INCLUSION IN TEXAS

Instructional Routines for Mathematics Intervention

The purpose of these mathematics instructional routines is to provide educators with materials to use when providing intervention to students who experience difficulty with mathematics. The routines address content included in the grades 2-8 Texas Essential Knowledge and Skills (TEKS). There are 23 modules that include routines and examples – each focused on different mathematical content. Each of the 23 modules include vocabulary cards and problem sets to use during instruction. These materials are intended to be implemented explicitly with the aim of improving mathematics outcomes for students.

TEA
Texas Education Agency

Instructional Routines for Mathematics Intervention

MODULE 12

Multiplication of Rational Numbers

Module 12: Multiplication of Rational Numbers

Mathematics Routines

A. Important Vocabulary with Definitions

Term	Definition
algorithm	A set of steps to solve a problem.
decimal	A number based on powers of ten.
denominator	The term in a fraction that tells the number of equal parts in a whole.
equal groups	Groups with the same number of objects or items in each group.
equal sign	The symbol that tells you that two sides of an equation are the same, balanced, or equal.
equivalent	Two numbers that have the same value.
factor	A number that you multiply with another number to get the product.
fraction	A number representing part of a whole or set.
hundredths	The digit in representing $\frac{1}{100}$.
improper fraction	Any fraction in which the numerator is greater than the denominator.
mixed number	A whole number and a fraction combined.
multiply/multiplication	The process of adding a number to itself a number of times.
multiplication sign	The symbol that tells you to multiply.
numerator	The term in a fraction that tells how many parts of a fraction.
ones	The digit representing 1.
partial products	The product of parts of each factor.
product	The result of multiplying two or more factors.
regroup/trade/exchange	The process of exchanging 10 ones for 1 ten, 10 tens for 1 hundred, 10 hundreds for 1 thousand, etc.
tenths	The digit in representing $\frac{1}{10}$.

B. Background Information

Background Information:
In this module, we focus on multiplication with fractions and decimals. As you focus on computation of rational numbers, continue to emphasize multiplication as equal groups and multiplication as comparison because students will see these concepts within word problems.

For multiplication of fractions, we recommend using several models of fractions to help students understand concepts related to multiplication of fractions. We also recommend demonstrating several algorithms for multiplication of decimals. Every student should develop efficiency with strategies for multiplication of fractions and decimals. In the following sections, we provide examples of (1) multiplication of fractions, (2) multiplication of decimals with the traditional algorithm, and (3) multiplication of decimals with the partial products algorithm.

C. Routines and Examples

(1) Multiplication of Fractions*

*Most students know the *procedure* for multiply decimals but do not have *conceptual* understanding of multiplication of fractions. Here, we provide two conceptual **Routines** (one with manipulatives and one with drawings) as well as a procedural **Routine**. Our **Example** is conceptual and uses manipulatives. Consider reading the **Example** before reading the **Routines**.

Routine

Materials:

- Module 12 Problem Sets
- Module 12 Vocabulary Cards
    - If necessary, review Vocabulary Cards before teaching
- A hands-on tool or manipulative like fraction tiles or two-color counters
    - Note that drawings can be used alongside or instead of manipulatives

ROUTINE WITH MANIPULATIVES
(Only use manipulatives with simpler problems)

Teacher	**Let's work on multiplication. What does it mean to multiply?**
Students	To make equal groups or to compare.
Teacher	**Multiplication means to make equal groups or to compare. Look at this problem.** (Show problem.)
Teacher	**First, I see a multiplication sign** (point). **The multiplication sign tells us to multiply. What does the multiplication sign mean?**
Students	To multiply.

Teacher	**Let's do this problem with fraction tiles.** (Move fraction tiles to workspace.)
Teacher	**With multiplication of fractions, we interpret this problem as __** (first fraction) **of __** (second fraction). **How do we interpret this problem?**
Students	__ of __.
Teacher	**We want to determine __** (first fraction) **of __** (second fraction)**. If you wanted to determine half of 8, you would show 8 and then find half of that amount. The same works with fractions. We'll show the second fraction (or factor) and then find the first fraction of the second fraction. Which fraction will we show?**
Students	Second fraction.
Teacher	**So, let's show the second fraction with the fraction tiles.** (Show second fraction with fraction tiles.)
Teacher	**Now, let's find __** (first fraction) **of __** (second fraction)**. There are several ways to do this, but an easy way is to find __** (first fraction) **of each one-__** (second fraction denominator) **part. Let's focus on one-__ part at a time. What should we focus on?**
Students	One-__ part.
Teacher	**Let's just think about this one-__ part** (second fraction denominator)**. What's __** (first fraction) **of this part?**
Students	__.
Teacher	**If that's hard to answer, think about it this way. What's __** (first fraction) **times one-__** (second fraction denominator)**?**
Students	__.
Teacher	**__** (first fraction) **of this one-__ part** (second fraction denominator) **would be __. Let's place that/those fraction tiles on top of the one-__ part.** (Place fraction tiles.)
Teacher	**Now, I do that again for each one-__ part. I find __** (first fraction) **of each one-__ part.** (Place fraction tiles.)
Teacher	**We're multiplying by finding __** (first fraction) **of each of the one-__ parts. How are we multiplying?**
Students	Finding __ (first fraction) of each of the one-__ parts.
Teacher	**We've determined __** (first fraction) **of each of the one-__ parts with the fraction tiles, these are our partial products. What are these?**
Students	Partial products.
Teacher	**Let's add the partial products to determine the final product. What should we add?**
Students	The partial products.
Teacher	**We have __ plus __ plus … . That equals __. Say that with me.**
Students	__.
Teacher	**So, __** (first fraction) **of __** (second fraction) **equals __. What's the product?**

Students	__.
Teacher	**__ times __ equals __. Let's say that together.**
Students	__ times __ equals __.
Teacher	**So, if you have a set of __** (second fraction) **and you determine __** (first fraction) **of the second fraction, __ times __ equals __. Let's review. What's a factor?**
Students	The numbers multiplied in a multiplication problem.
Teacher	**What's a product?**
Students	The result of multiplying factors.
Teacher	**How could you explain multiplying of fractions to a friend?**
Students	We used fraction tiles to show the second fraction. Then, we found the first fraction of the second fraction to determine the product.

