LESSON PLAN #3

Name: Kevin Laley Date: March 31, 2005

Today’s Lesson: Multiplying Fractions

Unit Topic: Applying Fractions Course: Math 7

NYS Mathematics, Science, and Technology Learning Standards Addressed

Standard 1: Students will use mathematical analysis, scientific inquiry, and engineering design, as appropriate, to pose questions, seek answers, and develop solutions.

Standard 3: Students will understand mathematics and become mathematically confident by communicating and reasoning mathematically, by applying mathematics in real-world settings, and by solving problems through the integrated study of number systems, geometry, algebra, data analysis, probability, and trigonometry.

Standard 6: Students will understand the relationships and common themes that connect mathematics, science, and technology and apply the themes to these and other areas of learning.

Standard 7: Students will apply the knowledge and thinking skills of mathematics, science, and technology to address real-life problems and make informed decisions.

Objectives:

• The student will be able to use the “Rectangle Multiplication” program at the Virtual Manipulative Website and will be able to use it to evaluate the product of two fractions (Application)

• The student will construct a “rule” for multiplying fractions and will be able to evaluate the product of two fractions algebraically. (Synthesis)

Materials:

• One computer terminal (with working Internet connection) for each student (20 total).
• One red crayon (or colored pencil) and one blue crayon (or colored pencil) for each student (20 red, 20 blue).
• One “Multiplying Fractions – Exploration” packet for each student (20).
• One “Multiplying Fractions – Homework” sheet for each student (20).
• Marker Board/Marker Board Markers
Anticipatory Set:

For this class, students will meet in the computer lab. When they arrive, have them sit at stations next to one another so they are near other students if they need help with the lesson. Once everyone is seated, hand out one “Multiplying Fractions – Exploration” packet to each student, along with one red crayon and one blue crayon to each student.

Once everyone has a packet, read the top of the first page aloud: “Multiplication describes when equal groups of things are combined together. For example, the figure on the first page shows how many total circles there are when four groups of three each are combined.”

Fill in the section marked “Answer” together, asking for volunteers. \( H \) (Throughout this lesson, see the attached “Answer Key” for answers to questions printed on the handout. The symbol \( H \) will be used to denote answers found on the key.) Next, ask a student if they can describe how we can think of this situation in words. \( H \)

Tell students that another way to perform multiplication exercises like this is to use a strategy called “rectangle multiplication.” Show students how they can multiply 4 x 3 with rectangle multiplication on the front marker board by following the steps printed on the handout. \( H \) Make sure students are copying down the figure you draw on their packets as you go through it.

Say, “Today, you are going to use a variation of Rectangle Multiplication to find out how to multiply two fractions together.”

Lesson Body

Tell students that they will have until ten minutes before the end of class to complete the remainder of the packet up to the section labeled “Summing Up.” They will be using a website called “Virtual Manipulatives” with the goal of finding an answer to the question of the day: “Can you find a rule for multiplying fractions?” All the instructions they’ll need are printed in the packet.

As students begin working, filter throughout the classroom to make sure everyone is staying on task. Specifically, you may want to stop about 3 or 4 minutes into the activity to ask “Has everyone been able to get to the website and open up the program Rectangle Multiplication?” If any student has not, help them get to where they need to be.

Also, keep a close watch on the time. After about 10 minutes, tell them they should be starting Exploration A. After another 15 minutes, tell them they should be on Exploration B. When there is ten minutes left before the end of class, ask students to stop wherever they are, close out of the program, and turn off their monitors.

Go over questions (a)-(g) in the packet, asking for volunteers for each question. \( H \) Tell students if they do not have the correct answers, now is the time to be filling them in. These are the essential questions of the lesson. Draw special attention to question (e):
(e) Based on your findings, make a generalization about what happens to the products when you switch the order two fractions are multiplied. (*Switching the order the two fractions are multiplied does not change the product.*)

**Closure**

Complete the “Summing Up” section of the packet as a class. Ask, “Looking back at your answers to (e) and (g), can anyone come up with a “rule” for multiplying fractions?” (*To multiply two fractions together, multiply across the numerators and across the denominators.*)

Make sure each student writes something to this effect on their packet, as this is the goal of the lesson. Hand out the worksheet labeled “Multiplying Fractions – Homework” to each student.

**Accommodations for IEP:**

I anticipate this lesson to be well-suited for the student with ADD, because it should keep him busy working throughout the period. I will pay close attention to him as I walk throughout the class and make sure he is at the same point the rest of the class is. If he is extra-restless today, I will have him come up to the board while we are going over questions (a)-(g) to draw his diagrams of the grids, as asked in the packet.

