimal.

## Student Instructional Task

Lottie's teacher put the students in her class into groups and gave each group a stack of cards like the ones pictured below.


1. Each group had to create 3 different numbers using the decimal card **and** any 6 of the numeral cards. Each number the group created had to be to a different place value after the decimal (tenths, hundredths, thousandths). Groups randomly chose six numeral cards for each number they created.

    a. Write 3 numbers that Lottie's group could have created.

    b. Put the 3 numbers from *part a* in order from greatest to least. Explain how you decided the order of the numbers.

    c. Write the numbers created in *part a* in expanded form.

2. When the groups finished, they swapped lists of numbers. Lottie's group received the following list of numbers ordered from greatest to least with an explanation.

> 756.208
> 6981.92
> 46231.5
>
> We put these in order using the first digit because all of our numbers have six digits.

a. Explain why the group's reasoning in the box above is incorrect.

b. Write the numbers from the list Lottie's group received in the correct order. Explain how you know that you are correct.

c. Using >, =, or <, compare the number with the greatest value from problem 2c to the number with the greatest value from problem 1b.

d. Write your inequality from problem 2d using the number names and words instead of numerals and symbols.

e. Write the 3 numbers from the list Lottie's group received as amounts of money. Explain why the numbers had to change and what you did to change them.

## Instructional Task Exemplar Response

Lottie's teacher put the students in her class into groups and gave each group a stack of cards like the ones pictured below.


1. Each group had to create 3 different numbers using the decimal card **and** any 6 of the numeral cards. Each number the group created had to be to a different place value after the decimal (tenths, hundredths, thousandths). Groups randomly chose six numeral cards for each number they created.

    a. Write 3 numbers that Lottie's group could have created.

    *Sample response:*

    *512.430*
    *2831.45*
    *83029.7*

    b. Put the 3 numbers from *part a* in order from greatest to least. Explain how you decided the order of the numbers.

    *Sample response based on part a:*

    *83029.7*
    *2831.45*
    *512.430*

    *Each numeral has a different number of digits in front of the decimal. The numeral with the greatest number of digits before the decimal is the one with the greatest value. The numeral with the fewest number of digits in front of the decimal is the one with the lowest value.*

    c. Write the numbers created in *part a* in expanded form.

    *Sample response based on part b:*

    $$83029.7 = 8 \times 10000 + 3 \times 1000 + 2 \times 10 + 9 \times 1 + 7 \times \left(\frac{1}{10}\right)$$

    $$2831.45 = 2 \times 1000 + 8 \times 100 + 3 \times 10 + 1 \times 1 + 4 \times \left(\frac{1}{10}\right) + 5 \times \left(\frac{1}{100}\right)$$

    $$512.430 = 5 \times 100 + 1 \times 10 + 2 \times 1 + 4 \times \left(\frac{1}{10}\right) + 3 \times \left(\frac{1}{100}\right)$$

2. When the groups finished, they swapped lists of numbers. Lottie's group received the following list of numbers ordered from greatest to least with an explanation.

> 756.208
> 6981.92
> 46231.5
>
> We put these in order using the first digit because all of our numbers have six digits.

a. Explain why the group's reasoning in the box above is incorrect.

*The group did not use the decimal placement to determine the value of each digit.*

b. Write the numbers from the list Lottie's group received in the correct order. Explain how you know that you are correct.

*46231.5*
*6981.92*
*756.208*

*I looked at the number of digits in front of the decimal. The number with the greatest number of digits is the number with the greatest value because they all have different numbers of digits in front of the decimal. If the numbers had the same number of digits in front of the decimal, I would start comparing with the largest place value.*

c. Using >, =, or <, compare the number with the greatest value from problem 2c to the number with the greatest value from problem 1b.

*Sample response based on part 1b.*

$46231.5 < 83029.7$

d. Write your inequality from problem 2d using the number names and words instead of numerals and symbols.

*Sample response based on part 2d:*

*Forty-six thousand two hundred thirty-one and five tenths is less than eighty-three thousand twenty-nine and seven tenths.*

e. Write the three numbers from the list Lottie's group received as amounts of money. Explain why the numbers had to change and what you did to change them.

*6981.92 $6,981.92*

*I did not have to change the number because it already had two places after the decimal.*

*46231.5 $46,231.50*

*I had to add a zero to have two places behind the decimal.*

*756.208 $756.21*

*I had to round the number to the hundredths place in order to have two places after the decimal.*

## Dixieland Ranch (IT)

### Overview

Students will apply their understanding of multiplication and division to determine the supplies needed to construct a fence for a pasture.

