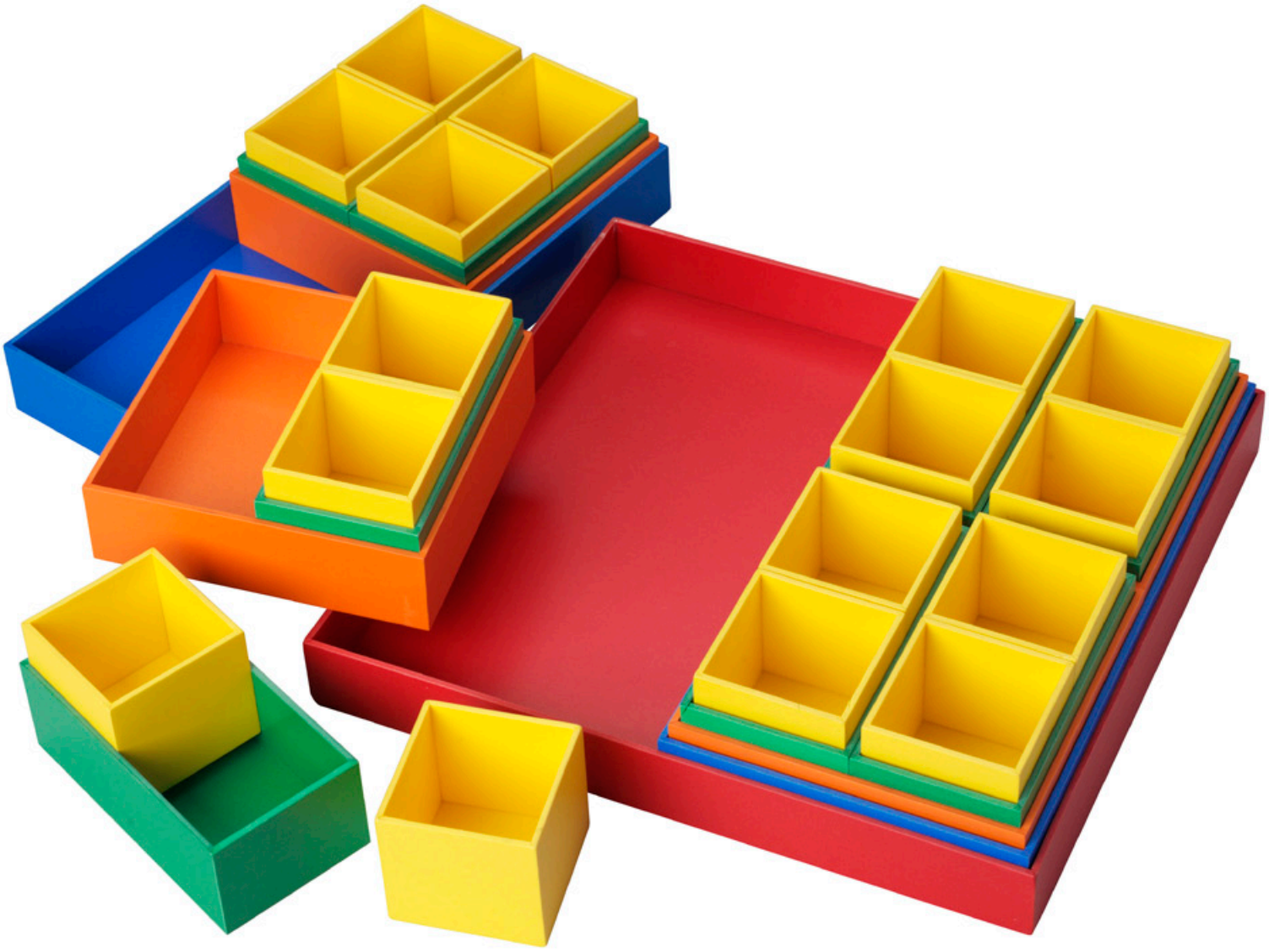
Alignment with NCTM and CCSS
Principles and Standards

