LESSON PLAN (Linda Bolin)

Lesson Title: Modeling Multiplication and Division of Fractions

Course: Math 7 **Date**: October Lesson 4

Utah State Core Content and Process Standards:

1.4c Extend the multiplication of whole numbers to the multiplication of fractions using area models, measurement models, and the number line

1.4d Compare the division of whole numbers to the division of fractions using area or set models, the number line and missing factors

Lesson Objective(s): Use various models to represent multiplication and division of fractions

Enduring Understanding (Big Ideas):	**Essential Questions**:
Operations with fraction	• How is multiplying or dividing whole numbers similar to multiplying or dividing fractions? • How can multiplying fractions be modeled using area, a number line, or measurement models? • How can dividing fractions be modeled using area, sets, or a number line?
Skill Focus: Use models to represent multiplication and division of fractions	**Vocabulary Focus**: product, quotient, area model, dimensions, measurement model (customary: inch, foot, metric: meter, centimeter)

Materials:

- Write and Wipe Centimeter Boards or Smart Pal with centimeter paper and markers
- Rulers (with customary and metric)
- Fraction Tiles or Bars and overheads, or a sheet of construction paper, light weight card stock or heavy paper, scissors and an envelope for each student to make fraction tiles kit
- Pattern Blocks
- One 2 x 11 inch piece of paper for each student
- Worksheets: Using Fraction Tiles For Multiplying and Dividing Fractions, Folding and Inch Record, Multiplying and Dividing Fractions on a Number Line, Fractions On A Ruler, Pattern Block Area For Multiplying and Dividing Fractions, Using Rectangles For Multiplying and Dividing Fractions

Assessment (Traditional/Authentic):
Performance task, observation, questioning

Ways to Gain/Maintain Attention (Primacy):
Manipulatives, sketching, cooperative structure, technology

Written Assignment:

Content Chunks

Post and refer to vocabulary

Starter: Review

1. **Write each number as a decimal: 3/5, 4 ¾**
2. **Write in scientific notation: 43,000**
3. **Order these numbers from least to greatest, then find their approximate locations on a number line:**
   0.7, 75%, 3/5, 3/8

Lesson Segment 1: How is multiplying or dividing whole numbers similar to multiplying or dividing fractions?

Tell students that when they really understand some mathematical idea, they can explain it using pictures, diagrams, sketches, math symbols, even writing. Many careers require a person to be able to use various ways to show and explain their ideas. Ways to show or explain an idea are called **models.** We use models in mathematics all the time. Ask student pairs at a team to find a way to show (model) multiplication and division. Have them model 3 x 2 using sketches, diagrams or pictures and 6/3 as well using sketches, diagrams or pictures. Tell them they may choose to use:

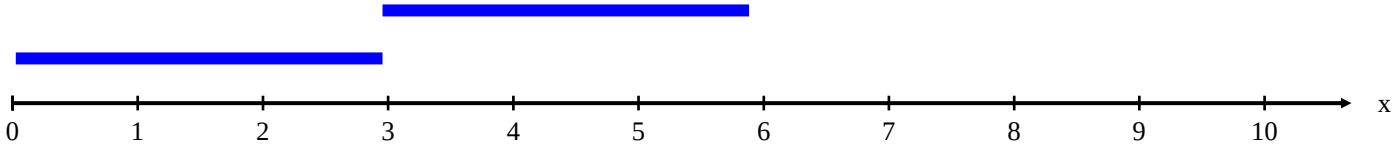
Write and Wipe centimeter boards or centimeter paper (with Smart Pal if available)
One of the number line cards (attached)
A ruler or meter stick
Objects they may want to sketch

Tell them they will be showing their model to others in the class, so we can compare some of the models. Give them a few minutes to discuss and find a way and record on their. Have the pairs show their models to another pair on their team. Have some pairs show the class. Ask students to be watching for how the approaches are similar and different. Discuss.

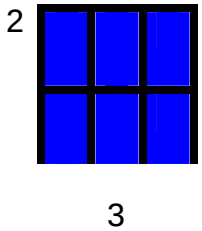
Suggest that there are many ways to model the two operations. If they have not used the following models, show these. If they have, emphasize them. Discuss how each model shows multiplying and how it shows dividing.

3 x 2 and 6/3

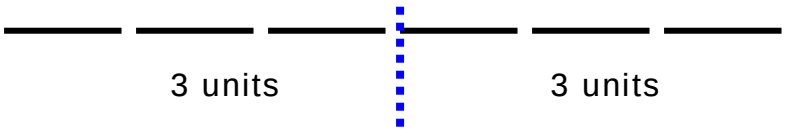
A. number line



B. area model



D. measurement model



c. set model 3 3

Multiplication of whole numbers is like repeatedly adding a number or a group *n* times to find how much is the total. How many is 3 if added 2 times? How many is two *of* three?

