Ohio’s Learning Standards-Clear Learning Targets

Math Grade 5

<table>
<tr>
<td>5.OA.1
Use parentheses in numerical expressions, and evaluate expressions with this symbol. Formal use of algebraic order of operations is not necessary.</td>
<td rowspan="2">Common Misconceptions
Students may believe the problems should be solved left to right regardless of symbols such as parentheses. Allow students to solve problems to see that answers vary if you ignore the parentheses. Discuss what parentheses represent and why we need to complete those calculations first. What would happen if everyone solved problems in their own order?</td>
<td rowspan="2">Academic Vocabulary/Language
▪ numerical expression
▪ parentheses

Tier 2
▪ evaluate</td>
</tr>
<tr>
<td>Essential Understanding
● Calculations with parentheses are evaluated first within an expression.</td>
</tr>
<tr>
<td>Learning Targets</td>
<td colspan="2">I can apply and evaluate parentheses in numerical expressions, including whole numbers, fractions, and decimals.</td>
</tr>
</table>

Classroom Snapshot

- Students will use parentheses to group an expression with multiple operations.
- Students will evaluate and interpret numerical expressions, including whole numbers, fractions, and decimals.

Sample Questions

1. Explain how the presence of parenthesis affects a mathematical expression.
2. Tyrone says that 16 - (4 + 4) = 8. Jada says it equals 24. Who do you agree with?
3. Do these two equations, (20 + 5) × 2 and 20 + (5 × 2), have the same solution? Why or why not? Explain your thinking.
4. Daniel wrote an equation using all four operations (+, - , ×, ÷), and one set of parentheses, with an answer of 36. What did Daniel's equation look like? Use what you know about order of operations to create an equation and explain why your answer is right?

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

5.OA.1 should be viewed as exploratory rather than for attaining mastery; students may use parentheses, brackets, or braces, but they should not be using nested expressions. Problems should be no more complex than the expressions one finds in an application of the associative or distributive property, e.g., (8 + 27) + 2 or (6 × 30) + (6 × 7).

Connections Across Standards

Apply and extend previous understandings of multiplication and division to multiply and divide fractions (5.NF.5).

4.OA.3 (Prior Grade Standard)	**6.EE.7 (Future Grade Standard)**
Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.	Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ *and* $px = q$ for cases in which *p, q and x* are all non-negative rational numbers.

Ohio's Learning Standards-Clear Learning Targets

Math Grade 5

5.OA.2 Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them. *For example, express the calculation "add 8 and 7, then multiply by 2" as 2 × (8 + 7). Recognize that 3 × (18,932 + 921) is three times as large as 18,932 + 921, without having to calculate the indicated sum or product.* **Essential Understandings** ● Expressions can be written using words or symbols. ● It is acceptable to change the order of an expression. For example, "add seven and six, then multiply by two" mathematically would get the same answer as (6 + 7) × 2 or 2 × (6 + 7).	**Common Misconceptions** Students may believe the problems should be solved left to right regardless of symbols such as parentheses. Allow students to solve problems to see that answers vary if you ignore the parentheses. Discuss what parentheses represent and why we need to complete those calculations first. What would happen if everyone solved problems in their own order?	**Academic Vocabulary/ Language** ▪ braces ▪ numerical expression ▪ parentheses **Tier 2** ▪ evaluate ▪ record
Learning Targets	I can write and explain numerical expressions that use whole numbers, fractions, and decimals. I can translate a word expression and numerical expression and explain the relationship between the two without calculating the answer.	

Assessment of Learning

- Students will write and interpret numerical expressions, including whole numbers, fractions, and decimals.
- Students will use conceptual understanding to interpret multiplicative comparisons without evaluating them.
- Students will explain the relationship between two number expressions without calculating the answers.
- Students will translate a numerical expression into words. For example, 3 × (18,932 + 921) is three times as large as 18,932 + 921.
- Students will translate an expression written in words symbolically. For example, twice the sum of seven and six is 2 × (7 + 6).

Sample Questions

1. The class is selling tickets for the talent show in two weeks. Arthur sold 24 tickets and Kylon sold 17 tickets during the first week. If the tickets are $3.00 each, how could they show how much money they made using numerical expressions?
2. Write a numerical expression that shows the sum of 54 and 45. Explain the reasoning you used when you wrote the expression.
3. Show how you can write an expression where the product is less than the number you begin with. Explain your reasoning.
4. Do you need to do the calculations to know which answer is larger? 4 × (184 + 948) OR (948 + 184) × 2? How much larger will the answer be?

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

Provide students with real world problems that give opportunities to explore the need for an operation to be performed before another in context. These problems will require students to use reasoning to solve the problem. Students will engage in mathematical discourse to explain their reasoning and compare it to the reasoning of others. Students need to write expressions that describe word problems. Allow students to productively struggle to gain understanding of the concept. Have students write scenarios that would match the expression as well as write expressions to match the scenarios. Have students model the math to deepen understanding. Providing scaffolding for students. Have students write numerical expressions in words without calculating the value. This is the foundation for writing algebraic expressions. Then, have students write numerical expressions from phrases without calculating them. Students in Grade 6 will use the conventions for order of operations to interpret as well as evaluate expressions.

Connections Across Standards

Apply and extend previous understandings of multiplication and division to multiply and divide fractions (5.NF.5).

4.OA.5 (Prior Grade Standard)	**6.EE.7 (Future Grade Standard)**
Generate a number or shape pattern that follows a given rule. Identify apparent features of the pattern that were not explicit in the rule itself. *For example, given the rule "Add 3" and the starting number 1, generate terms in the resulting sequence and observe that the terms appear to alternate between odd and even numbers. Explain informally why the numbers will continue to alternate in this way.*	Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ *and* $px = q$ for cases in which p, q *and* x are all non-negative rational numbers.

Ohio's Learning Standards-Clear Learning Targets

Math Grade 5

5.OA.3 Generate two numerical patterns using two given rules. Identify apparent relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane. *For example, given the rule "Add 3" and the starting number 0, and given the rule "Add 6" and the starting number 0, generate terms in the resulting sequences, and observe that the terms in one sequence are twice the corresponding terms in the other sequence. Explain informally why this is so.* **Essential Understandings** ● A relationship can exist between two numerical patterns generated from two given rules. ● Ordered pairs generated from given rules can be graphed on a coordinate plane	**Common Misconceptions** Students reverse the points when plotting them on a coordinate plane. They count up first on the *y*-axis and then count over on the *x*-axis. The location of every point in the plane has a specific place. Have students plot points where the numbers are reversed such as (4, 5) and (5, 4). Begin with students providing a verbal description of how to plot each point. Then, have them follow the verbal description and plot each point.	**Academic Vocabulary/ Language** ▪ numerical patterns ▪ rules ▪ ordered pairs ▪ coordinate plane ▪ sequence ▪ term **Tier 2** ▪ generate ▪ identify

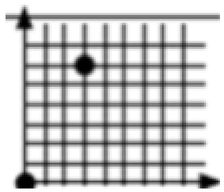
Learning Targets	I can generate two numerical patterns using two given rules to form ordered pairs and graph these on a coordinate plane. I can reason about the relationships between the numbers on the graph.