Online Supplement for

Gallon / Fraction Measurement Set

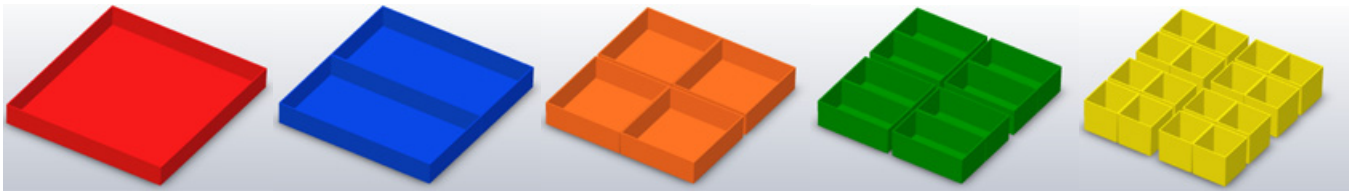


Introduction

The activities in this online supplement are designed to provide starting points for your students. We have designed the tasks in such a way that the ideas introduced will lead your students to additional exploration and investigation.
This guide has been divided in eight stages from easy to advanced. These eight stages are aligned to the NCTM Principles and Standards and CCSS.

Set of 31 measurement containers includes:

1 Gallon | 2 Half Gallons | 4 Quarts | 8 Pints | 16 Cups

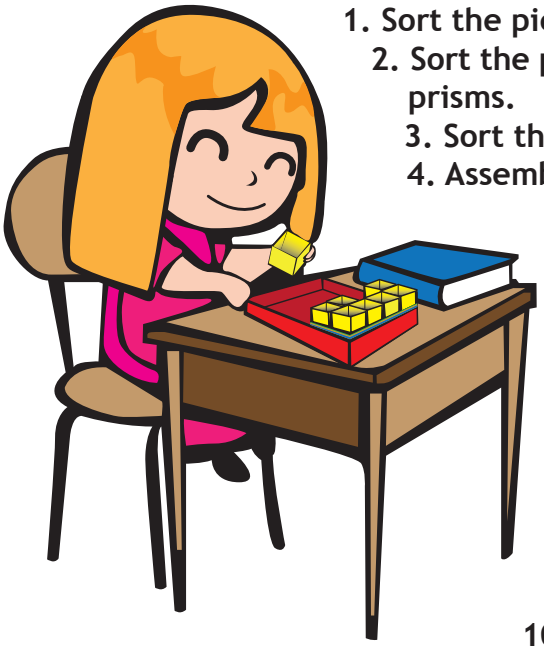


Stage 1: Free Play Exploration

CCSS Math Practice. Mp7 Look for and make use of structure
Become familiar with conversions using the Gallon/Fraction Measurement Set.

Set out the entire model for the students to break down and re-assemble. As they explore the model, they will develop familiarity with the shapes and sizes of each piece and how they fit together.

Activities for Free Play Exploration:



1. Sort the pieces by color, and compare the sets.
2. Sort the pieces by shape including near cubes and rectangular prisms.
3. Sort the pieces by size.
4. Assemble and disassemble the model.
5. Order the pieces from smallest to largest or largest to smallest.
6. Use the pieces to construct imaginary buildings, bridges, or artwork.
7. Make comparisons among and between the units.
8. Fill the containers with foam pieces, rice, sand or water and pour from one unit to another to explore measures of capacity.
9. Carefully take turns stacking the pieces so that they are stacked as high as possible without falling.
10. Stack all the pieces and take turns removing them one by one without moving the rest of the pieces.
11. Use the smaller pieces to build the larger units.
12. Predict how many of one piece will fit into a larger piece. Test out your predictions with foam, rice, sand or water.

Games for Exploration with the Gallon Fraction Measurement Set

CCSS. Math Practice. Mp2 Reason abstractly and quantitatively.
CCSS. Math Practice. Mp3 Construct viable arguments and critique the reasoning of others.