Division is like repeatedly subtracting a number or a group *n* times to find how many of the number or groups are in a total. How many 3's be taken out of six? How many 3's are *in* 6?

Multiplying and fractions is similar to multiplying whole numbers except we are working with parts to find how much of a whole or total we have if we repeatedly add a part.

When we are dividing fractions, we are repeatedly subtracting as well, but we are subtracting a part to find how many of one size part can be taken out of another size part or how many of one part is in the other part or the whole.

Segment 2: How can multiplying fractions be modeled using measurement and a number line? How can dividing fractions be modeled using measurement and a number line?

Using standardized lengths for parts and wholes is a measurement model. You could use either a Fraction Tiles or Bars type manipulative or have students make their own Fraction Tiles using strips of light weight card stock or construction paper. If you are using strips of lightweight card stock paper, cut an 8 ½ x 11 into widthwise strips 11 x 1-inch for each student. If you are using construction paper, cut 1- inch strips. You'll have an extra from each sheet in case the students mess up on one strip.

The students will make their own fraction bars by folding equal parts, labeling the fractional part of each and cutting the strips into those fractional parts. Each part of a strip must be the same length, so students should fold and cut carefully! Students label each part with the appropriate fraction and cut the strip as follows:

Strip 1 and 2= 2 wholes
Strip 3 = 2 halves
Strip 4 = 3 thirds
Strip 5 = 4 fourths
Strip 6 = 5 fifths
Strip 7 = 6 sixths
Strip 8 = 8 eighths
Strip 9 = 9 ninths
Strip 10 = 10 tenths
Strip 11 = 12 twelfths

Model, fold, label and cut with the students. Give each an envelope to put their fraction bars in. Overhead Fraction Tiles or Bars make this easier. As you are folding and labeling continue to ask students how many of that part are in the whole. This will reinforce parts of a whole. When cutting ask questions such as how many fourths are

in a half? Three of two sixths is how much? etc. As you do, write symbolic representations such as ½ ÷ ¼ or 3 x 2/6. Actually having students fold and cut is a very visual way to deepen concepts of fractions.

Work with the students, discussing how to visualize multiplying and dividing fractions using the attached "Using Fraction Tiles For Multiplying and Dividing Fractions" worksheet. When building each problem with the fraction tiles kit, lay the one whole piece on the desk above each problem to compare. Review the algorithms for multiplying and dividing fractions as each problem is modeled and discussed. Have the students represent the problems with their fraction tiles as well as with sketches, words and math symbols.

A ruler is also a great tool for multiplying and dividing fractions when the product or quotient will be a whole number. Ask students if they have ever seen the movie, "Honey, I Shrunk The Kids", where everything in the world seemed very magnified to the kids. Tell them they will be pretending they have been shrunken so an inch looks larger to them. Give students a strip of paper made by cutting an 8½ x 11 in 2-inch strips lengthwise. Have them fold the strip into increments of an inch to 16ths as shown in the foldable attached. As the folding is happening, ask students questions such as how many fourths in 1 whole inch? How many 16ths are in an 8th, etc. As you ask, write the question using math symbols such as 1 ÷ ¼, 1/8 ÷ 1/16, 3 x ¼ etc. Have students record your questions and answers on the Measuring an Inch Record. After the rulers are completed, have the students make up three multiplication or division problems of their own on the record paper. Two problems should be correct, but the third should be a fib. Choose a few students to write their three problems on the overhead challenging the class to "Guess the fib."

A number line can be used to help students multiply and divide fractions as well. Have the students work in pairs to complete the "Multiplying and Dividing Fractions on a Number Line" worksheet. Then have them use the TI-73 Num Line App as described to check their problems or to do other problems you may choose for practice.

Segment 3: How can multiplying fractions be modeled using area? How can dividing fractions be modeled using area?

Pattern Blocks and other area models such as rectangles or circular areas can be used to model multiplication and division. The two attached worksheets, "Pattern Blocks Area Multiplying and Dividing Fractions", and "Using Rectangles For Multiplying and Dividing Fractions" will help students connect physical models to mathematical symbols. These should be used as a basis for small group, and large group discussion. A cooperative structure such as Roving Reporter, where student teams work on a problem, then one student from each team is selected by the teacher to "rove" to another team to report what their team was thinking and how they approached the problem, is helpful in motivating engagement and discussion.

Summarize: In their journal, have students describe their favorite model for multiplying and dividing fractions and explain why this is their favorite.