Assessment of Learning

- Students will generate two numerical patterns from two given rules.
- Students will align two number sequences generated from the given rules to form corresponding terms.
- Students will generate ordered pairs using the corresponding terms of two given rules.
- Students will informally compare the relationships of the *x* and *y* coordinates of two different rules when graphed on a coordinate plane.
- Students will discuss and apply the relationship between the two results, when two rules are given.

Sample Questions

1. Graph the pairs of numbers below on a coordinate graph.
   (0,0); (3,6); (6,12); (9,18)



2. Sugar cookies need to bake for 11 minutes in the oven. Chocolate chip cookies need to bake for 9 minutes in the oven. How long will it take to make 5 batches of each cookie? Create a table for each type of cookie that shows the rules for the baking time. Graph the resulting coordinate pairs on a coordinate plane.
3. Tamia is using a copier that makes 8 copies per minute. Jacqueline's copier makes 11 copies per minute. How many copies will Tamia have after 10 minutes? Jacqueline finishes copying and has 121 copies, how many minutes did it take her? Explain your thinking.

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

Given two rules with an apparent relationship, students should be able to identify the relationship between the resulting sequences of the terms in one sequence to the corresponding terms in the other sequence. For example, starting with 0, multiply by 4 and starting with 0, multiply by 8 and generate each sequence of numbers (0, 4, 8, 12, 16, …) and (0, 8, 16, 24, 32,…). Students should see that the terms in the second sequence are double the terms in the first sequence, or that the terms in the first sequence are half the terms in the second sequence. Have students form ordered pairs and graph them on a coordinate plane. Patterns can be also discerned in graphs. Graphing ordered pairs on a coordinate plane is introduced to students in the Geometry domain where students solve real-world and mathematical problems. For the purpose of this cluster, only use the first quadrant of the coordinate plane, which contains positive numbers only. Provide coordinate grids for the students, but also have them make coordinate grids. In Grade 6, students will position pairs of integers on a coordinate plane.

The graph of both sequences of numbers is a visual representation that will show the relationship between the two sequences of numbers. Encourage students to represent the sequences in T-charts so that they can see a connection between the graph and the sequences.

0	0
1	4
2	8
3	12
4	16

0	0
1	8
2	16
3	24
4	32

Connections Across Standards

Graph points on the coordinate plane to solve real-world and mathematical problems (5.G.1-2).

4.OA.3 (Prior Grade Standard)	**6.EE.7 (Future Grade Standard)**
Solve multistep word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent these problems using equations with a letter standing for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding.	Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ *and* $px = q$ for cases in which *p, q and x* are all non-negative rational numbers.

Ohio's Learning Standards-Clear Learning Targets

Math Grade 5

5.NBT.1

Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and $\frac{1}{10}$ of what it represents in the place to its left.

Essential Understanding

- In the base-ten system, the value of each place is 10 times the value of the place to the immediate right and $\frac{1}{10}$ of the value to its immediate left.

Common Misconceptions

A misconception that is directly related to comparing whole numbers is the idea that the longer the number the greater the number. With whole numbers, a 5-digit number is always greater than a 1-, 2-, 3-, or 4-digit number. However, with decimals a number with one decimal place may be greater than a number with two or three decimal places. For example, 0.5 is greater than 0.12, 0.009 or 0.499. One method for comparing decimals is to make all numbers have the same number of digits to the right of the decimal point by adding zeros to the number, such as 0.500, 0.120, 0.009 and 0.499. A second method is to use a place-value chart to place the numerals for comparison.

Academic Vocabulary/ Language

- place value
- period
- decimal
- decimal point
- tenths
- hundredths
- thousandths
- place value chart

Tier 2

- recognize
- represents

Learning Targets	I can apply the mathematical understanding of multi-digit numbers and determine that the digit to the left is 10 times greater than a given digit with whole numbers, and/or decimal numbers. I can determine that in a multi-digit number, a digit to the right is $\frac{1}{10}$ of the given digit with whole numbers and/or decimal numbers.

Assessment of Learning

- Students will use an understanding of multiplication and division to relate the value of a number compared to its place value location.
- Students will apply their understanding about place value when reasoning about numbers that are 10 times greater than or $\frac{1}{10}$ of a given number.

Sample Questions

1. How is the value of 4 different in 496 and 9.64? Use what you know about place value to explain your answer.
2. Why is 35 × 10 = 350? Draw pictures and/or use numbers sentences to illustrate your explanation.
3. Jennifer puts 10 jellybeans on a scale and the scale reads 12.0 grams. How much would you expect 1 jellybean to weigh? Why?
4. Engage students in a discussion explaining how 24 and .24 are alike and different.

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

In Grade 4, students explored the concept that a digit in one place represents ten times what it represents in the place to its right. Also, they compared decimals to the hundredths and rounded whole numbers to a given place. In Grade 5, students extend their conceptual understanding of the base-ten system to the relationship that a digit in one place represents $\frac{1}{10}$ of what it represents in the place to its left.

Money is a good medium to compare decimals. Present contextual situations that require the comparison of the cost of two items to determine the lower or higher priced item. Students should also be able to identify how many pennies, dimes, dollars and ten dollars, etc., are in a given value. Help students make connections between the number of each type of coin and the value of each coin, and the expanded form of the number. Build on the understanding that it always takes ten of the number to the right to make the number to the left.

Connections Across Standards

Solve real-world problems by adding, subtracting, multiplying, and dividing decimals using concrete models or drawings (5.NBT.7).

4.NBT.2 (Prior Grade Standard)	**6.NS.6 (Future Grade Standard)**
Read and write multi-digit whole numbers using standard form, word form, and expanded form [G]. Compare two multi-digit numbers based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons. Grade 4 expectations in this domain are limited to whole numbers less than or equal to 1,000,000.	Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates.

Ohio’s Learning Standards-Clear Learning Targets

Math Grade 5

<table>
<tr>
<td colspan="2">

5.NBT.2 Explain patterns in the number of zeros of the product when multiplying a number by powers of 10, and explain patterns in the placement of the decimal point when a decimal is multiplied or divided by a power of 10. Use whole-number exponents to denote powers of 10.

</td>
<td rowspan="2">

Common Misconceptions
A common misconception that students have when trying to extend their understanding of whole number place value to decimal place value is that as you move to the left of the decimal point, the number increases in value. Reinforcing the concept of powers of ten is essential for addressing this issue.