ROUTINE WITH DRAWING

(Only use drawings with simpler problems)

Teacher	**Let's work on multiplication. What does it mean to multiply?**
Students	To make equal groups or to compare.
Teacher	**Multiplication means to make equal groups or to compare. Look at this problem.** (Show problem.)
Teacher	**First, I see a multiplication sign** (point). **The multiplication sign tells us to multiply. What does the multiplication sign mean?**
Students	To multiply.
Teacher	**Let's do this problem by drawing. What could we use to draw?**
Students	Pencil and graph paper.
Teacher	**I like to use a pencil and graph paper when I draw fractions. Good idea. Now, with multiplication of fractions, we interpret this problem as __** (first fraction) **of __** (second fraction). **How do we interpret this problem?**
Students	__ of __.
Teacher	**We want to determine __** (first fraction) **of __** (second fraction)**. For example, if you wanted to determine one-third of 12, you would show 12 cupcakes and then find one-third of the 12 cupcakes. The same works with fractions. We'll show the second fraction (or factor) and then find the first fraction of the second fraction. Which fraction will we show?**
Students	Second fraction.
Teacher	**So, let's draw the second fraction. Today, I'll draw a rectangle, divide that rectangle into __ equal parts** (denominator from second fraction) **and shade in __ parts** (numerator from the second fraction)**.** (Draw fraction and shade with pencil.)

Teacher	**Now, let's find __** (first fraction) **of __** (second fraction)**. There are several ways to do this, but an easy way is to find __** (first fraction) **of each one-__** (second fraction denominator) **part. Let's focus on one-__ part at a time. What should we focus on?**
Students	One-__ part at a time.
Teacher	**Let's just think about this one-__ part** (second fraction denominator)**. The first fraction has a denominator of __. What's the denominator?**
Students	__.
Teacher	**Let's divide this one-__ part** (second fraction denominator) **into __ equal parts** (first fraction denominator) **by drawing.** (By drawing, mark __ equal parts.)
Teacher	**Now, what's the numerator of the first fraction?**
Students	__.
Teacher	**__** (first fraction numerator) **of this one-__ part** (second fraction denominator) **would be __. Let's shade – with a highlighter or colored pencil – the __ parts of the first fraction.** (Highlight or color __ equal parts.)
Teacher	**Now, I do that again for each one-__ part. I draw and highlight or color __** (first fraction) **of each one-__ part** (second fraction denominator)**.** (Mark equal parts and highlight or color __ equal parts.)
Teacher	**Even though we only focused on determining __** (first fraction) **of __** (second fraction), **I want to divide any non-shaded parts of the second fraction into equal parts of the first fraction. This will help us learn of the denominator for the product.** (By drawing, mark __ equal parts.)
Teacher	**We're multiplying by finding __** (first fraction) **of each of the one-__ parts** (second fraction denominator)**. How are we multiplying?**
Students	Finding __ (first fraction) of each of the one-__ parts.
Teacher	**We've determined __** (first fraction) **of each of the one-__ parts by highlighting or coloring. Those are our partial products. Now, let's add the partial products to determine the final product. What should be add?**
Students	The partial products.
Teacher	**We have __ plus __ plus … . That equals __. Say that with me.**
Students	__.
Teacher	**So, __** (first fraction) **of __** (second fraction) **equals __. What's the product?**
Students	__.
Teacher	**__ times __ equals __. Let's say that together.**
Students	__ times __ equals __.
Teacher	**So, if you have a set of __** (second fraction) **and you determine __** (first fraction) **of the second fraction, __ times __ equals __. Let's review. What's a factor?**
Students	The numbers multiplied in a multiplication problem.

Teacher	**What's a product?**
Students	The result of multiplying factors.
Teacher	**How could you explain multiplying of fractions to a friend?**
Students	We drew the second fraction. Then, we highlighted the first fraction of each of the one-__ parts. Those were our partial products. We added the partial products to determine the product of __ and __.

ROUTINE WITHOUT MANIPULATIVES OR DRAWINGS

Teacher	**Let's work on multiplication. What does it mean to multiply?**
Students	To make equal groups or to compare.
Teacher	**Multiplication means to make equal groups or to compare. Look at this problem.** (Show problem.)
Teacher	**First, I see a multiplication sign** (point). **The multiplication sign tells us to multiply. What does the multiplication sign mean?**
Students	To multiply.
Teacher	**When we multiply, we multiply the numerators then we multiply the denominators. How do we multiply?**
Students	Multiply the numerators then multiply the denominators.
Teacher	**Let's focus on the numerators. What are the numerators in this problem?**
Students	__ and __.
Teacher	**What's __ times __?**
Students	__.
Teacher	**__ times __ equals __, so let's write __ as the numerator of our product.** (Write numerator.)
Teacher	**Let's focus on the denominators. What are the denominators in this problem?**
Students	__ and __.
Teacher	**What's __ times __?**
Students	__.
Teacher	**__ times __ equals __, so let's write __ as the denominator of our product.** (Write denominator.)
Teacher	**So, __** (first fraction) **of __** (second fraction) **equals __. What's the product?**
Students	__. (If product is not in simplest form, use greatest common factor to determine an equivalent fraction in simplest form.)
Teacher	**__ times __ equals __. Let's say that together.**
Students	__ times __ equals __.

Teacher	**So, if you have a set of __** (second fraction) **and you determine __** (first fraction) **of the second fraction, __ times __ equals __. Let's review. What's a factor?**
Students	The numbers multiplied in a multiplication problem.
Teacher	**What's a product?**
Students	The result of multiplying factors.
Teacher	**How could you explain multiplying of fractions to a friend?**
Students	We multiplied the numerators. Then, we multiplied the denominators. The product was __.

Example

$$\frac{1}{2} \times \frac{3}{4} = \frac{3}{8}$$

Step 1: Show second fraction (three-fourths).

Step 2: Find the first fraction (one-half) of each one-fourth part.

EXAMPLE WITH MANIPULATIVES

Teacher	**Let's work on multiplication. What does it mean to multiply?**
Students	To make equal groups or to compare.
Teacher	**Multiplication means to make equal groups or to compare. Look at this problem.** (Show problem.)
Teacher	**First, I see a multiplication sign** (point). **The multiplication sign tells us to multiply. What does the multiplication sign mean?**
Students	To multiply.
Teacher	**Let's do this problem with fraction tiles.** (Move fraction tiles to workspace.)
Teacher	**With multiplication of fractions, we interpret this problem as $\frac{1}{2}$ of $\frac{3}{4}$. How do we interpret this problem?**
Students	$\frac{1}{2}$ of $\frac{3}{4}$.
Teacher	**Because we want to determine one-half of three-fourths, we show $\frac{3}{4}$. What fraction do we show?** (Show 3 one-fourth parts compared to a whole.)
Students	$\frac{3}{4}$.