Name _____

Using Fraction Tiles
For Multiplying and Dividing Fractions

Use the Fraction Tiles, sketches, mathematics symbols, and words to model each problem. Write words in the blank parentheses to represent those problems.

1a. $\frac{1}{4} \times 3$ (How much is one-fourth added 3 times?)

1b. $\frac{3}{4} \div \frac{1}{4}$ (How many one-fourths in ¾?)

2a. $\frac{2}{3} \times 2$ (How much is _____ added 2 times?)

2b. $1\frac{1}{3} \div \frac{2}{3}$ (How many _____ in _____)

3a. $1\frac{2}{10} \times 2$ (How much is $1\frac{2}{10}$ added ___ times?)

3b. $2\frac{2}{5} \div 1\frac{2}{10}$ (How many $1\frac{2}{10}$ in __ ?)

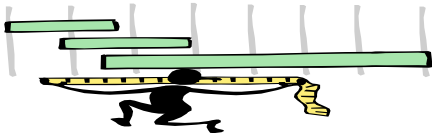
4a. $\frac{1}{2} \times \frac{1}{2}$ (How much is ____ added ____ time?)

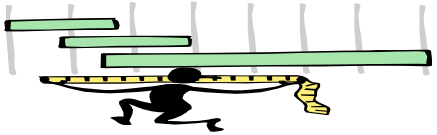
4b. $\frac{1}{4} \div \frac{1}{2}$ (How many _____ in ____?)

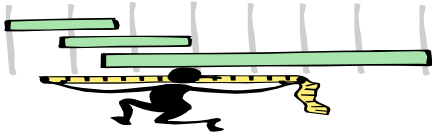
5a. $\frac{1}{2} \times \frac{1}{3}$ (How much is ____ added _____ time?)

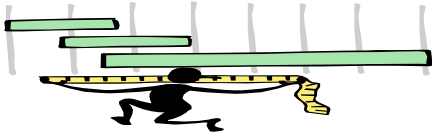
5b. $\frac{1}{6} \div \frac{1}{3}$ (How many ____ in ____?)

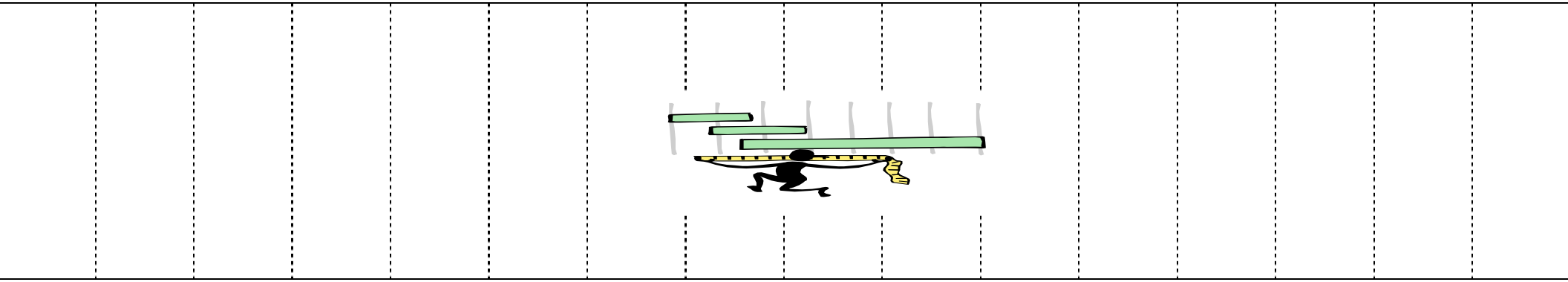
Write three problems of your own on the back. Be sure you sketch, label and draw to represent each. Find the answer to each using an algorithm.











Teacher front

0 0/2 0/4 0/8 0 /16	1/16	1/8 2/16	3/16	1/4 2/8 4/16	5/16	3/8 6/16	7/16	1/2 2/4 4/8 8/16	9/16	5/8 10/16	11/16	3/4 6/8 12/16	13/16	7/8 14/16	15/16	1 2/2 4/4 8/8 16/16

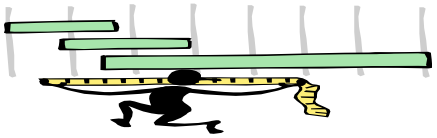
Teacher back

Folding An Inch

Tell students they have been shrunk (Honey, I Shrunk The Kids). They are looking at one inch in proportion to their new size. They will be folding and labeling parts of an inch. Have students label 0 and 1 on the inch leaving space below the numbers for them to write 5 fraction. Begin by folding the inch in half, labeling 0/2, ½, and 2/2. Then, fold the inch in half again. Label 0/4, ¼, 2/4, and 4/4. Continue folding in half labeling each part as indicated on the teacher foldable above.