**Homework/Assessment**

The homework for this lesson is the worksheet titled “Multiplying Fractions – Homework.” This handout first asks students to restate the rule for multiplying fractions (they should all have this in their notes from class), as well as using the tactic of rectangle multiplication to find the product of two fractions. The homework also takes the lesson one step further: multiplying fractions analytically. Students should be able to complete this from today’s lesson, using the rule they came up with for multiplying fractions.

**Extensions**

If students finish the packet early, have them explore the “Test Me” function of the Rectangle Multiplication program by clicking the button next to “Test Me” on the screen. This activity gives students a fraction to compute by using the strategy taught in this lesson. Once students think they have the correct answer, they can click the “Check” button to see if they are correct. If they are, they are given the option to compute another product. Otherwise, they are given a hint as to how to correct their mistake.
Warm-Up

Multiplication describes events when equal groups of things are combined together.

Example: How many circles are there when four groups of three circles each are combined together?

Answer: _____ (groups) \( \times \) _____ (circles per group) = _____ (total circles)

In words, we think of this situation as:

Another way to perform simple multiplication with whole numbers such as these is to use rectangle multiplication. Let's practice this by performing the following steps in the space at the bottom of the page.

1. To multiply 4 \( \times \) 3, first draw a rectangle with length 4 and width 3.
2. Draw lines through the rectangle dividing the length into 4 equal sections.
3. Draw lines through the rectangle dividing the width into 3 equal sections.
4. Count the number of small rectangles that were created by the lines drawn in steps 2 and 3.
5. This number is the answer to 4 \( \times \) 3 ☺
Activity

Question of the day? Can you find a rule for multiplying fractions?

- On the start menu, go to Programs > Internet Tools > Internet Explorer
- Wait for the browser to load.
- In the Address field, type http://matti.usu.edu/nlvm/nav/category_g_3_t_1.html
- Scroll down until you find the link that says “Fractions – Rectangle Multiplication.” Click on this link.
- A new window should come up that looks like the figure below:

- Make sure the bullet next to “Proper Fractions” is selected, as well as the bullet next to “Show Me”
- The grid shows two fractions multiplied together by showing one fraction in red on the left and another in blue on the bottom of the grid. The area of the overlapping region shown in purple is the product of the fractions.
- The equations to the right of the grid show the same product that is represented on the grid.

Example: In the image above, we are multiplying \( \frac{1}{3} \times \frac{1}{3} \). How can we think of this situation in words? (If you need a hint, look back to our example at the beginning of class.)
On the grid, the red shaded area represents \( \frac{1}{3} \) of the entire grid. The blue shaded area also represents \( \frac{1}{3} \) of the entire grid. Notice to the right of the grid, the fraction represented in blue is written in blue. Similarly, the fraction represented in red on the grid is written in red. The product of these two fractions \( \left( \frac{1}{3} \times \frac{1}{3} \right) \) is represented by the purple shaded area on the grid.

What fraction of the grid is represented by the purple region? : _________________________

Your answer above should correspond with the fraction that is written in purple to the right of the grid. If it doesn't, take another look at the grid and see if you can figure out why the purple shaded region represents 1/9 of the entire grid. If you can't, ask the person next to you for help or raise your hand.

Take another look at the fractions written to the right of the grid. Notice in the first line, the blue fraction is written first and the red fraction is written second. Beneath that, the red fraction is written first and the blue fraction is written second. Does the product of these two fractions change when you change the order the fractions are written in? __________________________

Exploration A:
- Next, let's examine the relationship \( \frac{4}{5} \times \frac{1}{7} \).
- Change the denominator on the left to 5 by clicking on the blue arrows to the left of the grid until the denominator in the fraction next to them is 5. Change the denominator on the bottom to 7 by clicking the blue arrows beneath the grid until the denominator of the fraction next to them is 7.
- Change the numerator on the left to 4 by dragging the "slider" (black box) to the left of the grid until the fraction next to it reads \( \frac{4}{5} \). Change the numerator on the bottom to 1 to dragging the "slider" beneath the grid until the fraction next to it reads \( \frac{1}{7} \).
- Check to make sure you see “\( \frac{4}{5} \) of \( \frac{1}{7} \)” written in black near the top right corner. If you don't, repeat the previous two steps again.

Draw the grid (with the correct boxes shaded) below:
(a) What fraction of the entire grid to the purple squares represent? : ____________________

(Remember that the purple squares represent the product of the two fractions.)