Teacher	**Now, let's find $\frac{1}{2}$ of $\frac{3}{4}$. I could do the multiplication by multiplying $\frac{1}{2}$ of $\frac{1}{4}$ to find $\frac{1}{2}$ of each $\frac{1}{4}$ part. Let's see. If I have $\frac{1}{4}$, what's $\frac{1}{2}$ of $\frac{1}{4}$?**
Students	$\frac{1}{8}$.
Teacher	**Yes, if I divide a $\frac{1}{4}$ part in half, that would be $\frac{1}{8}$. I'll place one $\frac{1}{8}$ piece on top of the $\frac{1}{4}$ part.**
	(Place one $\frac{1}{8}$ piece on a $\frac{1}{4}$ part.)
Teacher	**Now, I do that again for each $\frac{1}{4}$ part. I find $\frac{1}{2}$ of each $\frac{1}{4}$ part.**
	(Place one $\frac{1}{8}$ piece on each $\frac{1}{4}$ part.)
Teacher	**We're multiplying by finding $\frac{1}{2}$ of each of the three $\frac{1}{4}$ parts or $\frac{3}{4}$. How are we multiplying?**
Students	Finding $\frac{1}{2}$ of each of the three $\frac{1}{4}$ parts.
Teacher	**Now that we've determined $\frac{1}{2}$ of each $\frac{1}{4}$ part, let's add the $\frac{1}{8}$ pieces to determine the product. What should we add?**
Students	The $\frac{1}{8}$ pieces.
Teacher	**We have $\frac{1}{8}$ plus $\frac{1}{8}$ plus $\frac{1}{8}$. That's $\frac{3}{8}$. Say that with me.**
Students	$\frac{3}{8}$.
Teacher	**So, $\frac{1}{2}$ of $\frac{3}{4}$ equals $\frac{3}{8}$. What's the product?**
Students	$\frac{3}{8}$.
Teacher	**$\frac{1}{2}$ times $\frac{3}{4}$ equals $\frac{3}{8}$. Let's say that together.**
Students	$\frac{1}{2}$ times $\frac{3}{4}$ equals $\frac{3}{8}$.
Teacher	**So, if you have a set of $\frac{3}{4}$ and you find $\frac{1}{2}$ of the three-fourths, $\frac{1}{2}$ of $\frac{3}{4}$ equals $\frac{3}{8}$. Let's review. What's a factor?**
Students	The numbers multiplied in a multiplication problem.
Teacher	**What's a product?**
Students	The result of multiplying factors.
Teacher	**How could you explain multiplying of fractions to a friend?**
Students	We used fraction tiles to show the second fraction. Then, we found the first fraction of the second fraction to determine the product.

(2) Multiplication of Decimals with Traditional Algorithm

Routine

Materials:

- Module 12 Problem Sets
- Module 12 Vocabulary Cards
    - If necessary, review Vocabulary Cards before teaching

2-DIGIT × 2-DIGIT: ROUTINE WITHOUT MANIPULATIVES

Teacher	**Let's work on multiplication. What does it mean to multiply?**
Students	To make equal groups or to compare.
Teacher	**Multiplication means to make equal groups or to compare. Look at this problem.** (Show problem.)
Teacher	**First, I see a multiplication sign** (point). **The multiplication sign tells us to multiply. What does the multiplication sign mean?**
Students	To multiply.
Teacher	**Let's do this problem with our pencil. First, when I see a problem like this that requires computation, I like to draw vertical lines to separate the ones and the tenths. Let's draw a vertical line between the ones column and the tenths column.** (Draw vertical lines to separate place value columns.)
Teacher	**Now, we start by multiplying the tenths of the second factor. This means we'll write these products starting in the tenths column below the equal line. Where will we write the products?**
Students	Below the equal line in the tenths.
Teacher	**We first multiply the tenths of the second factor times the tenths of the first factor. What should we multiply first?**
Students	The tenths of the second factor times the tenths of the first factor.
Teacher	**Which tenths do we multiply?**
Students	__ times __.
Teacher	**What's __ times __?** (If a student has difficulty with multiplication, use a multiplication table or other resource.)
Students	__.
Teacher	**__ times __ equals __. Let's write __ below the equal line in the tenths column.** IF REGROUPING: **Our product is greater than 9, so we have to regroup. That means we write the ones in the tenths place and regroup the tens above the ones column.** (Write product.)

Teacher		**Now, we multiply the tenths of the second factor times the ones of the first factor. What do we multiply?**
Students		The tenths of the second factor times the ones of the first factor.
Teacher		**So, what do we multiply?**
Students		__ times __.
Teacher		**What's __ times __?**
Students		__.
Teacher	IF REGROUPING:	**Remember, we regrouped __ from when we multiplied the tenths of the second factor by the tenths of the first factor. Now, we add that regrouped amount to our product of __ times __. So, what's __ plus __?**
Students		__.
Teacher		**Let's write __ below the equal line in the ones column.** (Write product.)
Teacher		**So, we multiplied the tenths of the second factor times the tenths of the first factor then the tenths of the second factor times the ones of the first factor. Who can describe what we multiplied so far?**
Students		We multiplied the tenths of the second factor times the tenths of the first factor then the tenths of the second factor times the ones of the first factor.
Teacher		**We've multiplied the tenths of the second factor. Now, it's time to multiply the ones of the second factor. What will we multiply now?**
Students		The ones of the second factor.
Teacher		**When writing the products of multiplying the ones of the second factor, we'll write them below this first line of products. Because we're now multiplying the ones, we will write our products starting in the ones column. I like to place an X or zero in the tenths column below the equal line to remember to start writing my products in the ones column.** (Write X or 0.)
Teacher		**Now, let's multiply the ones of the second factor times the tenths of the first factor. What should we multiply?**
Students		The ones of the second factor times the tenths of the first factor.
Teacher		**What numbers do we multiply?**
Students		__ times __.
Teacher		**What's __ times __?** (If a student has difficulty with multiplication, use a multiplication table or other resource.)
Students		__.
Teacher		**__ times __ equals __. Let's write __ below the equal line in the ones column.**
	IF REGROUPING:	**Our product is greater than 9, so we have to regroup. That means we write the ones and regroup the tens above the problem.**
		(Write product.)
Teacher		**Now, we multiply the ones of the second factor times the ones of the first factor. What do we multiply?**