Drop It – Part 1

Allow each student to select one unit from the set. There are 31 pieces in the model set. Have the students sit facing each other in 2 rows. They should be holding the piece of the model that they have selected. Play some music as the students pass their models along clockwise. When the music stops, each student should "drop it" or place their model down in front of them gently. The students across from each other then compare models. They discuss their model as compared to their partner's model. Some questions the teacher can ask the students to discuss include:

1. Name the size of your model and your partner's model. (gallon, half-gallon, quart, pint or cup)
2. Is your model larger than, smaller than, or equal to your partner's model?
3. If your model is smaller, how many of your model do you think would fit into your partner's model?
4. If your model is larger, how many of your partner's model will fit into your model?
5. If you added your models together, what size model would you get?
6. If you subtracted your models, what size model would you get?
7. What objects would you like to fill your model with? Why?

Play the music again and have the students continue passing the models. When the music stops again, have them "drop it" and compare the two new models.

Drop It – Part 2

Have students bring in recycling from home including containers of various sizes that have been emptied and washed out. Ask them to bring in a variety of shapes and sizes to include gallons, half gallons, quarts, pints, cups, tablespoons, etc. Have the students sit facing each other in 2 rows. Have each student begin with their own container. Play some music as the students pass their containers along clockwise. When the music stops, each student should "drop it" or place their container down in front of them gently. The students across from each other then compare containers. They discuss their container as compared to their partner's container. Some questions the teacher can ask the students to discuss include:

1. Name the shapes of your containers. (round, square, rectangular, etc.)
2. Name the sizes of your containers. (gallon, half-gallon, quart, pint or cup)
3. Compare your containers, is one larger or are your containers the same size?
4. How can you tell whose container is larger?
5. How many of your containers do you think will fit into your partner's containers?
6. If you added your containers, how big would your container be?
7. If you subtracted your containers, how big would your container be?

Play the music again and have the students continue passing the containers. When the music stops again, have them "drop it" and compare the two new containers.

Drop It - Part 3

Allow half of the students to use the models and half of the students to use the containers brought from home and play "Drop It" again, using the same procedure. Here are some possible questions:

1. How are the containers different?
2. How are the containers the same?
3. How do you know if they hold the same amount of material?
4. If they hold more or less, how much more or less?
5. Experiment with foam, sand, rice or water to determine for sure if the models and containers are the same or different sizes.

Students can also use the "Drop It Recording Sheet" to write about their comparisons. Play the music again and have the students continue passing the models and containers. When the music stops again, have them "drop it" and compare the two new models and containers.

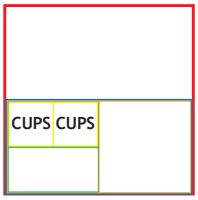
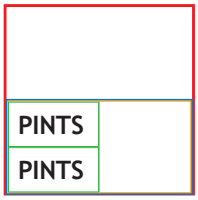
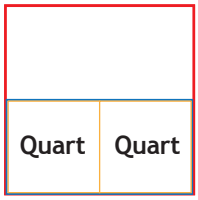
Stage 2: Practice Conversions with Trading Games

CCMS 4.MD.1. Know relative sizes of measurement units within one system of units … Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit.

Build or Break a Gallon Trading Game

Practicing Unit Conversions with the Gallon/Fraction Measurement Set (Trading Games)

1. Addition (Smallest to Largest): Use the trading mat for reference. Students flip a coin, heads=1 cup, tails = 2 cups. 2 cups trades up to 1 pint, 2 pints trades up to 1 quart, etc. The first student to obtain the gallon is the winner.
2. Subtraction with Regrouping (Largest to Smallest): Begin with the gallon. Students flip a coin, heads= -1 cup, tails =-2 cups. Students regroup and subtract until zero is reached. The first student to reach zero is the winner.