</td>
<td rowspan="2">

Academic Vocabulary/ Language
- exponent
- base
- power
- squared
- cubed

Tier 2
- explain
- denote

</td>
</tr>
<tr>
<td colspan="2">

Essential Understanding
- There are patterns in the number of zeros when multiplying or dividing a number by a power of ten.

</td>
</tr>
<tr>
<td>

Learning Targets

</td>
<td colspan="3">

I can explain place value in our number system and how powers of 10 are used in multiplication, division, and decimals.
I can generate a pattern that occurs when multiplying by a power of 10.
I can generate a pattern that occurs when dividing by a power of 10.

</td>
</tr>
</table>

Assessment of Learning

- Students will explain how multiplying by a power of 10 changes the value of the number.
- Students will use whole number exponents to denote powers of 10.

Sample Questions

1. Compute the value of $10^3 \times 23.4$.
2. Explain how you might find the answer to $234 \div 10^2$ without computing the division problem.
3. How many zeros does the product 20 x 50 have? Does the product of 2×500 have the same number of zeros? Explain your thinking.
4. Brian is multiplying 64.15×10 so he put a zero at the end of the number to get his answer. $64.15 \times 10 = 64.150$. Explain why you agree or disagree with Brian's thinking.

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

In Grade 4, students explored the concept that a digit in one place represents ten times what it represents in the place to its right. Also, they compared decimals to the hundredths and rounded whole numbers to a given place. In Grade 5, students extend their conceptual understanding of the base-ten system to the relationship that a digit in one place represents $\frac{1}{10}$ of what it represents in the place to its left. Decimals move from the domain Number and Operations—Fractions to the domain Number and Operations in Base Ten. Students extend base-ten relationships as they explain patterns in the number of zeros when multiplying by powers of 10 and in the placement of the decimal point when a decimal is multiplied or divided by a power of 10.

Connections Across Standards

Solve real-world problems by adding, subtracting, multiplying, and dividing decimals using concrete models or drawings (5.NBT.7).

4.NBT.5 (Prior Grade Standard)	**6.NS.3 (Future Grade Standard)**
Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.	Fluently add, subtract, multiply and divide multi-digit decimals using the standard algorithm for each operation.

Ohio's Learning Standards-Clear Learning Targets

Math Grade 5

5.NBT.3

Read, write, and compare decimals to thousandths.

a. Read and write decimals to thousandths using base-ten numerals, number names, and expanded form [G], e.g., $347.392 = 3 \times 100 + 4 \times 10 + 7 \times 1 + 3 \times (\frac{1}{10}) + 9 \times (\frac{1}{100}) + 2 \times (\frac{1}{1000})$.
b. Compare two decimals to thousandths based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons.

Essential Understandings

- Each period of three digits separated by commas is read as hundreds, tens, and ones, followed (when appropriate) by the name of the period, e.g., 123,456 is read as one hundred twenty-three thousand, four hundred fifty-six.
- In a decimal number, digits to the right of the decimal point are named by the appropriate unit: tenths, hundredths, thousandths.
- In a decimal number, the digits to the right of the decimal point are read followed by the name of the appropriate unit.
- When reading a decimal number, the decimal point is read as and.
- Decimals to thousandths can be expressed in standard form, word form, and expanded form.
- Two decimals to thousandths can be compared using the symbols >, =, and <.

Common Misconceptions

A misconception that is directly related to comparing whole numbers is the idea that the longer the number the greater the number. With whole numbers, a 5-digit number is always greater than a 1-, 2-, 3-, or 4-digit number. However, with decimals a number with one decimal place may be greater than a number with two or three decimal places. For example, 0.5 is greater than 0.12, 0.009 or 0.499. One method for comparing decimals is to make all numbers have the same number of digits to the right of the decimal point by adding zeros to the number, such as 0.500, 0.120, 0.009 and 0.499. A second method is to use a place-value chart to place the numerals for comparison.

Academic Vocabulary/ Language

- greater than
- less than
- equal to
- comparison
- <, >, =
- expanded form

Tier 2

- read
- write
- compare

Learning Targets	I can read and write decimals to the thousandths place using base-ten numerals, number names and expanded form. I can compare decimals based on the value of the digits and record the answer using <, >, and = symbols.

Assessment of Learning

- Students will represent, read, and write decimals to the thousandths in various forms (standard, number names and expanded form).
- Students will use patterns in the place value system to read and write numbers.
- Students will compare numbers based on place-value understanding.
- Students will connect the mathematical language to the use of symbols >, <, and = when describing the relationship between the numbers.
- Students will write two true inequality statements using symbols and words for a pair of decimals, e.g. 3.012 < 3.102 and 3.102 > 3.012.
- Students will compare the value of a numeral in a number to the same numeral in a different place in a different number, e.g. Given 3.423 and 4.32, compare the value of 3.

Sample Questions

1. Write the number twelve and three hundred fifty four thousandths using base ten numerals.
2. Using the different place value information, explain why 2.09 is smaller than 2.1.
3. Why is 3.3 > 3.2999 even though 3.2999 has more digits?
4. Avant is a candy maker. He has three different pieces of fudge. The chocolate fudge weighs 4.562 pounds, the white fudge is 4.872 pounds, and the peanut butter fudge weighs 4.572 pounds. Tanner is really hungry for fudge and wants to pick the largest piece, which piece of fudge should he pick? Explain.

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

Fifth graders are expected to read and write decimals to thousandths using base-ten numerals, number names, and expanded form. In addition students compare two decimals to the thousandths place using the symbols >, =, and <. In addition, students round decimals to any given place value, millions through hundredths. In future grades, they will extend the base-ten system to include negative numbers and scientific notation.

Number cards, number cubes, spinners and other manipulatives can be used to generate decimal numbers. For example, have students roll three number cubes, then create the largest and smallest number to the thousandths place. Ask students to represent the number with numerals and words.

Connections Across Standards

Solve real-world problems by adding, subtracting, multiplying, and dividing decimals using concrete models or drawings (5.NBT.7).

4.NBT.2 (Prior Grade Standard)	**6.NS.6 (Future Grade Standard)**
Read and write multi-digit whole numbers using standard form, word form, and expanded form [G]. Compare two multi-digit numbers based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons. Grade 4 expectations in this domain are limited to whole numbers less than or equal to 1,000,000.	Understand a rational number as a point on the number line. Extend number line diagrams and coordinate axes familiar from previous grades to represent points on the line and in the plane with negative number coordinates.