Students	The ones of the second factor times the ones of the first factor.
Teacher	**So, what do we multiply?**
Students	__ times __.
Teacher	**What's __ times __?**
Students	__.
Teacher	IF REGROUPING: **Remember, we regrouped __ from when we multiplied the ones of the second factor by the tenths of the first factor. Now, we add that regrouped amount to our product of __ times __. So, what's __ plus __?**
Students	__.
Teacher	**Let's write __ below the equal line.** (Write product.)
Teacher	**So, we multiplied the ones of the second factor times the tenths of the first factor and then the ones of the second factor times the ones of the first factor. Who can describe what we multiplied?**
Students	We multiplied the ones of the second factor times the tenths of the first factor then the ones of the second factor times the ones of the first factor.
Teacher	**Now, we did all the multiplication but we are not finished! We call these numbers here** (point to numbers under equal line) **our partial products. We have to add the partial products together to determine the final product. Let's draw another equal line and write in a plus sign. What should we draw?**
Students	An equal line and plus sign. (Write equal line and plus sign.)
Teacher	**So, let's add __ plus __. What's __ plus __?** (If students need help with addition of whole numbers, see Module 5.)
Students	__.
Teacher	**Yes. So, I write __ under the equal line.** (Write final product.)
Teacher	**Now, we seem finished but we're not. In this problem, we multiplied decimals. So, we have to place the decimal point in the product. What do we have to place in the product?**
Students	A decimal point.
Teacher	**To place the decimal point, we determine the number of decimal places in the two factors. Let's see. The first factor had __ decimal place. The second factor also had __ decimal place. What's __ plus __?**
Students	__.
Teacher	**So, in the product, we need to put in __ decimal places starting from the least place value (or the right). That means I'll place a decimal point between the __ and __.** (Write decimal point.)
Teacher	**So, __ times __ equals __. What's the product?**
Students	__.
Teacher	**Let's say it together again.**
Students	__ times __ equals __.

Teacher	**So, if you have __ and multiply by __, the product is __. __ times __ equals __. Let's review. What's a factor?**
Students	One of the numbers multiplied in a multiplication problem.
Teacher	**What's a product?**
Students	The result of multiplying factors.
Teacher	**What does it mean to make equal groups?**
Students	To have groups with an equal number in each group.
Teacher	**How could you explain multiplication of double-digit numbers to a friend?**
Students	We multiplied the tenths of the second factor times the tenths and ones of the first factor. Then, we multiplied the ones of the second factor times the tenths and ones of the first factor. Finally, we added the partial products to determine the final product. We multiplied two decimal places so we added in a decimal point two decimal places from the right of the number.

Example

$$\begin{array}{r} 7.3 \\ \times\ 6.1 \\ \hline 44.53 \end{array}$$

2-DIGIT × 2-DIGIT: EXAMPLE WITHOUT MANIPULATIVES

Teacher	**Let's work on multiplication. What does it mean to multiply?**
Students	To make equal groups or to compare.
Teacher	**Multiplication means to make equal groups or to compare. Look at this problem.** (Show problem.)
Teacher	**First, I see a multiplication sign** (point). **The multiplication sign tells us to multiply. What does the multiplication sign mean?**
Students	To multiply.
Teacher	**Let's do this problem with our pencil. First, when I see a problem like this that requires computation, I like to draw vertical lines to separate the ones and the tenths. Let's draw a vertical line between the ones column and the tenths column.** (Draw vertical lines to separate place value columns.)
Teacher	**Now, we start by multiplying the tenths of the second factor. This means we'll write these products starting in the tenths column below the equal line. Where will we write the products?**
Students	Below the equal line of the tenths.
Teacher	**We first multiply the tenths of the second factor times the tenths of the first factor. What should we multiply first?**
Students	The tenths of the second factor times the tenths of the first factor.
Teacher	**Which tenths do we multiply?**
Students	1 times 3.

Teacher	**What's 1 times 3?** (If a student has difficulty with multiplication, use a multiplication table or other resource.)
Students	3.
Teacher	**1 times 3 equals 3. Let's write 3 below the equal line in the tenths column.** (Write 3.)
Teacher	**Now, we multiply the tenths of the second factor times the ones of the first factor. What do we multiply?**
Students	The tenths of the second factor times the ones of the first factor.
Teacher	**So, what do we multiply?**
Students	1 times 7.
Teacher	**What's 1 times 7?**
Students	7.
Teacher	**Let's write 7 below the equal line in the ones column.** (Write product.)
Teacher	**So, we multiplied the tenths of the second factor times the tenths of the first factor then the tenths of the second factor times the ones of the first factor. Who can describe what we multiplied so far?**
Students	We multiplied the tenths of the second factor times the tenths of the first factor then we multiplied the tenths of the second factor times the ones of the first factor.
Teacher	**We've multiplied the tenths of the second factor. Now, it's time to multiply the ones of the second factor. What will we multiply now?**
Students	The ones of the second factor.
Teacher	**When writing the products of multiplying the ones of the second factor, we'll write them below this first line of products. Because we're now multiplying the ones, we will write our products starting in the ones column. I like to place an X or zero in the tenths column below the equal line to remember to start writing my products in the ones column.** (Write X or 0.)
Teacher	**Now, let's multiply the ones of the second factor times the tenths of the first factor. What should we multiply?**
Students	The ones of the second factor times the tenths of the first factor.
Teacher	**What numbers do we multiply?**
Students	6 times 3.
Teacher	**What's 6 times 3?** (If a student has difficulty with multiplication, use a multiplication table or other resource.)
Students	18.
Teacher	**6 times 3 equals 18. Let's write 8 below the equal line in the ones column and regroup the 1.** (Write 8 and regroup the 1.)
Teacher	**Now, we multiply the ones of the second factor times the ones of the first factor. What do we multiply?**

Students	The ones of the second factor times the ones of the first factor.
Teacher	**So, what do we multiply?**
Students	6 times 7.
Teacher	**What's 6 times 7?**
Students	42.
	Remember, we regrouped 1 from when we multiplied the ones of the second factor by the tenths of the first factor. Now, we add that regrouped amount to our product of 42. So, what's 42 plus 1?
Students	43.
Teacher	**Let's write 43 below the equal line.** (Write 43.)
Teacher	**So, we multiplied the ones of the second factor times the tenths of the first factor and then the ones of the second factor times the ones of the first factor. Who can describe what we multiplied?**
Students	We multiplied the ones of the second factor times the tenths of the first factor then we multiplied the ones of the second factor times the ones of the first factor.
Teacher	**Now, we did all the multiplication but we are not finished! We call these numbers here** (point to numbers under equal line) **our partial products. We have to add the partial products together to determine the final product. Let's draw another equal line and write in a plus sign. What should we draw?**
Students	An equal line and plus sign. (Write equal line and plus sign.)
Teacher	**So, let's add 73 plus 4380. What's 73 plus 4380?** (If students need help with addition of whole numbers, see Module 5.)
Students	4453.
Teacher	**Yes. So, I write 4453 under the equal line.** (Write 4453.)
Teacher	**Now, are we finished?**
Students	No!
Teacher	**We seem finished but we're not. In this problem, we multiplied decimals. So, we have to place the decimal point in the product. What do we have to place in the product?**
Students	A decimal point.
Teacher	**To place the decimal point, we determine the number of decimal places in the two factors. Let's see. The first factor had 1 decimal place. The second factor also had 1 decimal place. What's 1 plus 1?**
Students	2.
Teacher	**So, in the product, we need to put in 2 decimal places starting from the right of the number. That means I'll place a decimal point between the 4 and 5.** (Write decimal point.)
Teacher	**So, 7.3 times 6.1 equals 44.53. Let's say that together.**
Students	7.3 times 6.1 equals 44.53.
Teacher	**Let's say it together again.**