### Standards

**Perform operations with multi-digit whole numbers and with decimals to hundredths.**

**5.NBT.B.5** Fluently multiply multi-digit whole numbers using the standard algorithm.

**5.NBT.B.6** Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.

**Convert like measurement units within a given measurement system.**

**5.MD.A.1** Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multistep, real-world problems.

### Prior to the Task

***Standards Preparation***: The material in the chart below illustrates the standards and sample tasks that are pre-requisites for student success with this task's standards.

| Grade Level Standard | The Following Standards Will Prepare Them | Items to Check for Task Readiness | Sample Remediation Items |
|---|---|---|---|
| 5.NBT.B.5 | • 4.NBT.A.2<br>• 4.NBT.B.5<br>• 5.NBT.A.1 | 1. Multiply 635 x 12.<br>a. 7,620<br>2. Multiply 1732 x 33.<br>a. 57,156 | • http://www.illustrativemathematics.org/illustrations/1562<br>• http://www.illustrativemathematics.org/illustrations/1800<br>• http://www.illustrativemathematics.org/illustrations/1799<br>• http://www.illustrativemathematics.org/illustrations/459<br>• http://learnzillion.com/lessonsets/789-use-the-standard-algorithm-for-multiplication-of-multidigit-numbers<br>• http://learnzillion.com/lessonsets/257-multiply-multidigit-whole-numbers-using-the-standard-algorithm |
| 5.NBT.B.6 | • 5.NBT.B.5 | 1. Divide 7750 ÷ 31. | • http://learnzillion.com/lessonsets/211-find- |

| Grade Level Standard | The Following Standards Will Prepare Them | Items to Check for Task Readiness | Sample Remediation Items |
|---|---|---|---|
| | | a. 250<br>2. Divide 9548 ÷ 28.<br>a. 341 | whole-number-quotients-with-up-to-4digit-dividends-and-2digit-divisors |
| 5.MD.A.1 | • 4.MD.A.1<br>• 4.MD.A.2 | 1. Convert 930 yards to feet.<br>a. 2,790 feet<br>2. http://www.illustrativemathematics.org/illustrations/878 | • http://www.illustrativemathematics.org/illustrations/1508<br>• http://www.illustrativemathematics.org/illustrations/873<br>• http://learnzillion.com/lessonsets/697-convert-measurement-units-and-solve-real-world-problems<br>• http://learnzillion.com/lessonsets/548-convert-among-differentsized-measurement-units-and-use-these-conversions-to-solve-realworld-problems |

***Real-World Preparation***: The following questions will prepare students for some of the real-world components of this task:

- **What is a ranch?** A ranch is a large farm where livestock, such as cattle, horses, and pigs, is bred and raised. Ranches typically have lots of open area, which needs to be fenced in to keep the animals safe and on the ranch.
- **What is a pasture?** A pasture is a large area of land covered in grass and other low plants for grazing animals, such as cattle, to be able to roam and eat.

**During the Task:**

1. Have students work together in groups of two or three for this task.
2. Students may have difficulty deciding how to begin. Have students begin by making a plan including a list of the decisions they will have to make, what they already know, and the information they will need to determine before making those decisions. The given website information is arranged with the information about the gates first, but that does not have to be where students begin their decision-making process.
3. As students work to determine how much barbed wire is needed, monitor the groups to observe the approaches they use. Students may find the total perimeter, multiply it by three (for the three rows of barbed wire), and then try to divide by the feet per roll or feet per coil. Students may encounter difficulty dividing a five-digit dividend by a four-digit divisor. Ask probing questions to help students see that they can find the information for one side of the square pasture and use that information to find the quantity needed for the entire pasture.
4. Some students may forget that three rows of barbed wire are needed to construct the fence. Remind students to go back to the problem setup to find all information needed to solve the problem.
5. Have students share their recommendations with other groups. Encourage groups to ask questions about the process other groups use in order to understand reasoning that may be different from their own.

**After the Task:**

Discuss how constructing the fence around the pasture is similar to putting a board around a room or a fence around a house or the school. Have students find the cost to put a border around the classroom. Allow students to find costs by researching different options on the Internet. Students will have to measure the classroom in order to determine how much would need to be purchased.

## Student Instructional Task

The owners of Dixieland Ranch have hired your group to help determine the materials needed to fence in the pasture and the total cost. Your group will make its decision based on the information given below and any necessary calculations.

- The ranch has an unfenced square pasture that measures 880 yards on each side.
- In order to drive the tractor into the pasture to complete the chores, the pasture needs two wide gates installed on opposite ends of the pasture. The gates come in two different widths: a 10-ft gate and a 12-ft gate. Both gates at opposite ends of the pasture must be the same width.
- Fence posts will need to be purchased to construct the fence. The fence posts must be spaced evenly around the pasture. The distance between each fence post must be the same as the width of the chosen gate. For example, if you choose to purchase the 10-ft gate, the distance between each fence post will need to be 10 feet.
- Three rows of barbed wire will be used to construct the fence around the pasture.
- The owners of the ranch do not wish to spend more than $16,500.

Given the website information below and the details above, create a recommendation for the owners of Dixieland Ranch including which materials should be ordered, the quantity to be ordered, and the total cost of building the fence. Use the order form on the next page to record your recommendations. In addition to completing the order form, support your recommendation with an explanation of why you chose each of the materials and how you determined the quantity needed. Also include a record of your calculations to support the totals on the order form.