Ohio's Learning Standards-Clear Learning Targets

Math Grade 5

<table>
<tr><td colspan="2">5.NBT.4
Use place value understanding to round decimals to any place, millions through hundredths.</td><td rowspan="2">Common Misconceptions
A misconception that is directly related to comparing whole numbers is the idea that the longer the number the greater the number. With whole numbers, a 5-digit number is always greater than a 1-, 2-, 3-, or 4-digit number. However, with decimals a number with one decimal place may be greater than a number with two or three decimal places. For example, 0.5 is greater than 0.12, 0.009 or 0.499. One method for comparing decimals is to make all numbers have the same number of digits to the right of the decimal point by adding zeros to the number, such as 0.500, 0.120, 0.009 and 0.499. A second method is to use a place-value chart to place the numerals for comparison.</td><td rowspan="2">Academic Vocabulary/ Language
▪ decimal
▪ round
▪ place value</td></tr>
<tr><td colspan="2">Essential Understanding
● Rounding helps solve problems mentally and assess the reasonableness of an answer.</td></tr>
<tr><td>Learning Targets</td><td colspan="3">I can apply my understanding of place value to round decimals to any given place value through hundredths.
I can apply my understanding of rounding to assess the reasonableness of an answer when solving problems.</td></tr>
</table>

Assessment of Learning

- Students will round numbers based on place-value understanding.
- Students will explain reasoning when rounding.
- Students will develop and generalize rounding rules for decimals.
- Students will identify or create numbers that will round to a chosen number, e.g., Create a number that will round to 1.05.

Sample Questions

1. Lauryn and Kendall are having a "round off". Lauryn says that 7,456.856 rounded to the nearest tenth is 7,460. Kendall says Lauryn is wrong. Who do you believe is correct? Justify your answer.
2. Chris estimates the product of 6.9 × 5.1 as 35. Is this a reasonable estimate? Why?
3. Linda is buying peaches at the grocery store. Linda puts the peaches on the scale and it reads 3.83 pounds. The cost of the peaches depends on the weight. Since Linda wants to save money, should she round the weight of the peaches to the nearest tenth or whole number? Explain your thinking.

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

Fifth grade students round decimals to any given place value, millions through hundredths. Decimals are rounded in the same way that we round whole numbers. For example, we can round 30.56 to the nearest tenth (30.60). Rounding decimals is useful for estimating calculations with decimals or for approximating solutions. Students should be able to explain how a number is rounded using representations such as number lines, number charts, etc.

Connections Across Standards

Solve real-world problems by adding, subtracting, multiplying, and dividing decimals using concrete models or drawings (5.NBT.7).

4.NBT.3 (Prior Grade Standard)	**6.NS.7 (Future Grade Standard)**
Use place value understanding to round multi-digit whole numbers to any place through 1,000,000.	Understand ordering and absolute value of rational numbers.

Ohio’s Learning Standards-Clear Learning Targets

Math Grade 5

5.NBT.5 Fluently [G] multiply multi-digit whole numbers using a standard algorithm [G]. **Essential Understandings** ● There are different algorithms that can be used to multiply. ● Fluency is being efficient, accurate, and flexible with strategies.	**Common Misconceptions** When students only see each factor as a single digit numeral, they will not understand the magnitude of the numbers they are multiplying. Using the partial product method for multiplication often helps students see the actual numbers they are multiplying. Use grid paper to show the partial products and then how you add to get the final product.	**Academic Vocabulary/ Language** ▪ distributive property ▪ product ▪ rectangular arrays ▪ compatible numbers **Tier 2** ▪ fluently

Learning Targets	I can fluently multiply multi-digit whole numbers using a standard algorithm. I can apply efficient, accurate, and flexible strategies when multiplying multi-digit whole numbers.

Assessment of Learning

- Students will fluently multiply multi-digit whole numbers.
- Students will connect a standard algorithm to an efficient strategy.
- Students will explain and justify the reasoning used in a standard algorithm.
- Students will analyze other students' use of a standard algorithm, and explain any errors.
- Students will apply an efficient standard algorithm accurately and flexibly.

Sample Questions

1. Write a 3-digit by 1-digit multiplication problem with a product close to 2,000.
2. Is the product of 42 × 63 over or under 2,400? Use what you know about place value in the standard algorithm to explain your answer.
3. A rabbit's heart beats 212 beats per minute. How many times does it beat in 5 minutes? How can the product be used to determine the rabbit's heart beat in 10 minutes?
4. A bakery bakes 728 trays of cookies in a day. How many trays of cookies can the bakery make in 43 days? Explain how you found your solution.

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

Students must be able to use and explain the standard algorithm. Students should be challenged to determine when the standard algorithm is or isn't efficient.

Connections between the algorithm for multiplying multi-digit whole numbers and strategies such as partial products or lattice multiplication are necessary for students' understanding. You can multiply by listing all the partial products. For example:

234	
× 8	
32	Multiply the ones (8 × 4 ones = 32 ones)
240	Multiply the tens (8 × 3 tens = 24 tens or 240)
1600	Multiply the hundreds (8 × 2 hundreds = 16 hundreds or 1600)
1872	Add the partial products

The multiplication can also be done without listing the partial products by multiplying the value of each digit from one factor by the value of each digit from the other factor. Understanding of place value is vital in using the standard algorithm.

In using the standard algorithm for multiplication, when multiplying the ones, 32 ones is 3 tens and 2 ones. The 2 is written in the ones place. When multiplying the tens, the 24 tens is 2 hundreds and 4 tens. But, the 3 tens from the 32 ones need to be added to these 4 tens, for 7 tens. Multiplying the hundreds, the 16 hundreds is 1 thousand and 6 hundreds. But, the 2 hundreds from the 24 tens need to be added to these 6 hundreds, for 8 hundreds.

$$\begin{array}{r} 234 \\ \underline{\times\ 8} \\ 1872 \end{array}$$

Connections Across Standards Understand why multiplying by a power of 10 shifts the digits of a whole number or decimal that many places to the left (5.NBT.2). Apply and extend previous understandings of multiplication and division to multiply and divide fractions (5.NF.1-7).	
4.NBT.5 (Prior Grade Standard) Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.	**6.NS.3 (Future Grade Standard)** Fluently add, subtract, multiply and divide multi-digit decimals using a standard algorithm for each operation.

Ohio's Learning Standards-Clear Learning Targets

Math Grade 5

5.NBT.6 Find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models. **Essential Understandings** ● There is a relationship between multiplication and division. ● Equations, rectangular arrays, and/or area models can be used to illustrate and explain division. ● Remainders can be interpreted symbolically and in context. ● Real-world mathematical situations can be represented using concrete models or drawings. ● Patterns and structures can be generalized when multiplying and dividing whole numbers.	**Common Misconceptions** When students use the traditional algorithm, they often treat each digit in the dividend separately and do not look at the value of the entire number. Encourage the students to estimate prior to dividing, this helps them see what a reasonable quotient will be.	**Academic Vocabulary/ Language** ▪ quotients ▪ dividends ▪ divisor **Tier 2** ▪ illustrate ▪ explain ▪ calculation

Learning Targets	I can apply the strategies of place value, the properties of operations, and/or the relationship between multiplication and division to divide up to four-digit dividends and two-digit divisors when solving real-world problems. I can illustrate and explain division using equations, rectangular arrays or area models in real-world mathematical situations. I can interpret remainders symbolically and in context.