Students	7.3 times 6.1 equals 44.53.
Teacher	**So, if you have 7.3 and multiply by 6.1, the product is 44.53. Let's review. What's a factor?**
Students	One of the numbers multiplied in a multiplication problem.
Teacher	**What's a product?**
Students	The result of multiplying factors.
Teacher	**What does it mean to make equal groups?**
Students	To have groups with an equal number in each group.
Teacher	**How could you explain multiplication of double-digit numbers to a friend?**
Students	We multiplied the tenths of the second factor times the tenths and ones of the first factor. Then, we multiplied the ones of the second factor times the tenths and ones of the first factor. Finally, we added the partial products to determine the final product. We placed in the decimal point because we multiplied by two decimals.

(3) Multiplication with Partial Products Algorithm*

*For clarity, read **Example** before using **Routines**.

Routine

Materials:

- Module 12 Problem Sets
- Module 12 Vocabulary Cards
    - If necessary, review Vocabulary Cards before teaching

2-DIGIT × 2-DIGIT: ROUTINE WITHOUT MANIPULATIVES

Teacher	**Let's work on multiplication. What does it mean to multiply?**
Students	To make equal groups or to compare.
Teacher	**Multiplication means to make equal groups or to compare. Look at this problem.** (Show problem.)
Teacher	**First, I see a multiplication sign** (point). **The multiplication sign tells us to multiply. What does the multiplication sign mean?**
Students	To multiply.
Teacher	**Let's do this problem with our pencil. First, when I see a problem like this that requires computation, I like to draw vertical lines to separate the ones from the tenths. Let's draw a vertical line between the ones column and the tenths column.** (Draw vertical lines to separate place value columns.)
Teacher	**Let's use the partial products strategy. What strategy?**
Students	Partial products.
Teacher	**With the partial products strategy, we do the multiplication for each factor then we add the partial products together for a final product. With the partial products strategy, we work from the greatest place value to the least place value. How do we work?**
Students	From the greatest place value to the least place value.
Teacher	**First, we'll multiply the ones of the second factor times the ones of the first factor and tenths of the first factor. Let's do that now. What are the ones of the second factor?**
Students	__.
Teacher	**We have __ ones in the second factor. How many ones?**
Students	__.
Teacher	**Look at the first factor. What are the ones of the first factor?**
Students	__.
Teacher	**We have __ ones in the first factor. How many ones?**
Students	__. **So, let's multiply __ times __. What's __ times __?**
Students	__.

Teacher **__ times __ equals __. Let's write __ below the equal line and make sure to line up by place value.**

(Write product.)

Teacher **__ is our first partial product. Now, let's multiply the ones of the second factor times the tenths of the first factor? What do we multiply?**

Students __ times __.

Teacher **What's __ times __?**

Students __.

Teacher **Let's write __ below the equal line. We'll write this second partial product under the first partial product and make sure to line up by place value. That is – line up tens with tens, ones with ones, tenths with tenths, and hundredths with hundredths.**

(Write product.)

Teacher **Now, let's multiply the tenths of the second factor times the ones of the first factor and tenths of the first factor. Let's do that now. What are the tenths of the second factor?**

Students __.

Teacher **We have __ tenths in the second factor. Look at the first factor. What are the ones of the first factor?**

Students __.

Teacher **We have __ ones in the first factor. How many ones?**

Students __.

So, let's multiply __ times __. What's __ times __?

Students __.

Teacher **__ times __ equals __. Let's write __ below the equal line under our other partial products and make sure to line up by place value.**

(Write product.)

Teacher **Finally, let's multiply the tenths of the second factor times the tenths of the first factor. What do we multiply?**

Students __ times __.

Teacher **What's __ times __?**

Students __.

Teacher **Let's write __ below the equal line under our other partial products and make sure to line up by place value.**

(Write product.)

Teacher **To determine the final product, we add all the partial products together. I'll write a plus sign and another equal line.**

(Write plus sign and equal line.)

Teacher **So, what's __ plus __ plus __ plus __?**

(For assistance with the partial sums algorithm for addition, see Module 5.)

Students __.

Teacher **__ is our final product. Let's write __ under the equal line.**

Students (Write product.)

Teacher **That means __ times __ equals __. Let's say that together.**

Students	__ times __ equals __.
Teacher	**Let's say it together again.**
Students	__ times __ equals __.
Teacher	**So, if you have __ groups and multiply by __, the product is __. __ times __ equals __. Let's review. What's a factor?**
Students	The numbers multiplied in a multiplication problem.
Teacher	**What's a product?**
Students	The result of multiplying factors.
Teacher	**How could you explain multiplying to a friend?**
Students	We multiplied the ones of the second factor times the ones and tenths of the first factor. Then, we multiplied the tenths of the second factor times the ones and tenths of the first factor. We added the partial products to determine the final product.

Example

$$\begin{array}{r} 7.3 \\ \times\ 6.1 \\ \hline 42 \\ 1.8 \\ 0.7 \\ +\ 0.03 \\ \hline 44.53 \end{array}$$

2-DIGIT × 2-DIGIT: EXAMPLE WITHOUT MANIPULATIVES

Teacher	**Let's work on multiplication. What does it mean to multiply?**
Students	To make equal groups or to compare.
Teacher	**Multiplication means to make equal groups or to compare. Look at this problem.** (Show problem.)
Teacher	**First, I see a multiplication sign** (point). **The multiplication sign tells us to multiply. What does the multiplication sign mean?**
Students	To multiply.
Teacher	**Let's do this problem with our pencil. First, when I see a problem like this that requires computation, I like to draw vertical lines to separate the ones from the tenths. Let's draw a vertical line between the ones column and the tenths column.** (Draw vertical lines to separate place value columns.)
Teacher	**Let's use the partial products strategy. What strategy?**
Students	Partial products.
Teacher	**With the partial products strategy, we do the multiplication for each factor then we add the partial products together for a final product. With the partial**