Folding an Inch
Multiplying and Dividing
Fractions Record Sheet

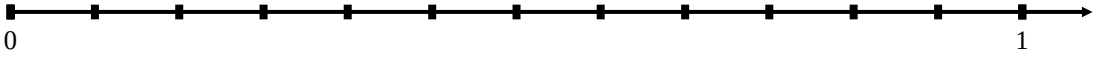
Name _____



Multiplying and Dividing Fractions on a Number Line **Name** _____

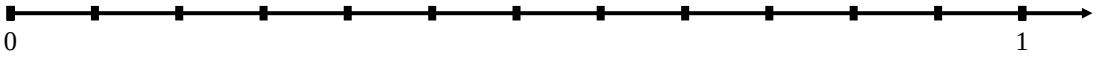
Place a large point on the number line to represent the first number in each problem. Shade the number line to model the problem and show the answer. Then, use math symbols to set up the problem and find the answer.

1. $\frac{1}{3}$ **x** 3



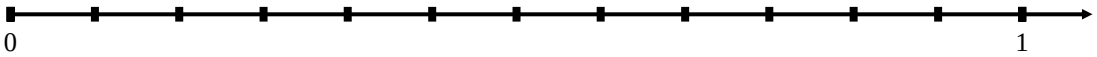
How much is $\frac{1}{3}$ added three times?

2. $\frac{1}{3}$ **x** $\frac{1}{4}$



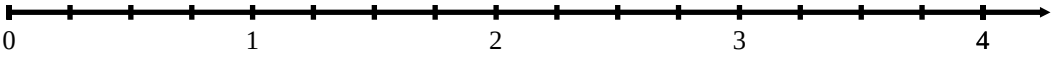
How much is $\frac{1}{3}$ added $\frac{1}{4}$ time?

3. $\frac{5}{6}$ **x** $\frac{1}{2}$



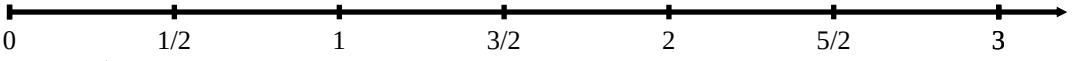
How much is $\frac{5}{6}$ added $\frac{1}{2}$ time?

4. $1\frac{1}{2}$ **x** $1\frac{1}{2}$



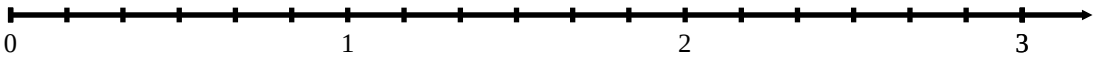
How much is $2\frac{1}{2}$ added $1\frac{1}{2}$ times?

5. $2\frac{1}{2}$ ÷ $\frac{1}{2}$



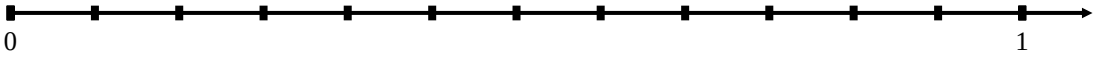
How many $\frac{1}{2}$'s in $2\frac{1}{2}$?

6. $2\frac{2}{3}$ ÷ $\frac{1}{6}$



How many $\frac{1}{6}$'s in $2\frac{2}{3}$ **?**

7. $\frac{1}{3}$ ÷ $\frac{1}{4}$

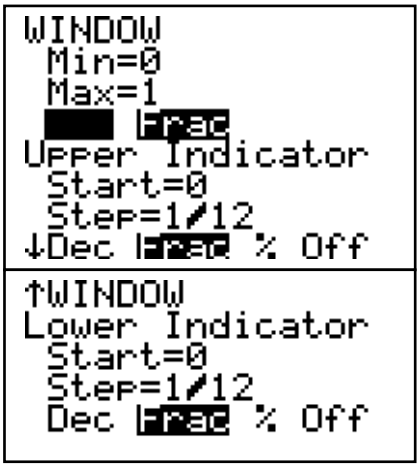


How many $\frac{1}{4}$'s in $\frac{1}{3}$?

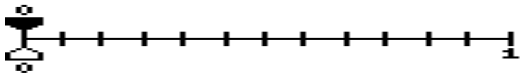
Using the Numline App On The TI-73 To Visualize
Multiplying and Dividing Fractions

You must have downloaded the Numline App to your calculator, if it is not already preloaded.