Measurement Units:	Cups	Pints	Quarts	Half Gallons	Gallon
Trading Rule:	2 cups = 1 pint	2 pints = 1 quart	2 quarts = 1 half gallon	2 half gallons = 1 gallon	1 Gallon
Trading Reference:					
For Your Record:					

CCSS. Math. Content. 3. MD. A.2. Solve problems and estimation involving measurement.
CCSS. Math. Content. 4. MD. A. 1,2
Common Core Math Standards: Solve problems involving measurement and conversion of measurements.
CCSS. Math. Practice. MP1 Make sense of problems and persevere in solving them.

Word Problems (Use with the model to solve single and multi-step word problems)

1. The students in Mrs. Fanning's 4th grade class each drank 1 cup of milk during lunch. There are 12 students in the class. How many quarts of milk did the class drink?
2. Annette uses a gallon bucket to water 4 plants. If she uses the same amount of water for each plant, how many cups of water does each plant receive?
3. Christina made some fruit punch for the class party. She used a half gallon of lime sherbet, a gallon of orange juice, a quart of kiwi juice, a pint of grape juice and two cups of lemonade. How many gallons of punch did she make for the party?
4. Emily went to the store to buy 2 gallons of milk. She plans to use three quarts to make bread pudding. She also plans to make hot chocolate for six people. Each hot chocolate mix requires one cup of milk. How much milk will be left after she finishes making the bread pudding and hot chocolate?
5. Jim is making corn chowder. He uses 3 quarts of chicken stock, 6 cups of diced potatoes, 9 cups of corn kernels, 1 pint of half and half, 1 cup of flour and 1 cup of butter. He knows that he needs to make two gallons of soup, but he is not sure if he has enough. Should he add some water? If so, how much?
6. For an oil change, a race car uses 4 gallons and a VW Beetle uses 2 quarts. How many more quarts does the race car use?

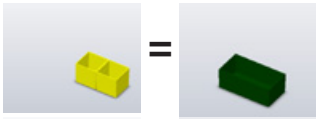
Answers: 1. 3 quarts 2. 4 cups per plant 3. 2 gallons 4. 7 pints or 14 cups 5. Yes, 1 cup 6. 14 quarts

Stage 3: Practice Equivalencies

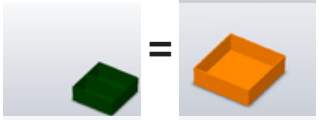
CCSS Math. Content. 5. MD. 1 Convert like measurements within a given measurement system.

Use the set to model these equivalencies.

Two cups equal _____ pint(s).

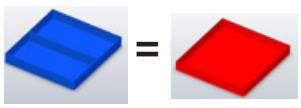


Two pints equal _____ quart(s).

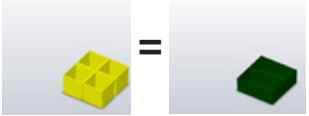


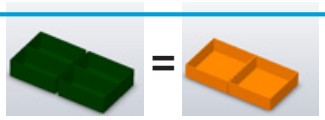
Two quarts equal _____ half gallon(s).

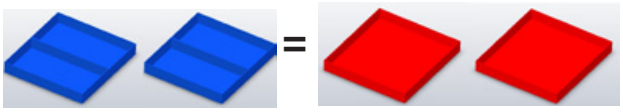
Two half gallons equal _____ gallon(s).

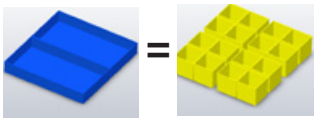


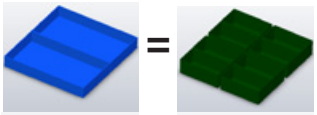
Four cups equal _____ pints(s).



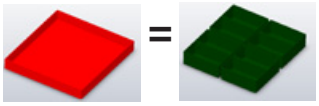
Four pints equal _____ quarts(s). 

Four half gallons equal _____ gallons(s). 