	products strategy, we work from the greatest place value to the least place value. How do we work?
Students	From the greatest place value to the least place value.
Teacher	**First, we'll multiply the ones of the second factor times the ones of the first factor and tenths of the first factor. Let's do that now. What are the ones of the second factor?**
Students	6.
Teacher	**We have 6 ones in the second factor. How many ones?**
Students	6.
Teacher	**Look at the first factor. What are the ones of the first factor?**
Students	7.
Teacher	**We have 7 ones in the first factor. How many ones?**
Students	7.
	So, let's multiply 6 times 7. What's 6 times 7?
Students	42.
Teacher	**6 times 7 equals 42. Let's write 42 below the equal line and make sure to place the 2 in the ones column and 4 in the tens column.** (Write 42.)
Teacher	**42 is our first partial product. Now, let's multiply the ones of the second factor times the tenths of the first factor. What do we multiply?**
Students	6 times 0.3.
Teacher	**What's 6 times 0.3?**
Students	1.8.
Teacher	**Let's write 1.8 below the equal line. We'll write this partial product under the first partial product. We'll write the 1 in the ones column and 0.8 in the tenths column.** (Write 1.8.)
Teacher	**Now, let's multiply the tenths of the second factor times the ones of the first factor and tenths of the first factor. Let's do that now. What are the tenths of the second factor?**
Students	0.1.
Teacher	**We have 0.1 in the second factor. Look at the first factor. What are the ones of the first factor?**
Students	7.
	So, let's multiply 0.1 times 7. What's 0.1 times 7?
Students	0.7.
Teacher	**0.1 times 7 equals 0.7. Let's write 0.7 below the equal line under our other partial products. Let's make sure to write the 7 in the tenths column.** (Write 0.7.)
Teacher	**Finally, let's multiply the tenths of the second factor times the tenths of the first factor. What do we multiply?**
Students	0.1 times 0.3.
Teacher	**What's 0.1 times 0.3?**
Students	0.03.

Teacher	**Let's write 0.03 below the equal line under our other partial products. Let's make sure to write the 3 in the hundredths column.** (Write 0.03.)
Teacher	**To determine the final product, we add all the partial products together. I'll write a plus sign and another equal line.** (Write plus sign and equal line.)
Teacher	**I like to add in steps. What's 42 plus 1.8?**
Students	43.8.
Teacher	**What's 43.8 plus 0.7?**
Students	44.5.
Teacher	**What's 44.5 plus 0.03?**
Students	44.53.
Teacher	**44.53 is our final product. Let's write 44.53 under the equal line.**
Students	(Write product.)
Teacher	**That means 7.3 times 6.1 equals 44.53. Let's say that together.**
Students	7.3 times 6.1 equals 44.53.
Teacher	**So, if you have 7.3 and multiply by 6.1, the product is 44.53. Let' review. What's a factor?**
Students	The numbers multiplied in a multiplication problem.
Teacher	**What's a product?**
Students	The result of multiplying factors.
Teacher	**What does it mean to use the partial products strategy?**
Students	We multiplied each factor for a partial product. Then, we added the partial products to determine the final product.
Teacher	**How could you explain multiplying to a friend?**
Students	We multiplied 6 times 7 then 6 times 0.3. Then, we multiplied 0.1 times 7 then 0.1 times 0.03. We added the partial products for a final product of 44.53.

D. Problems for Use During Instruction

See Module 12 Problem Sets.

E. Vocabulary Cards for Use During Instruction

See Module 12 Vocabulary Cards.

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Module 12:
Multiplication of Rational Numbers

Problem Sets

A. Proper fractions (30)
B. Improper fractions (20)
C. Mixed numbers (20)

D. Decimals with tenths (20)
E. Decimals with hundredths (20)
F. Decimals with tenths and hundredths (30)

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

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

A. $\frac{2}{5} \times \frac{2}{3} =$

A. $\frac{1}{2} \times \frac{1}{10} =$

A. $\frac{7}{10} \times \frac{2}{5} =$

A. $\frac{5}{6} \times \frac{1}{2} =$

A. $\frac{1}{8} \times \frac{1}{4} =$

A. $\frac{5}{6} \times \frac{1}{3} =$

A. $\frac{4}{5} \times \frac{2}{3} =$

A. $\frac{3}{5} \times \frac{3}{12} =$

A. $\frac{1}{2} \times \frac{9}{12} =$

A.

$$\frac{4}{5} \times \frac{3}{8} =$$

A. $\frac{5}{8} \times \frac{2}{3} =$

A. $\frac{3}{4} \times \frac{3}{4} =$

A. $\frac{1}{3} \times \frac{4}{5} =$

A. $\frac{1}{2} \times \frac{1}{2} =$

A. $\frac{2}{8} \times \frac{1}{4} =$

A. $\frac{1}{3} \times \frac{9}{10} =$

A. $\frac{2}{5} \times \frac{6}{8} =$

A. $\frac{1}{4} \times \frac{2}{3} =$

A. $\frac{3}{8} \times \frac{3}{4} =$

A. $\frac{1}{5} \times \frac{3}{4} =$

A. $\frac{1}{6} \times \frac{2}{3} =$

A. $\frac{2}{4} \times \frac{1}{5} =$

A. $\frac{2}{6} \times \frac{5}{10} =$

A. $\frac{4}{5} \times \frac{4}{5} =$

A. $\frac{5}{6} \times \frac{3}{4} =$

A. $\frac{3}{8} \times \frac{5}{6} =$

A. $\frac{1}{6} \times \frac{2}{5} =$

A. $\frac{1}{3} \times \frac{4}{12} =$

B.

$$\frac{1}{4} \times \frac{9}{6} =$$

B.

$$\frac{1}{2} \times \frac{13}{2} =$$

B.

$$\frac{1}{3} \times \frac{5}{4} =$$

B. $\frac{2}{3} \times \frac{14}{12} =$

B. $\frac{2}{8} \times \frac{4}{2} =$

B. $\frac{3}{4} \times \frac{11}{6} =$

B. $\frac{1}{3} \times \frac{13}{7} =$

B.

$$\frac{1}{6} \times \frac{7}{3} =$$

B.

$$\frac{4}{5} \times \frac{5}{3} =$$

B.

$$\frac{5}{6} \times \frac{5}{2} =$$

B. $\frac{1}{3} \times \frac{8}{6} =$

B. $\frac{3}{4} \times \frac{5}{2} =$

B.

$$\frac{2}{5} \times \frac{7}{6} =$$

B. $\frac{2}{4} \times \frac{9}{8} =$

B.

$$\frac{1}{8} \times \frac{7}{5} =$$

B. $\frac{2}{3} \times \frac{11}{2} =$

B. $\frac{1}{3} \times \frac{8}{7} =$

B. $\frac{1}{8} \times \frac{9}{4} =$

B. $\frac{2}{6} \times \frac{10}{6} =$

B. $\frac{1}{5} \times \frac{14}{5} =$

c.

$$1\frac{1}{4} \times \frac{2}{5} =$$

c. $\frac{3}{5} \times 2\frac{4}{10} =$

c.