**Rancher's Website**
**Fall Sale Page**

| | **Item and Description** | **Cost** |
|---|---|---|
| **Gates** | 10-ft Center Open Gate (two fence posts needed for installation—not included) | $186 per gate |
| | 12-ft Center Open Gate (two fence posts needed for installation—not included) | $200 per gate |
| **Barbed Wire** | 1,320-ft roll—12-gauge wire with 4-pt barbs | $75 per roll |
| | 50-ft coils—12-gauge wire with 4-pt barbs | $3 per coil |
| **Fence Posts** | Treated Wooden Posts—meant for long-term use<br>Sold in bundles of 10 only | $130 per bundle of 10 |
| | Untreated Wooden Posts—meant for short-term use<br>Sold in bundles of 10 only | $110 per bundle of 10 |

| Rancher's Website Order Form | | | | |
|---|---|---|---|---|
| **Item** | **Type** | **Price** (Cost per Item) | **Quantity** (How many needed) | **Total Cost** |
| Gate | | | | |
| Barbed Wire | | | | |
| Fence Post | | | | |
| **TOTAL ORDER AMOUNT** | | | | |

## Instructional Task Exemplar Response

The owners of Dixieland Ranch have hired your group to help determine the materials needed to fence in the pasture and the total cost. Your group will make its decision based on the information given below and any necessary calculations.

- The ranch has an unfenced square pasture that measures 880 yards on each side.
- In order to drive the tractor into the pasture to complete the chores, the pasture needs two wide gates installed on opposite ends of the pasture. The gates come in two different widths: a 10-ft gate and a 12-ft gate. Both gates at opposite ends of the pasture must be the same width.
- Fence posts will need to be purchased to construct the fence. The fence posts must be spaced evenly around the pasture. The distance between each fence post must be the same as the width of the chosen gate. For example, if you choose to purchase the 10-ft gate, the distance between each fence post will need to be 10 feet.
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Given the website information below and the details above, create a recommendation for the owners of Dixieland Ranch including which materials should be ordered, the quantity to be ordered, and the total cost of building the fence. Use the order form on the next page to record your recommendations. In addition to completing the order form, support your recommendation with an explanation of why you chose each of the materials and how you determined the quantity needed. Also include a record of your calculations to support the totals on the order form.

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| | Untreated Wooden Posts—meant for short-term use<br>Sold in bundles of 10 only | $110 per bundle of 10 |

*There will be multiple solutions to this task as students may have different reasons for choosing certain materials. If possible, allow students to do some research about the items described so they can better understand why some items*

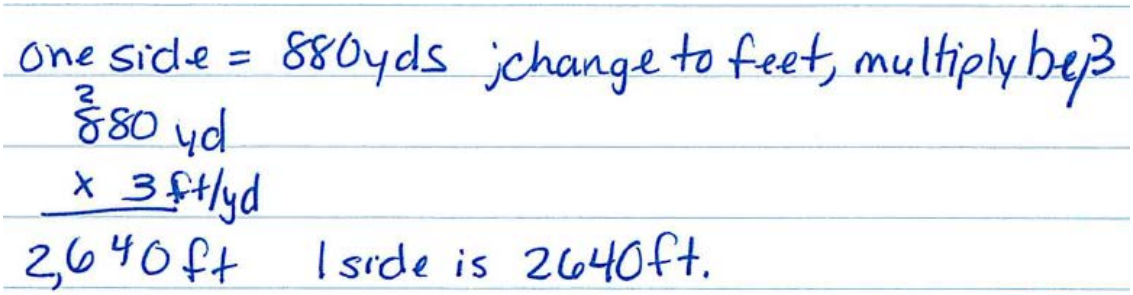
*might be chosen over others. Below is one sample order form with a sample written recommendation including calculations to support the order form.*

*Sample response:*

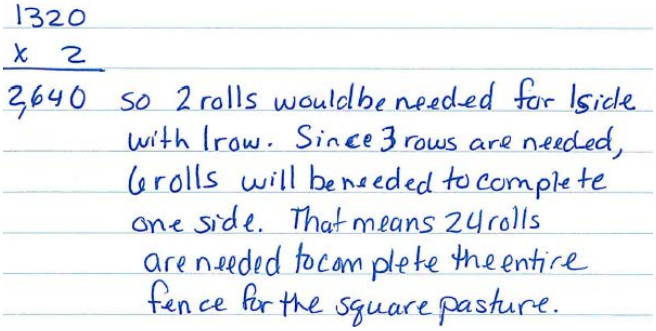
| Rancher's Website Order Form | | | | |
|---|---|---|---|---|
| **Item** | **Type** | **Price** (Cost per Item) | **Quantity** (How many needed) | **Total Cost** |
| Gate | *12-ft gate* | *$200* | *2 gates* | *$400* |
| Barbed Wire | *1,320-ft roll* | *$75* | *24 rolls* | *$1,800* |
| Fence Post | *Treated Wooden Posts* | *$130* | *88 bundles* | *$11,440* |
| **TOTAL ORDER AMOUNT** | | | | *$13,640* |