Assessment of Learning ● Students will divide finding whole number quotients with up to four-digit dividends and two-digit divisors. ● Students will explore division problems that result in remainders. ● Students will illustrate and explain the relationship between multiplication and division. ● Students will apply strategies that may include the following: decomposing factors; using the relationship between multiplication and division; creating equivalent but easier or known products; and properties of operations when solving real-word division problems. ● Students will illustrate and explain calculations using equations, rectangular arrays and/or other area models. ● Students will interpret remainders symbolically and in context. **Sample Questions** 1. John says, to divide 315 by 15 he first divides 15 into the last two digits of 3<u>15</u> which is one. Then, since 15 can not divide into 3 you put a zero so the answer is 10 r 3. Explain why you agree or disagree. 2. Draw an area model that would illustrate 624 ÷ 14 = 52. 3. Explain how to divide 1,036 by 14 using two different strategies. 4. Mr. Thomas bought 6 boxes of crayons at the store to share with his students. Each box contained a total of 64 crayons. Mr. Thomas wants to give each of his students an equal number of the crayons he bought. There are 28 students in Mr. Thomas' class. How many crayons should each student get?
Ohio Department of Education Model Curriculum Instructional Strategies and Resources This standard references various strategies for division. Division problems can include remainders. Even though this standard leads more towards computation, the connection to story contexts is critical. Make sure students are exposed to problems where the divisor is the number of groups and where the divisor is the size of the groups. In fourth grade, students' experiences with division were limited to dividing by one-digit divisors. This standard extends students' prior experiences with strategies, illustrations, and explanations. When the two-digit divisor is a "familiar" number, a student might decompose the dividend using place value. Students explore the conceptual understanding of division with remainders to include up to two-digit divisors and up to four digit dividends by applying equations, area models, and arrays to illustrate and explain strategies based on place value, the properties of operations, and/or the relationship between multiplication and division.
Connections Across Standards Understand why multiplying by a power of 10 shifts the digits of a whole number or decimal that many places to the left (5.NBT.2). Apply and extend previous understandings of multiplication and division to multiply and divide fractions (5.NF.1-7).

4.NBT.6 (Prior Grade Standard)	**6.NS.3 (Future Grade Standard)**
Find whole-number quotients and remainders with up to four digit dividends and one-digit divisors, using strategies based on place value, the properties of operations, and/or the relationship between multiplication and division. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.	Fluently add, subtract, multiply and divide multi-digit decimals using a standard algorithm for each operation.

Ohio's New Learning Standards-Clear Learning Targets

Math Grade 5

5.NBT.7 Solve real-world problems by adding, subtracting, multiplying, and dividing decimals using concrete models or drawings and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction, or multiplication and division; relate the strategy to a written method and explain the reasoning used.
a. Add and subtract decimals, including decimals with whole numbers, (whole numbers through the hundreds place and decimals through the hundredths place).
b. Multiply whole numbers by decimals (whole numbers through the hundreds place and decimals through the hundredths place).
c. Divide whole numbers by decimals and decimals by whole numbers (whole numbers through the tens place and decimals less than one through the hundredths place using numbers whose division can be readily modeled). *For example, 0.75 divided by 5, 18 divided by 0.6, or 0.9 divided by 3.*

Essential Understandings

- Patterns and structures can be generalized when multiplying and dividing decimals.
- There is a relationship between addition and subtraction.
- Real-world mathematical situations can be represented using concrete models or drawings when adding and subtracting decimals (including decimals with whole numbers through hundreds place and decimals through hundredths place).
- Real-world mathematical situations can be represented using concrete models or drawings when multiplying whole numbers by decimals (whole numbers through the hundreds place and decimals through the hundredths place).
- Real-world mathematical situations can be represented using concrete models or drawings when dividing whole numbers by decimals and decimals

Common Misconceptions

Students might compute the sum or difference of decimals by lining up the right-hand digits as they would the whole number. For example, in computing the sum of 15.34 + 12.9, students will write the problem in this manner:

$$\begin{array}{r} 15.34 \\ \underline{+\ 12.9} \\ 16.63 \end{array}$$

To help students add and subtract decimals correctly, have them first estimate the sum or difference. Providing students with a decimal-place value chart will enable them to place the digits in the proper place. When multiplying and dividing decimals students may understand a procedure without truly understanding why it works. Focus on using models before using an algorithm.

Academic Vocabulary/ Language

- associative property of multiplication
- commutative property of multiplication
- identity property of multiplication

Tier 2

- relate
- explain
- reason

by whole numbers (whole numbers through the tens place and decimals less than one through the hundredths place using numbers whose division can be readily modeled).		

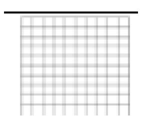
Learning Targets	I can perform operations with multi-digit whole numbers and with decimals to hundredths. I can compute with decimals to hundredths through the use of concrete models, drawings, or strategies based on place value. I can determine the reasonableness of my solution and explain how my strategy works and why I used it.

Assessment of Learning

- Students will solve and explain mathematical operations in context of real-world problems.
- Students will illustrate and explain calculations with decimals to hundredths through the use of concrete models, drawings, or strategies based on place value.
- Students will perform operations with multi-digit whole numbers through the hundreds and with decimals through the hundredths.
- Students will use concrete models or drawings to relate strategies to a written method.
- Students will determine reasonableness of a solution and compare to initial estimation with decimals in all four operations.

Sample Questions

1. Show at least two ways to multiply 23 × 4.76.
2. Explain how you would add 103 + 2.74 + 98.6.
3. When Richard added .4 + .7 he got .11. Is he correct? Justify your answer.
4. Zoe’s backpack weighed 12.09 pounds. Kharizma’s backpack weighed 15.3 pounds. How much heavier was Kharizma’s backpack? Use what you know about decimals to explain how you found your answer.
5. Use the grid below to model 3 × 0.4.