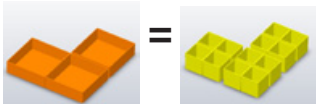
Two half gallons equal _____ cups(s). 

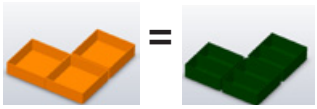
Two half gallons equal _____ pint(s). 

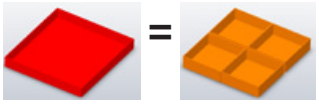
One quart equals _____ pint(s). 

One gallon equals _____ pint(s). 

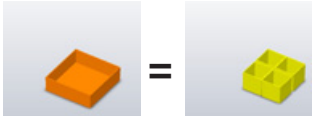
Five quarts equal _____ pint(s). 

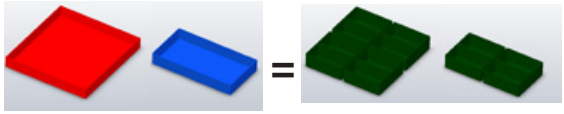
Three quarts equal _____ cup(s). 

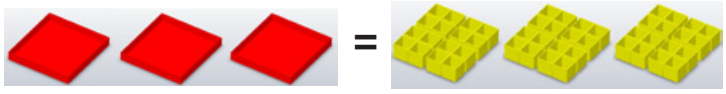
Three quarts equal _____ pint(s). 

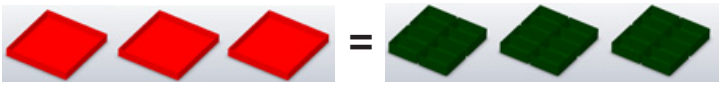
One gallon equals _____ quart(s). 

One and one half gallons equal _____ quart(s). 

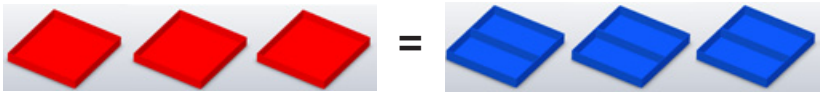
One quart equals _____ cup(s). 

One and one half gallon equals _____ pint(s). 

Three gallons equal _____ cup(s). 

Three gallons equal _____ pint(s). 

Three gallons equal _____ quart(s). 

Three gallons equal _____ half gallon(s). 

Stage 4 Applications

CCMS 5.MD.1. Convert among different-sized standard measurement units within a given measurement system … and use these conversions in solving multi-step, real world problems.

Problem Based Learning- Use the Gallon/Fraction Measurement Set Model to solve the following questions.

1. Robert drinks 1 cup of milk everyday with breakfast. How many pints of milk does Robert drink in 8 days?
2. Marianna went on a picnic with 3 friends. She brought 1 gallon of lemonade. If Marianna and her friends drink 2 quarts, how many quarts of lemonade are left?
3. The students in Mrs. Sanders's third grade class each drank 1 cup of water after recess. If there are 16 students in her class, how many total quarts did the students drink?
4. James needs 3 pints of lemon tea, 2 cups of ice water, and 2 quarts of raspberry tea to make his favorite punch. How many gallons of punch will James make?
5. There are six houseplants in Mr. Garcia's house. He likes to water each plant with one cup of water every Saturday. How many pints of water does Mr. Garcia use to water his plants on Saturday?
6. There were 6 quarts of orange juice for the party. Before the party started, two half gallons got knocked over and spilled on the floor. How many quarts of juice are left for the party?
7. The recipe for a batch of brownies calls for one cup of chocolate syrup. Christina has a one quart container of chocolate syrup. How many batches of brownies can Christina make with one quart of chocolate syrup?
8. Emily has a half gallon of milk. She needs 5 cups to make her cream of mushroom soup. Does she have enough milk?
9. We were out of milk, so mom sent me to the store to buy 3 half gallons of milk. She plans to use three quarts to make bread pudding. She also plans to make hot chocolate for all five of us. Each hot chocolate mix requires one cup of warm milk. How many cups of milk will be left after she finishes making the bread pudding and hot chocolate?
10. We are planning a class ice cream party. There are 30 students in our class. If we want each student to have one cup of ice cream, how many half gallons should we buy? The most popular flavor of ice cream in our class is chocolate, but one student does not like chocolate. Will we have any ice cream left for our teacher?