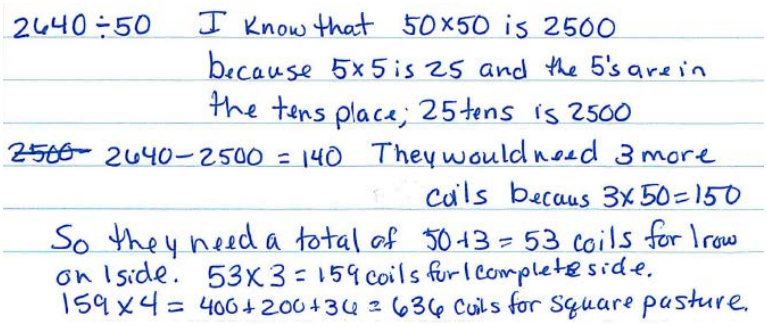
*Sample recommendation and calculations:*

*We started by figuring out the amount of barbed wire we would need. We had to convert 880 yards to feet in order to begin because the barbed wire and gates were sold in feet rather than yards.*

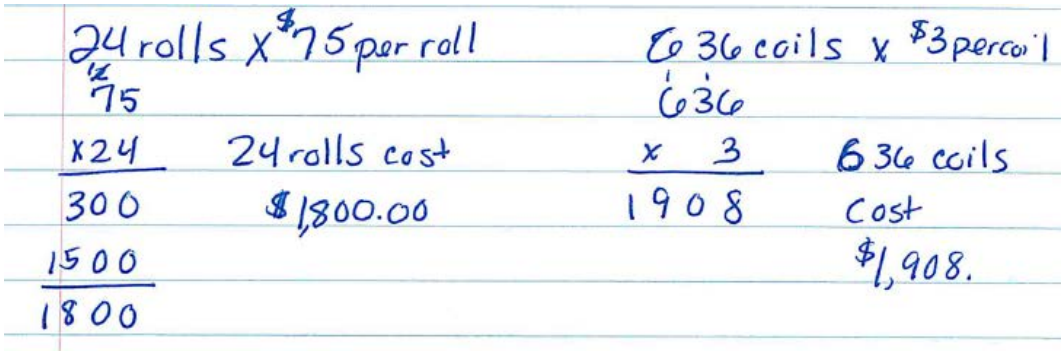



*Knowing that the pasture is a square, we then decided to find the amount of barbed wire needed to complete one side of the pasture. Then we would multiply that amount by 4 to find what was needed for the entire pasture.*



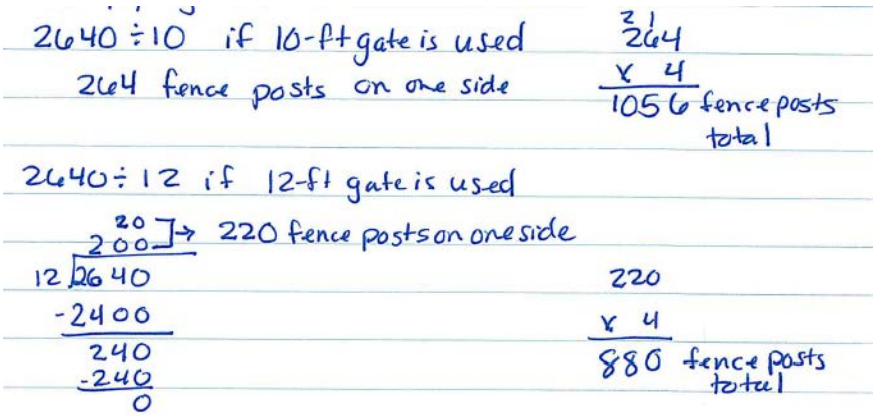



*Based on our calculations of how many rolls or coils would be needed, we then found the cost for each option.*




*Since the cost of buying the 24 rolls is cheaper, we recommend buying the 24 rolls of barbed wire.*

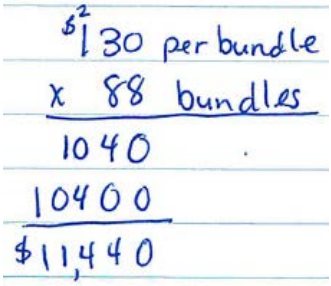
*Next we determined the number of fence posts needed. Again, we know that one side of the pasture is 2,640 feet, so if we find the number of fence posts needed for one side we can multiply that by 4 to find the total number needed.*



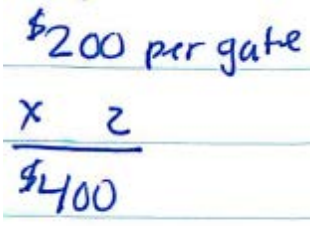

*Next, since fence posts are sold only in bundles of 10, we noticed that 880 is divisible by 10 so there would be no fence posts left over. 880 fence posts ÷ 10 posts per bundle = 88 bundles of fence posts. Therefore we recommend spacing the fence posts 12-ft apart, which means we will also recommend the 12-ft gates.*

*We also recommend the treated fence posts because they are designed to last a longer time—this means they may not have to be changed as often as the untreated fence posts might need to be changed.*

*Cost for 88 bundles of treated fence posts:*




*Cost for two 12-ft gates:*




*Adding up all of the costs, $400 + $1,800 + $11,440 = $13,640, which is under the $16,500 limit.*

# Rainfall Amounts (IT)

## Overview

Students will use rainfall amounts to answer questions that require adding and subtracting fractions with unlike denominators.