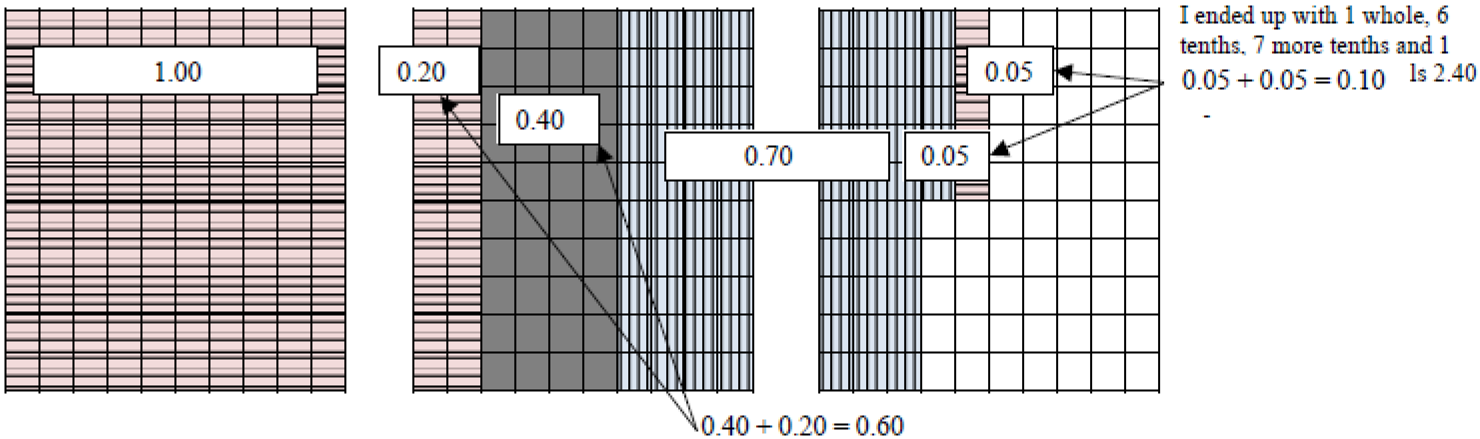


Ohio Department of Education Model Curriculum Instructional Strategies and Resources

As students developed efficient strategies to do whole number operations, they should also develop efficient strategies with decimal operations. Computation with decimals is more than “lining up decimals” (+/-) or “moving the decimal point” (×/÷). Students must understand computation with decimals and should transfer whole number computation strategies to decimals.

Students should learn to estimate decimal computations before they compute with pencil and paper. The focus on estimation should be on the meaning of the numbers and the operations, not on how many decimal places are involved. For example, to estimate the product of 32.84 × 4, the estimate would be more than 120, closer to 150. Students should consider that 32.84 is closer to 30. The product of 30 and 4 is 120. Therefore, the product of 32.84 × 4 should be more than 120 because 32.84 is more than 32.

Use models to show decimal computation such as 1.25 + 0.40 + 0.75



Connections Across Standards
Understand why multiplying by a power of 10 shifts the digits of a whole number or decimal that many places to the left (5.NBT.2).
Apply and extend previous understandings of multiplication and division to multiply and divide fractions (5.NF.1-7).

4.NBT.5 (Prior Grade Standard)	**6.NS.3 (Future Grade Standard)**
Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.	Fluently add, subtract, multiply and divide multi-digit decimals using a standard algorithm for each operation.

Ohio's Learning Standards-Clear Learning Targets

Math Grade 5

5.NF.1

Add and subtract fractions with unlike denominators (including mixed numbers and fractions greater than 1) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators. For example, use visual models and properties of operations to show $\frac{2}{3} + \frac{5}{4} = \frac{8}{12} + \frac{15}{12} = \frac{23}{12}$. In general, $a/b + c/d = (a/b \times d/d) + (c/d \times b/b) = (ad + bc)/bd$.

Essential Understandings

- Fractions can be added and subtracted when the wholes are the same size and the fractional parts (denominators) are the same.
- Fractions with different denominators are called unlike fractions.
- Fractions with different denominators can be added and subtracted by replacing each fraction with an equivalent fraction expressed with a like denominator.
- A fraction with a numerator larger than the denominator can be expressed as a mixed number or a fraction greater than one; both are correct representations.
- Expressing a mixed number as a fraction, e.g., $2\frac{3}{5} = \frac{13}{5}$, may be useful when solving a fraction problem.
- Benchmark fractions may be used to estimate and to check whether answers are reasonable.
- Common denominators are needed to add and subtract fractions with unlike denominators.
- Multiples may be used to find common denominators.

Common Misconceptions

Students often mix models when adding, subtracting or comparing fractions. Students will use a circle for thirds and a rectangle for fourths when comparing fractions with thirds and fourths. Remind students that the representations need to be from the same whole models with the same shape and size.

Academic Vocabulary/ Language

- record
- equivalent
- sum
- difference
- unlike denominator
- numerator
- mixed numbers
- denominator
- unlike fractions

Tier 2

- produce

Learning Targets

I can apply mathematical understanding of multiples to reason about the strategy needed to create equivalent fractions when adding and subtracting unlike denominators.

I can replace a given fraction with an equivalent fraction to create like denominators so I can add and subtract fractions that had unlike denominators.

I can express a fraction that has a numerator larger than the denominator as either a fraction larger than 1 or a mixed number.

I can apply the reasoning for representing a mixed number as a fraction that is greater than 1 when adding and subtracting fractions with unlike denominators.

Assessment of Learning

- Students will add and subtract fractions and mixed numbers with unlike denominators using models.
- Students will discuss and explore the use of models (e.g., rectangular area models, fraction strips, number lines, clock models, etc.) to find an appropriate model to represent both fractions.
- Students will decompose each of two fractions into a sum of fractions with the same denominator. e.g., To solve $\frac{1}{2} + \frac{3}{4}$ a student may think $\frac{1}{2} = \frac{1}{4} + \frac{1}{4} = \frac{2}{4}$, so $\frac{2}{4} + \frac{3}{4} = \frac{5}{4}$.
- Students will explain and justify their thinking when adding and subtracting combinations of fractions.
- Students will express a fraction that has a numerator larger than the denominator as either a fraction larger than 1 or a mixed number.
- Students will apply their understanding for representing a mixed number as a fraction that is greater than 1 when adding and subtracting fractions with unlike denominators.
- Students will add and subtract combinations of fractions whose denominators are multiples: (2, 4, 6, 8, 10, 12 or 3, 6, 12 or 5, 10, and 100) by using models and applying renaming fractions and strategies.

Sample Questions

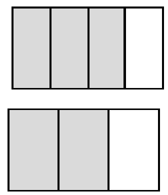
1. Lori subtracts two fraction and finds the difference of the two fractions is $\frac{3}{4}$. What could be the two fractions that Lori used?
2. Max and his 3 brothers and sisters are having pancakes for breakfast. Each child gets $1\frac{3}{4}$ pancakes. How many pancakes are needed?
3. Last night Sam spent $1\frac{3}{4}$ hours doing his Science project. He spent $\frac{2}{3}$ of an hour doing his math homework. How much time did he spend on this homework?
4. Show the sum of $\frac{2}{3} + \frac{5}{6}$ using a number line.
5. Jamie added the fractions $\frac{1}{4} + \frac{5}{6}$ and got an answer of $\frac{6}{10}$. Use what you know about addition of fractions to explain why Jamie's answer is incorrect.