$$2\frac{1}{8} \times \frac{1}{4} =$$

c. $\frac{2}{3} \times 1\frac{4}{5} =$

c.

$$6\frac{3}{8} \times \frac{1}{3} =$$

c. $\frac{5}{6} \times 4\frac{1}{2} =$

c.

$$4\frac{5}{8} \times \frac{1}{4} =$$

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

c.

$$8\frac{3}{6} \times \frac{1}{8} =$$

c. $\frac{2}{6} \times 3\frac{1}{3} =$

c.

$$9\frac{1}{5} \times \frac{3}{5} =$$

c. $\frac{3}{4} \times 7\frac{2}{4} =$

c.

$$1\frac{1}{12} \times \frac{1}{2} =$$

c. $\frac{1}{8} \times 4\frac{1}{3} =$

c.

$$5\frac{2}{3} \times \frac{1}{12} =$$

c. $\frac{1}{10} \times 6\frac{5}{8} =$

c.

$$7\frac{4}{9} \times \frac{1}{3} =$$

c. $\frac{3}{9} \times 4\frac{6}{9} =$

c. $4\frac{7}{8} \times \frac{1}{12} =$

c. $\frac{3}{4} \times 7\frac{2}{3} =$

D.

$$\begin{array}{r} 7.3 \\ \times\ 6.1 \\ \hline \end{array}$$

D.

$$\begin{array}{r} 0.2 \\ \times\ 1.8 \\ \hline \end{array}$$

D.

$$\begin{array}{r} 4.4 \\ \times\ 7.5 \\ \hline \end{array}$$

D.

$$\begin{array}{r} 9.2 \\ \times\ 9.3 \\ \hline \end{array}$$

D.

$$\begin{array}{r} 2.5 \\ \times\ 0.4 \\ \hline \end{array}$$

D.

$$\begin{array}{r} 8.9 \\ \times\ 2.0 \\ \hline \end{array}$$

D.

$$\begin{array}{r} 1.8 \\ \times\ 3.0 \\ \hline \end{array}$$

D.

$$\begin{array}{r} 6.4 \\ \times\ 8.8 \\ \hline \end{array}$$

D.

$$\begin{array}{r} 0.3 \\ \times\ 6.5 \\ \hline \end{array}$$

D.

$$\begin{array}{r} 1.1 \\ \times\ 8.4 \\ \hline \end{array}$$

D.

$$\begin{array}{r} 1.3 \\ \times\ 4.3 \\ \hline \end{array}$$

D.

$$\begin{array}{r} 6.4 \\ \times\ 3.5 \\ \hline \end{array}$$

D.

$$\begin{array}{r} 5.7 \\ \times\ 3.5 \\ \hline \end{array}$$

D.

$$\begin{array}{r} 4.4 \\ \times\ 0.8 \\ \hline \end{array}$$

D.

$$\begin{array}{r} 6.3 \\ \times\ 8.2 \\ \hline \end{array}$$

D.

$$\begin{array}{r} 1.2 \\ \times\ 1.2 \\ \hline \end{array}$$

D.

$$\begin{array}{r} 2.3 \\ \times\ 4.8 \\ \hline \end{array}$$

D.

$$\begin{array}{r} 1.9 \\ \times\ 3.5 \\ \hline \end{array}$$

D.

$$\begin{array}{r} 8.1 \\ \times\ 8.2 \\ \hline \end{array}$$

D.

$$\begin{array}{r} 2.4 \\ \times\ 7.0 \\ \hline \end{array}$$

E.

$$\begin{array}{r} 0.89 \\ \times\ 0.93 \\ \hline \end{array}$$

E.

$$\begin{array}{r} 0.54 \\ \times \quad 1.62 \\ \hline \end{array}$$

E.

$$\begin{array}{r} 1.35 \\ \times\ 2.71 \\ \hline \end{array}$$

E.

$$\begin{array}{r} 4.43 \\ \times\ 3.87 \\ \hline \end{array}$$

E.

$$\begin{array}{r} 3.85 \\ \times\ 0.88 \\ \hline \end{array}$$

E.

$$\begin{array}{r} 0.35 \\ \times\ 0.77 \\ \hline \end{array}$$

E.

$$\begin{array}{r} 1.93 \\ \times\ 0.13 \\ \hline \end{array}$$

E.

$$\begin{array}{r} 5.63 \\ \times \quad 0.61 \\ \hline \end{array}$$

E.

$$\begin{array}{r} 1.30 \\ \times\ 3.57 \\ \hline \end{array}$$

E.

$$\begin{array}{r} 0.12 \\ \times\ 0.27 \\ \hline \end{array}$$

E.

$$\begin{array}{r} 0.73 \\ \times \quad 0.49 \\ \hline \end{array}$$

E.

$$\begin{array}{r} 1.92 \\ \times \quad 4.58 \\ \hline \end{array}$$

E.

$$\begin{array}{r} 5.38 \\ \times\ 2.24 \\ \hline \end{array}$$

E.

$$\begin{array}{r} 6.89 \\ \times \quad 1.92 \\ \hline \end{array}$$

E.

$$\begin{array}{r} 14.21 \\ \times \quad 0.53 \\ \hline \end{array}$$

E.

$$\begin{array}{r} 6.46 \\ \times \quad 4.11 \\ \hline \end{array}$$

E.

$$\begin{array}{r} 0.33 \\ \times \quad 2.12 \\ \hline \end{array}$$

E.

$$\begin{array}{r} 3.17 \\ \times\ 1.34 \\ \hline \end{array}$$

E.

$$\begin{array}{r} 0.45 \\ \times\ 0.54 \\ \hline \end{array}$$

E.

$$\begin{array}{r} 11.27 \\ \times \quad 0.68 \\ \hline \end{array}$$

F.

$$\begin{array}{r} 8.61 \\ \times \quad 7.9 \\ \hline \end{array}$$

F.

$$\begin{array}{r} 6.95 \\ \times \quad 2.8 \\ \hline \end{array}$$

F.

$$\begin{array}{r} 9.07 \\ \times \quad 6.6 \\ \hline \end{array}$$

F.

$$\begin{array}{r} 2.25 \\ \times \quad 1.5 \\ \hline \end{array}$$

F.

$$\begin{array}{r} 3.89 \\ \times \quad 4.3 \\ \hline \end{array}$$

F.

$$\begin{array}{r} 5.61 \\ \times \quad 2.4 \\ \hline \end{array}$$

F.

$$\begin{array}{r} 1.39 \\ \times \quad 6.7 \\ \hline \end{array}$$

F.

$$\begin{array}{r} 1.14 \\ \times \quad 2.0 \\ \hline \end{array}$$

F.

$$\begin{array}{r} 2.78 \\ \times \quad 4.1 \\ \hline \end{array}$$

F.