(b) Notice what is written beneath the black writing that says “$\frac{4}{5}$ of $\frac{1}{7}$”. Copy what you see in the space below:

- Now, set up $\frac{1}{7}$ to the left of the grid and $\frac{4}{5}$ beneath the grid. (If you need reminding on how to set up these fractions, look back to the instructions at the beginning of Exploration A.)

Draw the grid (with the correct boxes shaded) below:

(c) What fraction of the entire grid to the purple squares represent? : ____________________

(d) What do you notice about your answers to (a) and (c)? : ________________________________

(e) Based on your findings here, make a generalization about what happens to the products when you switch the order two fractions are multiplied: (i.e. $\frac{4}{5} \times \frac{1}{7}$ and $\frac{1}{7} \times \frac{4}{5}$)
Exploration B:
- Click on the button next to "Improper Fractions" beneath the grid.
- Set up the expression $\frac{11}{6} \times \frac{2}{3}$. (If you need help on how to do this, refer back to the steps in Exploration A for setting up the fractions.)
- Notice that the entire grid is now split up into 4 "mini-grids" (separated by the bold black lines).
  So, the big grid from exploration A is now one "mini-grid." Count the number of rectangles in one of these "mini-grids": ______________

(f) Write the # of purple rectangles over the total number of rectangles in one mini-grid:

__________________

(g) Notice what is written beneath the black writing that says $\frac{11}{6}$ of $\frac{2}{3}$. Copy what you see in the space below:

Ø

➢ Summing Up

Look back at your answers to (e) and (g). Based on these observations, try to come up with a "rule" for multiplying fractions:
Name: ___________________________  Multiplying Fractions - Homework

Date: ___________________________

➢ Explain (in words) how you would tell someone to multiply fractions.

➢ Use the rectangle multiplication method to compute each of the following products. (Shade in the appropriate squares in the grids provided in #1-2. In #3, you will have to draw your own grid.)

1. \( \frac{5}{7} \times \frac{3}{4} = \)

2. \( \frac{1}{2} \times \frac{2}{5} = \)

3. \( \frac{1}{4} \times \frac{5}{6} = \)

➢ Compute each product algebraically:

4. \( \frac{1}{9} \times \frac{7}{8} = \)

5. \( \frac{9}{7} \times \frac{2}{3} = \)

6. \( \frac{1}{3} \times \frac{3}{4} = \)

7. \( \frac{1}{6} \times 3 = \)
Warm-Up

Multiplication describes events when equal groups of things are combined together.

Example: How many circles are there when four groups of three circles each are combined together?

Answer: \[4\text{ (groups)} \times 3\text{ (circles per group)} = 12\text{ (total circles)}\]

In words, we think of this situation as:

4 (groups) of 3 (each) equals 12 total.

Another way to perform simple multiplication with whole numbers such as these is to use rectangle multiplication. Let’s practice this by performing the following steps in the space at the bottom of the page.

1. To multiply 4 \(\times\) 3, first draw a rectangle with length 4 and width 3.
2. Draw lines through the rectangle dividing the length into 4 equal sections.
3. Draw lines through the rectangle dividing the width into 3 equal sections.
4. Count the number of small rectangles that were created by the lines drawn in steps 2 and 3.
5. This number is the answer to 4 \(\times\) 3

\[
\begin{array}{cccc}
1 & 2 & 3 & 4 \\
5 & 6 & 7 & 8 \\
9 & 10 & 11 & 12 \\
\end{array}
\]

4

12 total, so 4 \(\times\) 3 = 12
Activity

**Question of the day?** Can you find a rule for multiplying fractions?

- On the start menu, go to Programs > Internet Tools > Internet Explorer
- Wait for the browser to load.
- In the Address field, type [http://matti.usu.edu/nlvm/nav/category_g_3_t_1.html](http://matti.usu.edu/nlvm/nav/category_g_3_t_1.html)
- Scroll down until you find the link that says “Fractions – Rectangle Multiplication.” Click on this link.
- A new window should come up that looks like the figure below:

![Multiplication of Fractions](http://matti.usu.edu/nlvm/nav/category_g_3_t_1.html)

- Make sure the bullet next to “Proper Fractions” is selected, as well as the bullet next to “Show Me”
- The grid shows two fractions multiplied together by showing one fraction in red on the left and another in blue on the bottom of the grid. The area of the overlapping region shown in purple is the product of the fractions.
- The equations to the right of the grid show the same product that is represented on the grid.

**Example:** In the image above, we are multiplying $\frac{1}{3} \times \frac{1}{3}$. How can we think of this situation in words? (If you need a hint, look back to our example at the beginning of class.)