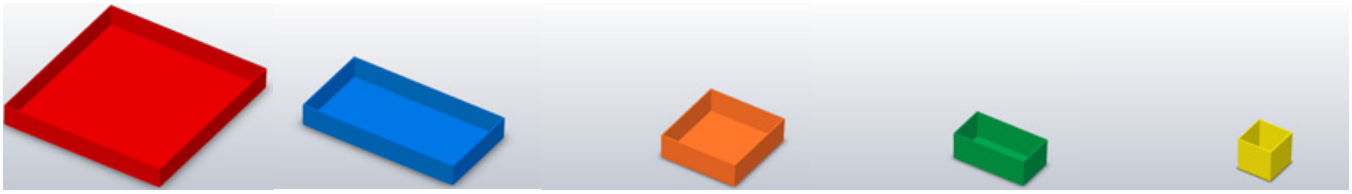
Answers: (1) 4 pints (2) 2 quarts (3) 4 quarts (4) 1 gallon (5) 3 pints (6) 2 quarts (7) 4 batches of brownies (8) yes (9) 7 cups (10) 4 gallons total, 3 half gallons of chocolate and 1 half gallon of vanilla with 2 cups left over for the teacher and room parent.

Stage 5 Equivalent Fractions Connection

CCSS. Math. Practice. MP4 model with mathematics. In this example, the region model can also be used as a set model

Use the model to find equivalent fractions with the gallon as the whole.

Gallon = 1 Half Gallon = ½ gallon Quart = ¼gallon Pint = ⅛gallon Cup = 1/16gallon



Find the equivalent fractions for a half gallon.

½ gallon = ²⁄₄ gallon (2 quarts) = ⁴⁄₈ gallon (4pints) = ⁸⁄₁₆ gallon (8 cups). Use the model to demonstrate these equivalencies.

Find the equivalent fractions for ¼ of a gallon.

¼ gallon = ¼ gallon (1 quart)= ²⁄₈ gallon (2 pints)= ⁴⁄₁₆ gallon (4 cups). Use the model to demonstrate these equivalencies.

Find the equivalent fractions for ¾ of a gallon.

¾ of a gallon = ¾ gallon (3 quarts) = ⁶⁄₈ gallon (6 pints)= ¹²⁄₁₆ gallon (12 cups). Use the model to demonstrate these equivalencies.

Mixed numbers

Find equivalent fractions for 1 and ½ gallon.

1½ gallon = ³⁄₂ gallons(3 half gallons) = ⁶⁄₄ quarts(6 quarts)= ¹²⁄₈ pints (12pints) = ²⁴⁄₁₆ cups(24 cups).

Find equivalent fractions for 1 and ¼ gallon.

1¼ gallon = ⁵⁄₄ quarts(5 quarts) = ¹⁰⁄₈ pints(10 pints) = ²⁰⁄₁₆ cups(20 cups).

Stage 6 Addition and Subtraction of Fractions

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

CCMS 5.NF.A1. 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

CCSS. Math. Practice. MP4. Model with mathematics.