## Standards

**Use equivalent fractions as a strategy to add and subtract fractions.**

**5.NF.A.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 an equivalent sum or difference of fractions with like denominators. *For example, 2/3 + 5/4 = 8/12 + 5/12 = 23/12 (in general, a/b +c/d = (ad + bc)/bd).*

**5.NF.A.2** Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators, e.g., by using visual fraction models or equations to represent the problem. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers. *For example, recognize an incorrect result 2/5 + ½ = 3/7, by observing that 3/7 < 1/2.*

## Prior to the Task

***Standards Preparation***: The material in the chart below illustrates the standards and sample tasks that are pre-requisites for student success with this task's standards.

| Grade Level Standard | The Following Standards Will Prepare Them | Items to Check for Task Readiness | Sample Remediation Items |
|---|---|---|---|
| 5.NF.A.1 | • 4.NF.A.1<br>• 4.NF.B.3 | 1. Add $\frac{1}{2} + 1\frac{3}{4}$.<br>a. $\frac{9}{4}$ OR $2\frac{1}{4}$<br>2. Subtract $\frac{7}{8} - \frac{1}{4}$.<br>a. $\frac{5}{8}$<br>3. http://www.illustrativemathematics.org/illustrations/839<br>4. http://www.illustrativemathematics.org/illustrations/847 | • http://www.illustrativemathematics.org/illustrations/743<br>• http://www.illustrativemathematics.org/illustrations/881<br>• http://www.illustrativemathematics.org/illustrations/831<br>• http://www.illustrativemathematics.org/illustrations/837<br>• http://www.illustrativemathematics.org/illustrations/968<br>• http://www.illustrativemathematics.org/illustrations/856<br>• http://www.illustrativemathematics.org/illustrations/874<br>• http://learnzillion.com/lessonsets/536-add-and-subtract-fractions-and-mixed-numbers-with-unlike-denominators-using-fraction-bars<br>• http://learnzillion.com/lessonsets/383-add-and-subtract-fractions-and-mixed-numbers- |

| Grade Level Standard | The Following Standards Will Prepare Them | Items to Check for Task Readiness | Sample Remediation Items |
|---|---|---|---|
| | | | with-unlike-denominators-using-area-models<br>• http://learnzillion.com/lessonsets/216-add-and-subtract-fractions-with-unlike-denominators<br>• http://learnzillion.com/lessonsets/63-add-and-subtract-mixed-numbers |
| 5.NF.A.2 | • 4.NF.A.2 | 1. If you have $\frac{3}{4}$ cup water and $\frac{2}{3}$ cup water, how many total cups of water do you have?<br>a. $1\frac{5}{12}$ cups<br>2. http://www.illustrativemathematics.org/illustrations/481 | • http://www.illustrativemathematics.org/illustrations/812<br>• http://www.illustrativemathematics.org/illustrations/811<br>• http://www.illustrativemathematics.org/illustrations/183<br>• http://learnzillion.com/lessonsets/642-assess-the-reasonableness-of-answers-to-word-problems-involving-the-addition-and-subtraction-of-fractions<br>• http://learnzillion.com/lessonsets/385-solve-word-problems-involving-the-addition-and-subtraction-of-fractions-with-unlike-denominators<br>• http://learnzillion.com/lessonsets/223-solve-word-problems-involving-addition-and-subtraction-of-fractions-referring-to-the-same-whole-2<br>• http://learnzillion.com/lessonsets/219-solve-word-problems-involving-addition-and-subtraction-of-fractions-referring-to-the-same-whole-1 |

***Real-World Preparation***: The following tips will prepare students for some of the real-world components of this task:

1. It may be helpful to discuss the different city locations from the task. This could be a social studies connection.

**During the Task:**

- As students work through the task, they may have difficulty finding common denominators to compare fractions. Remind students of the different ways to compare the fractions. For example, students locate the fractions on a number line and find their distances from 1 (or the next whole number if both fractions are larger than 1) as another way to compare the fractions.

**After the Task:**

Students can connect this to their own lives by collecting water in a rain gauge on various days that it rains. This data can be used to compare fractions. With the actual rain to look at, students will have a better understanding of the fractions.

## Student Instructional Task

The table below shows the possible rainfall amounts over a 24-hour period in four different cities.

| City | Rainfall (in inches) |
|---|---|
| New Orleans | $1\frac{1}{2}$ |
| Lafayette | $\frac{1}{10}$ |
| Baton Rouge | $\frac{7}{8}$ |
| Shreveport | $2\frac{3}{4}$ |
| | |

1. Choose two cities from the table above and complete the questions that follow.

   a. City One: _____ City Two: _____

   b. Look at the rainfall amounts for the two cities you chose. Which one had more rainfall during the 24-hour period? What is the difference between the two rainfall amounts? Show how you found the difference.

2. Look at the rainfall amounts for the two cities you did not choose**.** Which of these two cities received less rain during the 24-hour period? What is the difference between the two rainfall amounts? Show how you found the difference.