$\frac{1}{3}$ of $\frac{1}{3}$ is what?
On the grid, the red shaded area represents $\frac{1}{3}$ of the entire grid. The blue shaded area also represents $\frac{1}{3}$ of the entire grid. Notice to the right of the grid, the fraction represented in blue is written in blue. Similarly, the fraction represented in red on the grid is written in red. The product of these two fractions ($\frac{1}{3} \times \frac{1}{3}$) is represented by the purple shaded area on the grid.

What fraction of the grid is represented by the purple region? : __________$1/9$____________

Your answer above should correspond with the fraction that is written in purple to the right of the grid. If it doesn’t, take another look at the grid and see if you can figure out why the purple shaded region represents $1/9$ of the entire grid. If you can’t, ask the person next to you for help or raise your hand.

Take another look at the fractions written to the right of the grid. Notice in the first line, the blue fraction is written first and the red fraction is written second. Beneath that, the red fraction is written first and the blue fraction is written second. Does the product of these two fractions change when you change the order the fractions are written in? __________no______________

**Exploration A:**

- Next, let’s examine the relationship $\frac{4}{5} \times \frac{1}{7}$.
- Change the denominator on the left to 5 by clicking on the blue arrows to the left of the grid until the denominator in the fraction next to them is 5. Change the denominator on the bottom to 7 by clicking the blue arrows beneath the grid until the denominator of the fraction next to them is 7.
- Change the numerator on the left to 4 by dragging the "slider" (black box) to the left of the grid until the fraction next to it reads $\frac{4}{5}$. Change the numerator on the bottom to 1 to dragging the "slider" beneath the grid until the fraction next to it reads $\frac{1}{7}$.
- Check to make sure you see “$\frac{4}{5}$ of $\frac{1}{7}$” written in black near the top right corner. If you don’t, repeat the previous two steps again.

**Draw the grid (with the correct boxes shaded) below:**

![Grid with shaded boxes](image_url)
(a) What fraction of the entire grid to the purple squares represent? : ___4/35_________

(Remember that the purple squares represent the product of the two fractions.)

(b) Notice what is written beneath the black writing that says “\( \frac{4}{5} \) of \( \frac{1}{7} \).” Copy what you see in the space below:

\[
\frac{4}{5} \times \frac{1}{7} = \frac{4}{35} = \frac{4 \times 1}{5 \times 7} \\
\frac{1}{7} \times \frac{4}{5} = \frac{4}{35} = \frac{1 \times 4}{7 \times 5}
\]

- Now, set up \( \frac{1}{7} \) to the left of the grid and \( \frac{4}{5} \) beneath the grid. (If you need reminding on how to set up these fractions, look back to the instructions at the beginning of Exploration A.)

Draw the grid (with the correct boxes shaded) below:

(c) What fraction of the entire grid to the purple squares represent? : ___4/35_________

(d) What do you notice about your answers to (a) and (c)? : __they’re the same___________

(e) Based on your findings here, make a generalization about what happens to the products when you switch the order two fractions are multiplied: (i.e. \( \frac{4}{5} \times \frac{1}{7} \) and \( \frac{1}{7} \times \frac{4}{5} \))

Switching the order the two fractions are multiplied does not change the product.
Exploration B:
- Click on the button next to "Improper Fractions" beneath the grid.
- Set up the expression $\frac{11}{6} \times \frac{2}{3}$. (If you need help on how to do this, refer back to the steps in Exploration A for setting up the fractions.)
- Notice that the entire grid is now split up into 4 "mini-grids" (separated by the bold black lines). So, the big grid from exploration A is now one "mini-grid." Count the number of rectangles in one of these "mini-grids": ____18_____

(f) Write the # of purple rectangles over the total number of rectangles in one mini-grid:

____22/18_____

(g) Notice what is written beneath the black writing that says "$\frac{11}{6}$ of $\frac{2}{3}$". Copy what you see in the space below:

\[
\frac{11}{6} \times \frac{2}{3} = \frac{22}{18} = \frac{11 \times 2}{6 \times 3} \\
\frac{2}{3} \times \frac{11}{6} = \frac{22}{18} = \frac{2 \times 11}{3 \times 6}
\]

➢ Summing Up

Look back at your answers to (e) and (g). Based on these observations, try to come up with a "rule" for multiplying fractions:

To multiply two fractions together, multiply across the numerators and across the denominators.

\[
\frac{a}{b} \times \frac{c}{d} = \frac{a \times c}{b \times d}
\]