CCMS 5.NFA.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

Addition

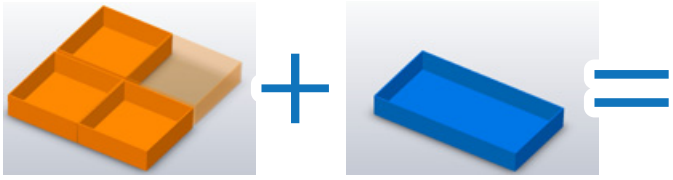
¾ + ½ =

Take ¾ of a gallon or 3 out of 4 quart pieces to show ¾^{ths}. Use the half gallon to show ½. Trade in the half gallon for 2 quarts. ½ = ²⁄₄. Add all the quarts. 3 quarts plus 2 quarts = 5 quarts. Trade in 4 quarts for a gallon and get 1 and ¼ as the answer.
There are other ways to use the model to answer this question. Here is a second way. Take 2 quarts and trade them in for a half gallon. Take 2 half gallons and trade them in for a gallon. Then you will have one gallon and one quart or 1 and ¼ gallons.

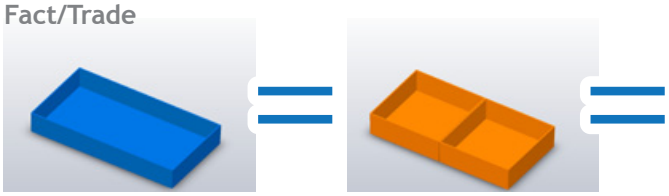
This is the problem:

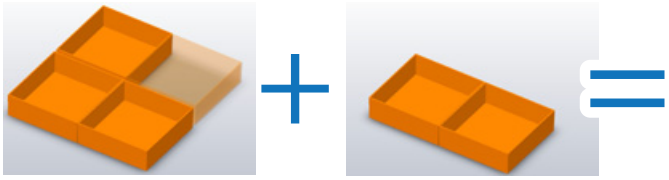
Answer:

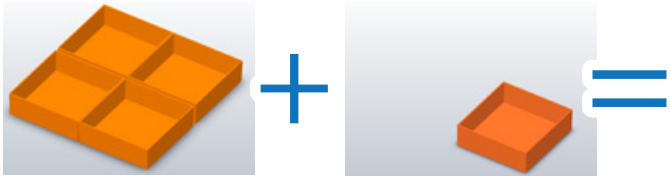
¾ ½ trade in for ²⁄₄



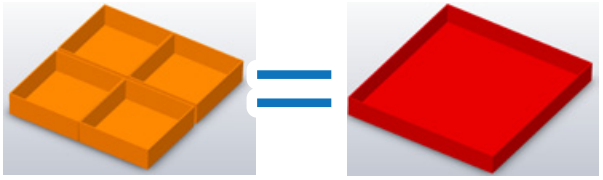
Fact/Trade



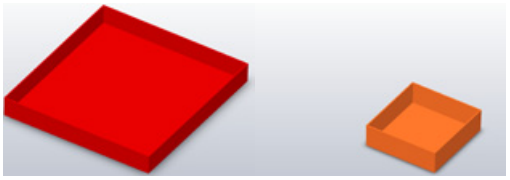




Fact/Trade



Answer:

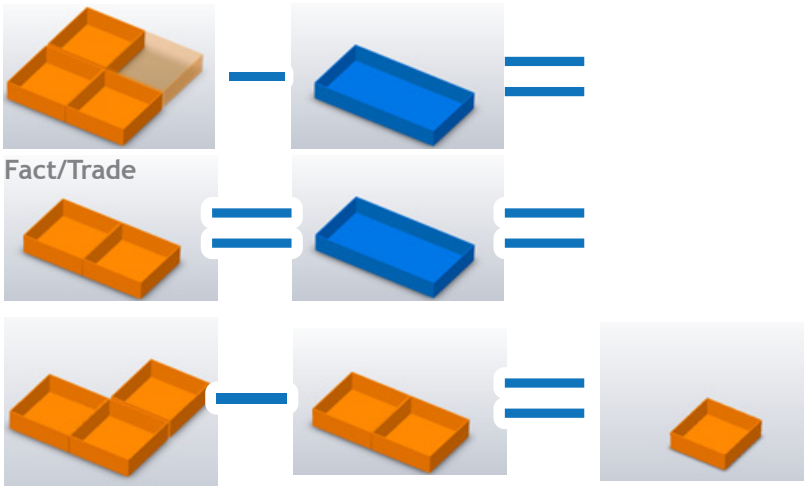


Subtraction

1) ¾ − ½ =

Take three quarts. Trade in 2 quarts for a half gallon and subtract that half gallon to get the answer of one quart = ¼. So ¾ − ½ = ¼.