3. What was the total rainfall for all four cities during the 24-hour period? Show your work.

4. Complete the table above by adding information for the city of Alexandria. Alexandria had a rainfall amount that was more than Lafayette but less than Baton Rouge. Show or explain how you determined a possible rainfall amount for Alexandria.

## Instructional Task Exemplar Response

The table below shows the possible rainfall amounts over a 24-hour period in four different cities.

| City | Rainfall in inches |
|---|---|
| New Orleans | $1\frac{1}{2}$ |
| Lafayette | $\frac{1}{10}$ |
| Baton Rouge | $\frac{7}{8}$ |
| Shreveport | $2\frac{3}{4}$ |
| **Alexandria** | $\mathbf{\frac{1}{2}}$ ***(Sample response)*** |

1. Choose two cities from the table above and complete the questions that follow.

   a. City One: _____*New Orleans*_____ City Two: _____*Lafayette*_____

   b. Look at the rainfall amounts for the two cities you chose. Which one had more rainfall during the 24-hour period? What is the difference between the two rainfall amounts? Show how you found the difference.

   *Sample answer based on cities chosen in part a:*

   *New Orleans had more rainfall during the 24-hour period. New Orleans received* $1\frac{2}{5}$ *inch rainfall more than Lafayette.*

   $1\frac{1}{2} = \frac{3}{2} = \frac{15}{10}$

   $\frac{15}{10} - \frac{1}{10} = \frac{14}{10} = 1\frac{4}{10}$ or $1\frac{2}{5}$

2. Look at the rainfall amounts for the two cities you did not choose**.** Which of these two cities received less rain during the 24-hour period? What is the difference between the two rainfall amounts? Show how you found the difference.

   *Sample answer based on the cities not chosen for question 1:*

   *Baton Rouge had less rain during the 24-hour period. Baton Rouge received* $1\frac{7}{8}$ *inches rainfall less than Shreveport.*

$2\frac{3}{4} - \frac{7}{8} = \frac{11}{4} - \frac{7}{8} = \frac{22}{8} - \frac{7}{8} = \frac{15}{8} = 1\frac{7}{8}$

3. What was the total rainfall for all four cities during the 24-hour period? Show your work.

$$1\frac{1}{2} = \frac{3}{2} = \frac{60}{40}$$

$$\frac{1}{10} = \frac{4}{40}$$

$$\frac{7}{8} = \frac{35}{40}$$

$$2\frac{3}{4} = \frac{11}{4} = \frac{110}{40}$$

$\frac{60}{40} + \frac{4}{40} + \frac{35}{40} + \frac{110}{40} = \frac{209}{40} = 5\frac{9}{40}$

$5\frac{9}{40}$ *inches fell in the four cities during the 24-hour period.*

***Note: Students may choose to use other methods to add these four fractions.*

4. Complete the table above by adding information for the city of Alexandria. Alexandria had a rainfall amount that was more than Lafayette but less than Baton Rouge. Show or explain how you determined a possible rainfall amount for Alexandria.

*A sample response is given in the table. The answer must be a fraction between* $\frac{1}{10}$ *and* $\frac{7}{8}$.

*I got* $\frac{1}{2}$ *by finding a common denominator for both fractions. The common denominator is 40.* $\frac{1}{10} = \frac{4}{40}$ *and* $\frac{7}{8} = \frac{35}{40}$. *Since one fraction is smaller than one-half and one is greater than one-half, I decided to choose* $\frac{1}{2}$ *which is* $\frac{20}{40}$.

## Colored Jugs (IT)

### Overview

Students will use knowledge of fractions to answer questions related to fractions of a gallon.

### Standards

**Use equivalent fractions as a strategy to add and subtract fractions.**

**5.NF.A.2** Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators, e.g., by using visual fraction models or equations to represent the problem. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers. *For example, recognize an incorrect result 2/5 + ½ = 3/7, by observing that 3/7 < 1/2.*

**Apply and extend previous understandings of multiplication and division to multiply and divide fractions.**

**5.NF.B.4** Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction.

a. Interpret the product ($a/b$) x $q$ as $a$ parts of a partition of $q$ into $b$ equal parts; equivalently, as the result of a sequence of operations $a$ x $q$ ÷ $b$. *For example, use a visual fraction model to show (2/3) x 4 = 8/3, and create a story context for this equation. Do the same with (2/3) x (4/5) = 8/15. (In general, (a/b) x (c/d) = ac/bd.)*

**5.NF.B.6** Solve real-world problems involving multiplication of fractions and mixed numbers, e.g., by using visual fraction models or equations to represent the problem.