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

To add or subtract fractions with unlike denominators, students use their understanding of equivalent fractions to create fractions with the same denominators. Start with problems that require the changing of one of the fractions and progress to changing both fractions. Allow students to add and subtract fractions using different strategies such as number lines, area models, fraction bars or strips. Have students share their strategies and discuss commonalities in them.

Students need to develop the understanding that when adding or subtracting fractions, the fractions must refer to the same whole. Any models used must refer to the same whole. Students may find that a circular model might not be the best model when adding or subtracting fractions.

These models of fractions use the same size rectangle to represent the whole unit and are therefore much easier to compare fractions.



Connections Across Standards

Write and interpret numerical expressions (5.OA.1-2).
Generate a pattern given a rule (5.OA.3).
Add and subtract decimals (5.NBT.7).
Display and interpret data in graphs (5.MD.2).

4.NF.3 a,b (Prior Grade Standard)	**6.EE.7 (Future Grade Standard)**
Understand a fraction *a/b* with *a > 1* as a sum of fractions *1/b*. a. Understand addition and subtraction of fractions as joining and separating parts referring to the same whole. b. Decompose a fraction into a sum of fractions with the same denominator in more than one way, recording each decomposition by an equation. Justify decompositions, e.g., by using a visual fraction model[G]. Examples: $\frac{3}{8} = \frac{1}{8} + \frac{1}{8} + \frac{1}{8}$; $\frac{3}{8} = \frac{1}{8} + \frac{2}{8}$; $2\frac{1}{8} = 1 + 1 + \frac{1}{8} = \frac{8}{8} + \frac{8}{8} + \frac{1}{8}$.	Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p, q and x are all nonnegative rational numbers.

Ohio's Learning Standards-Clear Learning Targets

Math Grade 5

<table>
<tr>
<td colspan="2">

5.NF.2

Solve word problems involving addition and subtraction of fractions referring to the same whole, including cases of unlike denominators, e.g., by using visual fraction models [G] or equations to represent the problem. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers.

For example, recognize an incorrect result $\frac{2}{5} + \frac{1}{2} = \frac{3}{7}$, *by observing that* $\frac{3}{7} < \frac{1}{2}$.

</td>
<td rowspan="2">

Common Misconceptions

Students often mix models when adding, subtracting or comparing fractions. Students will use a circle for thirds and a rectangle for fourths when comparing fractions with thirds and fourths. Remind students that the representations need to be from the same whole models with the same shape and size.

</td>
<td rowspan="2">

Academic Vocabulary/ Language

- record
- equivalent
- sum
- difference
- unlike denominator
- numerator
- mixed numbers
- denominator
- benchmark fractions
- estimate

Tier 2

- solve
- reasonableness

</td>
</tr>
<tr>
<td colspan="2">

Essential Understandings

- An equation can be used to describe a mathematical situation involving fractions.
- There is usually more than one way to describe and solve a mathematical situation involving fractions.
- Benchmark fractions may be used to estimate and to check whether answers are reasonable.

</td>
</tr>
<tr>
<td>

Learning Targets

</td>
<td colspan="3">

I can apply my understanding of equivalence to create fractions with like denominators when solving real-world multi-step word problems.

I can create a visual model or use an equation to support my understanding of adding and subtracting fractions with like/unlike denominators when solving real-world multi-step word problems.

I can use benchmark fractions and general number sense to determine the reasonableness of my answer.

</td>
</tr>
</table>

Assessment of Learning

- Students will use models and equations to add and subtract to solve word problems with two or more fractions with unlike denominators.
- Students will solve multiple groups problems involving groups of $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{3}$, $\frac{1}{5}$, $\frac{1}{6}$, $\frac{1}{8}$, $\frac{1}{10}$ and $\frac{1}{12}$ which included mixed numbers.
- Students will represent real-world problems with visual models and with equations; justify their solutions using the relationship between addition and subtraction and properties of operation.
- Students will explore and explain estimates of fraction problems using number sense or benchmark fractions.
- Students will access solutions to determine if the solutions are reasonable.

Sample Questions

1. There is $\frac{4}{5}$ of the cheese pizza left over, and $\frac{3}{4}$ of the pepperoni left over. Kai says that there is about $1\frac{1}{2}$ total pizzas left. Do you agree? Explain.
2. How do you know that $2\frac{1}{2} + 3\frac{2}{3} > 6$? Explain your thinking.
3. Create a model to show how to add $\frac{5}{12}$ and $\frac{1}{4}$.
4. John's paper strip is $\frac{7}{8}$" long and Adele's is $\frac{3}{4}$" long. Who's paper strip is longer and by how much?
5. Is the sum of $\frac{3}{5}$ and $\frac{7}{16}$ going to be greater than or less than one?

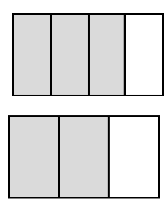
Ohio Department of Education Model Curriculum Instructional Strategies and Resources

As with solving word problems with whole number operations, regularly present word problems involving addition or subtraction of fractions. The concept of adding or subtracting fractions with unlike denominators will develop through solving problems. Mental computations and estimation strategies should be used to determine the reasonableness of answers. Students need to prove or disprove whether an answer provided for a problem is reasonable.

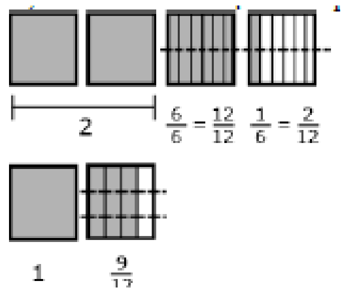
Estimation is about getting useful answers, it is not about getting the right answer. It is important for students to learn which strategy to use for estimation. Students need to think about what might be a close answer.

Students need to develop the understanding that when adding or subtracting fractions, the fractions must refer to the same whole. Any models used must refer to the same whole. Students may find that a circular model might not be the best model when adding or subtracting fractions.

These models of fractions use the same size rectangle to represent the whole unit and are therefore much easier to compare fractions.



This diagram models a way to show how $3\frac{1}{6}$ and $1\frac{3}{4}$ can be expressed with a denominator of 12. Once this is accomplished, a student can complete the problem $2\frac{14}{12} - 1\frac{9}{12} = 1\frac{5}{12}$.