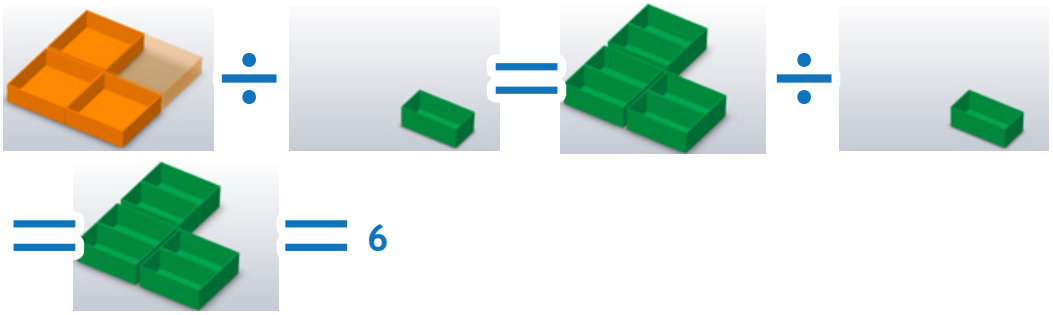
This is the problem:



Stage 7 Division of Fractions

CCSS. Math. Content. 5. NF.B.7c Solve real world problems involving divison of unit fractions by non-zero whole

¾ ÷ ⅛ =



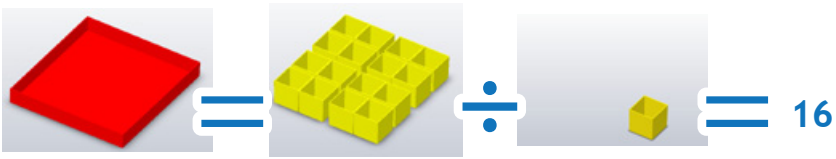
With the Gallon Fraction Measurement Set as a visual, ¾ equals 3 quart pieces. ⅛ = one pint piece. So, how many pints are in 3 quarts? A visual model shows the division principle that there are 2 pints in every quart so there are 6 pints in the 3 quarts. Numbers and division of whole numbers by unit fractions by using visual fraction models and equations to represent the problem.

The answer is 6. This demonstrates the "invert and multiply" strategy as ¾ x 8 = 6 in a highly effective visual manner.

Problem #1

We have one gallon of ice cream. How many one cup servings of ice cream do we have?

$1 \div \frac{1}{16} = 16$



Problem #2

We have $\frac{3}{4}$ gallons of milk. We need $\frac{1}{8}$ gallon of milk for our soup recipe. How many times can we make our soup recipe before we run out of milk?

$\frac{3}{4} \div \frac{1}{8} =$

Stage 8: Creativity and Synthesis

Using Higher Order Thinking: Challenge Activity

Have your students study the models and the actual containers from the recycling. Let them pick a particular size. Give your students some laminated cardstock, strong tape, rulers, and scissors. Challenge them to construct a net for a particular container size that is different in structure but not in volume from the model and the recycling materials. For example, ask them to use the cardstock to build a quart, pint, half gallon or cup. Allow the students to use the measurements from the model or the recycling to help them in their task. They can use volume calculations from the interior of the model to help them design their own container for that measurement. Volume = length x height x width. Once the containers are built, they should be able to use foam or rice to determine the accuracy of their measurement devices.

Variations in the height of the containers are due to the volume occupied by the plastic material.

Enjoy working with Fraction Measurement Set!

SI Manufacturing

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Patent Pending
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