Multiplying Fractions
The Area Model

• Follows Area Model for Multiplication of Whole Numbers

• A visual model that assists in learning the standard algorithm

• Extends easily to multiplying mixed numbers

• Natural extension to Algebra
Example 1

Mariela would like to share her Kit Kat bar with 3 friends. How could she divide it equally? How much of the whole candy bar does each one get?
Each would get $\frac{1}{4}$ of the candy bar
Example 2

Mariela has made more friends. How could she divide the Kit Kat bar equally with 11 friends? What part of the whole candy bar would each one get?
Mariela could cut each of the long sticks into 3 equal pieces or she could make the 5 cuts shown above.
So, there are 12 pieces, each would get 1/12 of the Kit Kat bar.
How can we model the following fraction multiplication problem with the Kit Kat bar?

\[
\frac{1}{3} \cdot \frac{1}{4}
\]
First split the candy bar lengthwise into 4 equal pieces as shown. This gives us pieces of $\frac{1}{4}$ each.
Next, split the candy bar into 3 equal pieces of 1/3 each
\[
\frac{1}{3} \text{ of } \frac{1}{4} = \frac{1}{12}
\]
Exercise 1 – Use an area model to show the solution to the following multiplication of fractions problem:

\[
\frac{1}{3} \cdot \frac{3}{4}
\]
Drag the upper left corner of the blue square to move it over the red square.
Use an area model to multiply the fractions

1. \( \frac{1}{3} \cdot \frac{2}{5} = \)

2. \( \frac{2}{3} \cdot \frac{3}{4} = \)

3. \( \frac{3}{4} \cdot \frac{3}{5} = \)

4. \( \frac{2}{3} \cdot \frac{1}{2} = \)
1. \[ \frac{1}{3} \cdot \frac{2}{5} = \]

**Multiplying Fractions - Area Model**

Drag the upper left corner of the blue square to move it over the red square.
2. \[ \frac{2}{3} \cdot \frac{3}{4} = \]

**Multiplying Fractions - Area Model**

\[ \frac{2}{3} \times \frac{3}{5} = \frac{6}{15} \]

*Drag the upper left corner of the blue square to move it over the red square.*
3. \( \frac{3}{4} \cdot \frac{3}{5} = \)

**Multiplying Fractions - Area Model**

\[
\frac{3}{4} \times \frac{3}{5} = \frac{9}{20}
\]

*Drag the upper left corner of the blue square to move it over the red square.*
4. \[ \frac{2}{3} \cdot \frac{1}{2} = \]

**Multiplying Fractions - Area Model**

Drag the upper left corner of the blue square to move it over the red square.
What do you think the answer should be?

\[
\frac{a}{b} \cdot \frac{c}{d} = ?
\]
\[
\frac{a}{b} \cdot \frac{c}{d} \equiv \frac{a \cdot c}{b \cdot d}
\]

Multiply straight across

\[
\frac{4}{7} \cdot \frac{3}{5} \equiv \frac{4 \cdot 3}{7 \cdot 5} = \frac{12}{35}
\]
Multiplying Fractions - Area Model

\[ \frac{4}{7} \times \frac{3}{5} = \frac{12}{35} \]

Drag the upper left corner of the blue square to move it over the red square.
Can you use an area model to come up with a solution?

\[
\begin{array}{c}
1 \\
3 \\
\end{array} \cdot \begin{array}{c}
3 \\
2 \\
\end{array} = \begin{array}{c}
3 \\
\end{array}
\]
Multiplying Mixed Numbers with an Area Model

$3 \cdot 2 \frac{1}{2}$
\[
3 \cdot 2 \frac{1}{2} = 3 \cdot \left(2 + \frac{1}{2}\right) \\
= 3 \cdot 2 + 3 \cdot \frac{1}{2} \\
= 6 + 1\frac{1}{2} \\
= 7\frac{1}{2}
\]
Solve these problems. Use words and drawings to explain how you got your answer.

1. You have $\frac{3}{4}$ of a pizza left. If you give $\frac{1}{3}$ of the leftover pizza to your brother, how much of a whole pizza will your brother get?

2. Someone ate $\frac{1}{10}$ of the cake, leaving only $\frac{9}{10}$. If you eat $\frac{2}{3}$ of the cake that is left, how much of a whole cake will you have eaten?

3. Gloria used 2 $\frac{1}{2}$ tubes of blue paint to paint the sky in her picture. Each tube holds $\frac{4}{5}$ ounce of paint. How many ounces of blue paint did Gloria use?