**5.NF.B.7** Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions.

c. 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. *For example, how much chocolate will each person get if 3 people share 1/2 lb of chocolate equally? How many 1/3-cup servings are in 2 cups of raisins?*

### Prior to the Task

***Standards Preparation***: The material in the chart below illustrates the standards and sample tasks that are pre-requisites for student success with this task's standards.

| Grade Level Standard | The Following Standards Will Prepare Them | Items to Check for Task Readiness | Sample Remediation Items |
|---|---|---|---|
| 5.NF.A.2 | • 4.NF.A.2<br>• 5.NF.A.1 | 1. New Orleans, Louisiana, received $\frac{2}{3}$ inch of rain on Monday and $\frac{5}{6}$ inch of rain on Tuesday. How much total rain did the city receive for both days?<br>a. $\frac{9}{6}$ inches or $1\frac{1}{2}$ inches<br>2. http://www.illustrativemathematics.org/illustrations/481 | • http://www.illustrativemathematics.org/illustrations/812<br>• http://www.illustrativemathematics.org/illustrations/811<br>• http://www.illustrativemathematics.org/illustrations/183<br>• http://learnzillion.com/lessonsets/642-assess-the-reasonableness-of-answers-to-word-problems-involving-the-addition-and-subtraction-of-fractions<br>• http://learnzillion.com/lessonsets/385-solve-word-problems-involving-the-addition-and-subtraction-of-fractions-with-unlike-denominators<br>• http://learnzillion.com/lessonsets/223-solve-word-problems-involving-addition-and-subtraction-of-fractions-referring-to-the-same-whole-2<br>• http://learnzillion.com/lessonsets/219-solve-word-problems-involving-addition-and-subtraction-of-fractions-referring-to-the-same-whole-1 |
| 5.NF.B.4a | • 3.MD.C.7b<br>• 4.NF.B.4 | 1. Ming is making bows for gifts. She uses $\frac{2}{3}$ yard of ribbon for each bow. If she is making 4 bows, how much ribbon will she need?<br>a. $\frac{8}{3}$ yards or $1\frac{2}{3}$ yards<br>2. http://www.illustrativemathematics.org/illustrations/321 | • http://www.illustrativemathematics.org/illustrations/857<br>• http://learnzillion.com/lessonsets/316-interpret-the-product-ab-x-q-as-a-part-of-a-partition-of-q-into-b-equal-parts<br>• http://learnzillion.com/lessonsets/66-multiply-fractions |
| 5.NF.B.6 | • 3.OA.A.1<br>• 3.OA.A.2<br>• 4.OA.A.1<br>• 4.OA.A.2<br>• 4.MD.A.2 | 1. $\frac{3}{5}$ of the audience for a play was female. Of the females, $\frac{6}{7}$ were under the age of 15. What fraction of the audience were females under the age of 15?<br>a. $\frac{18}{35}$<br>2. http://www.illustrativemathematics.org/illustrations/295<br>3. http://www.illustrativemathematics.org/illustrations/294 | • http://www.illustrativemathematics.org/illustrations/1531<br>• http://www.illustrativemathematics.org/illustrations/1540<br>• http://www.illustrativemathematics.org/illustrations/263<br>• http://www.illustrativemathematics.org/illustrations/873<br>• http://learnzillion.com/lessonsets/538-solve-problems-involving-multiplication-of-fractions-and-mixed-numbers<br>• http://learnzillion.com/lessonsets/67-multiply-fractions-and-mixed-numbers |
| 5.NF.B.7c | • 3.OA.B.6<br>• 3.NF.A.1 | 1. A grandmother left $\frac{1}{5}$ of her | • http://www.illustrativemathematics.org/illustrations/833 |

| Grade Level Standard | The Following Standards Will Prepare Them | Items to Check for Task Readiness | Sample Remediation Items |
|---|---|---|---|
| | • 4.NF.B.4 | savings to each of her 6 grandchildren. What fraction of the savings did each grandchild receive?<br>a. $\frac{1}{30}$<br>2. http://www.illustrativemathematics.org/illustrations/1120 | • http://learnzillion.com/lessonsets/737-divide-whole-numbers-by-unit-fractions-and-unit-fractions-by-whole-numbers |

**During the Task:**

- Encourage students to share their answers and reasoning (with each other) to questions 1 and 2. Students should be guided to offer suggestions to each other about different ways to approach the problem. Share different approaches with the whole class and allow students to critique each other's reasoning.
- Encourage students to use visual fraction models to help answer the questions. Students can either use manipulatives or drawings for the visual models. Have students draw representations of the models to support their explanations.
- Guide students to create a table to keep track of the fraction of a gallon each jug holds for Demetrius and Brooke. This will help students stay organized as they work through the task.
- Students may have difficulty determining an amount of lemonade for Brooke in the final question. It may not be apparent at first that if she simply has more than Demetrius, her friend will receive a larger amount. Ask students to find a fraction that one of Brooke's friends could receive that would be greater than the fraction Demetrius's friends received. Then have students find the amount Brooke's jug would hold if all 6 of her friends received that same amount.

**After the Task:**

To connect this to the real world, students could be placed in groups and make lemonade in various containers. They could divide it equally among their group members. They could measure the amount each group member has. This could lead to a discussion about future jobs in the restaurant industry where they may need to determine servings in a container.

## Student Instructional Task

Demetrius and Brooke each have 5 colored jugs. They have one of each of the following colors: red, blue, yellow, green, and orange. Each of their jugs hold less than one gallon.

1. Demetrius has a red jug that is measured in sevenths of a gallon. Brooke's red jug is measured in ninths of a gallon.
    a. Give an example of what fraction of a gallon each of their jugs could hold if Brooke's red jug holds more than Demetrius's red jug. Explain your thinking.

    b. Based on your example, how much more of a gallon does Brooke's red jug hold than Demetrius's red jug? Show your work.