$$\begin{array}{r} 17.98 \\ \times \quad 3.8 \\ \hline \end{array}$$

F.

$$\begin{array}{r} 6.61 \\ \times \quad 8.2 \\ \hline \end{array}$$

F.

$$\begin{array}{r} 9.62 \\ \times \quad 4.3 \\ \hline \end{array}$$

F.

$$\begin{array}{r} 2.33 \\ \times \quad 5.3 \\ \hline \end{array}$$

F.

$$\begin{array}{r} 6.98 \\ \times \quad 4.9 \\ \hline \end{array}$$

F.

$$\begin{array}{r} 7.05 \\ \times \quad 8.8 \\ \hline \end{array}$$

F.

$$\begin{array}{r} 2.30 \\ \times \quad 9.7 \\ \hline \end{array}$$

F.

$$\begin{array}{r} 4.73 \\ \times \quad 8.6 \\ \hline \end{array}$$

F.

$$\begin{array}{r} 11.03 \\ \times \quad 4.0 \\ \hline \end{array}$$

F.

$$\begin{array}{r} 3.37 \\ \times \quad 1.4 \\ \hline \end{array}$$

F.

$$\begin{array}{r} 2.88 \\ \times \quad 2.3 \\ \hline \end{array}$$

F.

$$\begin{array}{r} 65.21 \\ \times \quad 8.4 \\ \hline \end{array}$$

F.

$$\begin{array}{r} 7.91 \\ \times \quad 0.9 \\ \hline \end{array}$$

F.

$$\begin{array}{r} 6.02 \\ \times \quad 5.1 \\ \hline \end{array}$$

F.

$$\begin{array}{r} 13.15 \\ \times \quad 0.4 \\ \hline \end{array}$$

F.

$$\begin{array}{r} 0.92 \\ \times \quad 0.5 \\ \hline \end{array}$$

F.

$$\begin{array}{r} 0.38 \\ \times \quad 1.7 \\ \hline \end{array}$$

F.

$$\begin{array}{r} 71.89 \\ \times \quad 0.2 \\ \hline \end{array}$$

F.

$$\begin{array}{r} 1.35 \\ \times \quad 9.6 \\ \hline \end{array}$$

F.

$$\begin{array}{r} 31.78 \\ \times \quad 0.9 \\ \hline \end{array}$$

F.

$$\begin{array}{r} 9.16 \\ \times \quad 1.3 \\ \hline \end{array}$$

Module 12:

Multiplication of Rational Numbers

Vocabulary Cards

algorithm
decimal
denominator
equal groups
equal sign
equivalent
factor
fraction
hundredths
improper fraction
least common multiple
mixed number
multiply/multiplication
multiplication sign
numerator
ones
partial products
product
regroup/trade/exchange
tenths

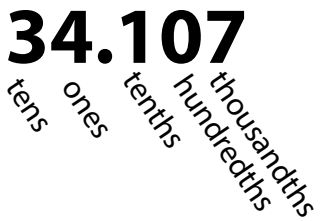
algorithm

A set of steps to solve a problem.

---

decimal

A number based on powers of ten.



denominator

The term in a fraction that tells the number of equal parts in a whole.

2 / 3

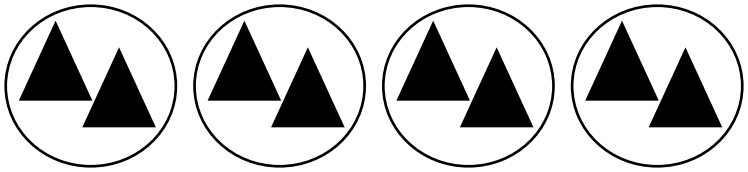
$$\frac{2}{3}$$

In these fractions, 3 is the denominator.

---

equal groups

Groups with the same number of objects or items in each group.



equal sign

The symbol that tells you that two sides of an equation are the same, balanced, or equal.

$$2 \times 8 = 16$$

= is the equal sign

---

equivalent

Two numbers that have the same value.

$$\frac{1}{4} = \frac{2}{8} \qquad \frac{2}{3} = \frac{8}{12}$$

factor

A number that you multiply with another number to get the product.

$$2 \times 8 = 16$$

2 and 8 are the factors

---

fraction

A number representing part of a whole or set.

$$\frac{3}{6} \qquad \frac{10}{12} \qquad \frac{8}{3}$$

hundredths

The digit in representing $\frac{1}{100}$.

In the number 4.23, 3 is in the hundredths place.

---

improper fraction

Any fraction in which the numerator is greater than the denominator.

$$\frac{9}{4} \qquad \frac{17}{12} \qquad \frac{10}{3}$$

mixed number

A whole number and a fraction combined.

$$1\frac{1}{6} \qquad 4\frac{5}{12} \qquad 12\frac{4}{3}$$

---

multiply/multiplication

The process of adding a number to itself a number of times.

$$4 \times 2 = 8$$

multiplication sign

The symbol that tells you to multiply.

$$2 \times 8 = 16$$

$\times$ is the multiplication sign

---

numerator

The term in a fraction that tells how many parts of a fraction.

2 / 3 $\quad \frac{2}{3}$ **In these fractions, 2 is the numerator.**

ones

The digit representing 1.

In the number 4.23, 4 is in the ones place.

---

partial products

The product of parts of each factor.

$$
\begin{array}{r}
13 \\
\times\ 45 \\
\hline
400\ (40 \times 10) \\
120\ (40 \times 3) \\
50\ (10 \times 5) \\
+\ 15\ (5 \times 3) \\
\hline
585
\end{array}
$$

product

The result of multiplying two or more factors.

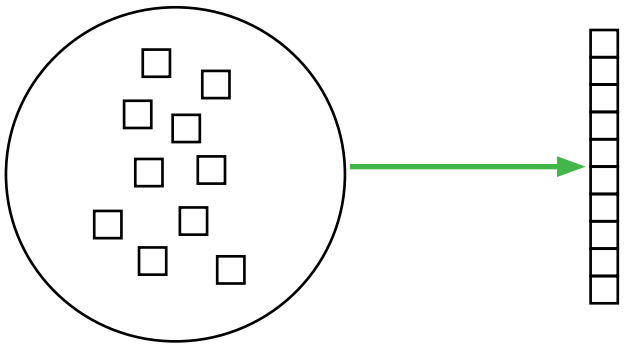
$$2 \times 8 = 16$$

16 is the product

---

regroup/trade/exchange

The process of exchanging 10 ones for 1 ten, 10 tens for 1 hundred, 10 hundreds for 1 thousand, etc.



tenths

The digit in representing $\frac{1}{10}$.

In the number 4.23, 2 is in the tenths place.