Select [APPS]. Choose Numline. In Numline, select Fraction line. Push [WINDOW] and set the window as shown below. You may select a different minimum and maximum if you want numbers greater than 1. The "Start" can be adjusted to begin at any point on the number line. The "Step" can be adjusted to be increments common to both numbers using the LCD of two numbers



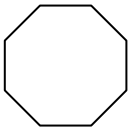
After the window is set, press [2nd] [MODE]. The screen will look like this:

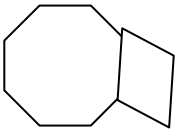


To show the first fraction, push [DRAW] and select drawLabel. Type the first fraction (using the [b/c] key). Press [ENTER] to see where that fraction is on the number line. Use the distance on the number line to predict where the answer to the problem will be located on the number line. Then type the entire problem and push [ENTER] . To begin another problem push [DRAW] and select ClearDraw and [ENTER].

Pattern Blocks Area For
Multiplying and Dividing Fractions Name _____

Trace Pattern Blocks as directed to model each. Sketch, label and find the answer. Set up an algorithm to representation each as well.

For the first column, use this as one whole 

For this column, use this as one whole 

1. $\frac{1}{2} \times 3$

2. $\frac{1}{4} \times \frac{1}{2}$

3. $\frac{1}{6} \times 4$

4. $1\frac{1}{2} \times \frac{1}{4}$

5. $1\frac{2}{3} \div \frac{1}{6}$

6. $1\frac{1}{8} \div \frac{3}{8}$

7. $1\frac{2}{3} \div \frac{2}{3}$

8. $\frac{5}{8} \div \frac{1}{4}$

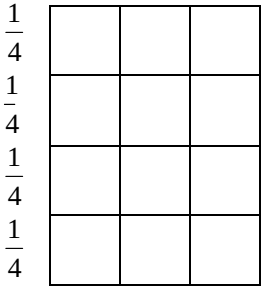
Name _____

Using Rectangles For Multiplying and Dividing Fractions

Shade the rectangle(s) to show each problem, and then use mathematics symbols to show the algorithms for multiplying and dividing.

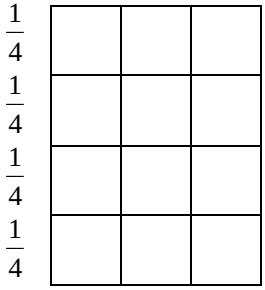
1a. $\frac{1}{4} \times 3$

(How much is ___ added ___ times?)



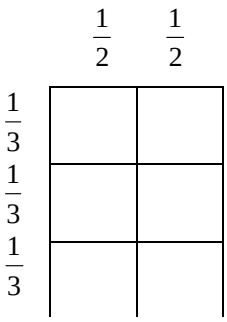
1b. $\frac{3}{4} \div \frac{1}{4}$

(How many ___ in ____?)



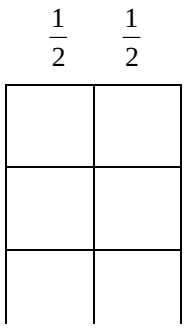
2a. $\frac{1}{2} \times \frac{1}{3}$

(How much is ___ added ____ time?)



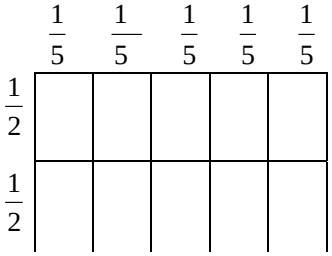
2b. $\frac{1}{6} \div \frac{1}{2}$

(How many ___ in ____?)



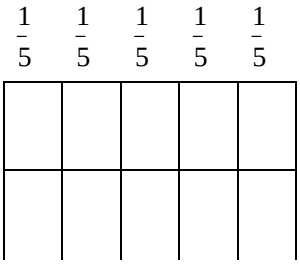
3a. $\frac{2}{5} \times \frac{1}{2}$

(How much is ___ added ___ time?)



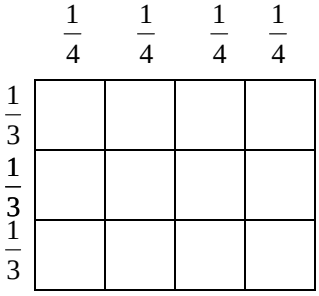
3a. $\frac{1}{5} \div \frac{2}{5}$

(How many ___ in ___?)



4. $\frac{2}{3} \times \frac{3}{4}$

(How much is ___ added ___ time?)



5. $\frac{1}{2} \div \frac{1}{4}$

(How many ___ in ___?)