2. Demetrius's blue jug is measured in fourths of a gallon, and Brooke's blue jug is measured in sixteenths of a gallon.
    a. Give an example that would show their blue jugs hold the same amount. Explain your thinking.

    b. Based on your example, what is the total amount that both blue jugs would hold?

3. Brooke's yellow jug holds $\frac{3}{4}$ of a gallon. If she fills the jug four times with water and pours the water into a bucket, how much water will be in the bucket? Show how you found your answer.

4. Give an example that would show that Brooke has a green jug that holds four times more water than the green jug Demetrius has. Remember that all jugs hold less than one gallon. Explain your thinking.

5. Demetrius fills his orange jug with lemonade to share with his friends. If his jug contains $\frac{1}{2}$ of a gallon, what fraction of a gallon would each of his 6 friends receive? (Do not include Demetrius.) Show your work.

6. Brooke thinks sharing lemonade is a great idea and decides to do the same. How much lemonade could her orange jug hold in order to give her 6 friends a larger amount than Demetrius's friends received? (Remember her orange jug holds less than one gallon.) Show your work.

## Instructional Task Exemplar Response

Demetrius and Brooke each have 5 colored jugs. They have one of each of the following colors: red, blue, yellow, green, and orange. Each of their jugs hold less than one gallon.

1. Demetrius has a red jug that is measured in sevenths of a gallon. Brooke's red jug is measured in ninths of a gallon.
    a. Give an example of what fraction of a gallon each of their jugs could hold if Brooke's red jug holds more than Demetrius's red jug. Explain your thinking.

    *Sample answer:*

    *Brooke's jug could hold* $\frac{7}{9}$ *and Demetrius's jug could hold* $\frac{4}{7}$*. I can change the fractions into equivalent fractions with common denominators.* $\frac{49}{63}$*(Brooke's) >* $\frac{36}{63}$ *(Demetrius's).*

    b. Based on your example, how much more of a gallon does Brooke's red jug hold than Demetrius's red jug? Show your work.

    *Sample answer based on part a:*

    $\frac{49}{63} - \frac{36}{63} = \frac{13}{63}$ *Brooke's red jug holds* $\frac{13}{63}$ *of a gallon more than Demetrius's red jug.*

2. Demetrius's blue jug is measured in fourths of a gallon, and Brooke's blue jug is measured in sixteenths of a gallon.
    a. Give an example that would show their blue jugs hold the same amount. Explain your thinking.

    *Sample answer:*

    *Demetrius's jug holds* $\frac{3}{4}$ *and Brooke's holds* $\frac{12}{16}$*.* $\frac{3}{4}$ *is equivalent to* $\frac{12}{16}$ *because it takes four groups of four to make 16 for the denominator. Four groups of three in the numerator would make 12.*

    b. Based on your example, what is the total amount that both blue jugs would hold?

    *Sample answer based on part a:*

    $\frac{3}{4} \times 2 = \frac{6}{4} = 1\frac{2}{4} = 1\frac{1}{2}$ *Together the two blue jugs hold* $1\frac{1}{2}$ *gallons.*

    ***Note: Students may also show addition here.*

3. Brooke's yellow jug holds $\frac{3}{4}$ of a gallon. If she fills the jug four times with water and pours the water into a bucket, how much water will be in the bucket? Show how you found your answer.

    $\frac{3}{4}$ *x 4 =* $\frac{12}{4} = 3$ *There will be 3 gallons of water in the bucket.*

4. Give an example that would show that Brooke has a green jug that holds four times more water than the green jug Demetrius has. Remember that all jugs hold less than one gallon. Explain your thinking.

   *Sample answer:*

   *Demetrius has a jug that holds $\frac{1}{6}$ of a gallon. Brooke has a jug that holds $\frac{4}{6}$ of a gallon.*

   *I know that $\frac{1}{6} \times 4 = \frac{4}{6}$, so Brooke's green jug holds four times more than Demetrius's green jug.*

5. Demetrius fills his orange jug with lemonade to share with his friends. If his jug contains $\frac{1}{2}$ of a gallon, what fraction of a gallon would each of his 6 friends receive? (Do not include Demetrius.) Show your work.

   $\frac{1}{2} \div 6 = \frac{1}{2} \times \frac{1}{6} = \frac{1}{12}$ *Each of Demetrius's friends will receive $\frac{1}{12}$ of a gallon of lemonade.*

6. Brooke thinks sharing lemonade is a great idea and decides to do the same. How much lemonade could her orange jug hold in order to give her 6 friends a larger amount than Demetrius's friends received? (Remember her orange jug holds less than one gallon.) Show your work.

   *Sample answer:*

   *Her jug could hold $\frac{6}{7}$ of a gallon of lemonade. Any fraction larger than $\frac{1}{2}$ would work because if Brooke has more than $\frac{1}{2}$ of a gallon and is sharing with the same number of people as Demetrius, then each person would get more than $\frac{1}{12}$ of a gallon of lemonade.*