Connections Across Standards

Write and interpret numerical expressions (5.OA.1-2).
Generate a pattern given a rule (5.OA.3).
Add and subtract decimals (5.NBT.7).
Display and interpret data in graphs (5.MD.2).

4.NF.3 (Prior Grade Standard)	**6.EE.7 (Future Grade Standard)**
Understand a fraction *a/b* with *a* > *1* as a sum of fractions *1/b*. a. Understand addition and subtraction of fractions as joining and separating parts referring to the same whole. b. Decompose a fraction into a sum of fractions with the same denominator in more than one way, recording each decomposition by an equation. Justify decompositions, e.g., by using a visual fraction model[G]. Examples: $\frac{3}{8} = \frac{1}{8} + \frac{1}{8} + \frac{1}{8}$; $\frac{3}{8} = \frac{1}{8} + \frac{2}{8}$; $2\frac{1}{8} = 1 + 1 + \frac{1}{8} = \frac{8}{8} + \frac{8}{8} + \frac{1}{8}$. c. Add and subtract mixed numbers with like denominators, e.g., by replacing each mixed number with an equivalent fraction, and/or by using properties of operations and the relationship between addition and subtraction. d. Solve word problems involving addition and subtraction of fractions referring to the same whole and having like denominators, e.g., by using visual fraction models and equations to represent the problem.	Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p, q and x are all nonnegative rational numbers.

Ohio's Learning Standards-Clear Learning Targets

Math Grade 5

<table>
<tr>
<td>

5.NF.3

Interpret a fraction as division of the numerator by the denominator ($a/b = a \div b$). Solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers, e.g., by using visual fraction models or equations to represent the problem. *For example, interpret* $\frac{3}{4}$ *as the result of dividing 3 by 4, noting that* $\frac{3}{4}$ *multiplied by 4 equals 3, and that when 3 wholes are shared equally among 4 people each person has a share of size* $\frac{3}{4}$. *If 9 people want to share a 50 pound sack of rice equally by weight, how many pounds of rice should each person get? Between what two whole numbers does your answer lie?*

</td>
<td rowspan="2">

Common Misconceptions

Students may believe that division always results in a smaller number. Using models when dividing with fractions will enable students to see that the results will be larger.

</td>
<td rowspan="2">

Academic Vocabulary/ Language

- fraction
- numerator
- denominator

Tier 2

- interpret
- solve
- represent

</td>
</tr>
<tr>
<td>

Essential Understandings

- The denominator describes what number of equal parts a whole has been divided into.
- The numerator describes how many of the parts are considered.
- The numerator is a multiplier, e.g., $\frac{4}{5} = 4 \times \frac{1}{5}$.
- A fraction represents division, so $a \div b = a/b$, e.g., $3 \div 4 = \frac{3}{4}$.
    - The denominator is the divisor.
    - The numerator is the dividend.
- Equal shares means each sharer gets the same sized part and no parts are discarded.
- The solution to an equal sharing problem can be shown with a fraction representing the relationship of the sharers and the amount.
- When adding or subtracting unlike fractions, all fractions must be represented with equal sized parts of the same whole.

</td>
</tr>
<tr>
<td>

Learning Targets

</td>
<td colspan="2">

I can use real-world situations as context to support understanding of division of a numerator by a denominator.
I can apply my understanding of the denominator as the divisor and the numerator as the dividend when solving real-world problems involving whole numbers leading to answers in the form of mixed numbers or fractions.
I can create visual models to support my understanding of division of the numerator by the denominator when solving real-world problems.

</td>
</tr>
</table>

Assessment of Learning

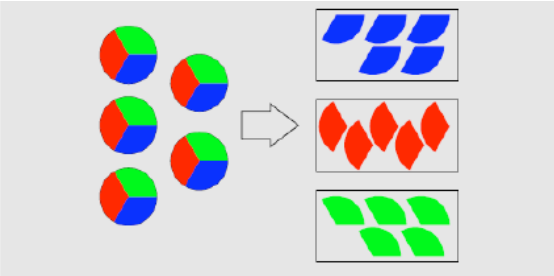
- Students will represent a fraction as division problems and vice versa.
- Students will solve word problems involving division of whole numbers leading to answers in the form of fractions or mixed numbers.
- Students will create, explain, and solve real-world problems involving equal shares or multiple groups using models and equations.
- Students will solve equal sharing problems where the amount shared is less than the number of shares by writing the fraction, eg., When three pizzas are shared with 8 students, each student gets $\frac{3}{8}$ of a pizza..
- Students will solve equal sharing problems involving comparisons where the amount shared is less than the number of sharers, e.g., Who gets more? A student in a group of 6 sharing 4 brownies or a student in a group of 5 sharing 3 brownies?

Sample Questions

1. Every kid in the car on their way to basketball practice got $\frac{3}{4}$ of a sub. There were four kids. How many subs did the mom get? Explain.
2. 15 friends want to share 3 watermelons equally. What fraction of a watermelon will each friend get?
3. Draw a picture to show why $\frac{1}{8} = 1 \div 8$.
4. A school went on a field trip to the zoo. Five students forgot their lunch. Luckily, their teacher brought 3 subs in case this happened. How could their teacher share the 3 subs equally among the 5 students? Explain your thinking.

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

How to share 5 objects equally among 3 shares. $5 \div 3 = 5 \times \frac{1}{3} = \frac{5}{3}$



When fractions represent division, the denominator acts as the divisor and the numerator is the multiplier. Students need to understand that the numerator is the same as the dividend and denominator is the same as the divisor. If you divide 5 objects equally among 3 shares, each of the 5 objects should contribute $\frac{1}{3}$ of itself to each share. Thus, each share consists of 5 pieces, each of which is $\frac{1}{3}$ of an object, and so each share is $5 \times \frac{1}{3} = \frac{5}{3}$ of an object.

Connections Across Standards

Write and interpret numerical expressions (5.OA.1-2).
Generate a pattern given a rule (5.OA.3).
Multiply and divide decimals (5.NBT.7).
Represent and interpret data (5.MD.2).

4.NF.5 (Prior Grade Standard)	**6.NS.1 (Future Grade Standard)**
Express a fraction with denominator 10 as an equivalent fraction with denominator 100, and use this technique to add two fractions with respective denominators 10 and 100. *For example, express* $\frac{3}{10}$ *as* $\frac{30}{100}$*, and add* $\frac{3}{10} + \frac{4}{100} = \frac{34}{100}$. In general, students who can generate equivalent fractions can develop strategies for adding fractions with unlike denominators, but addition and subtraction with unlike denominators is not a requirement at this grade.	Interpret and compute quotients of fractions, and solve word problems involving division of fractions by fractions, e.g., by using visual fraction models[G] and equations to represent the problem. *For example, create a story context for* $(\frac{2}{3}) \div (\frac{3}{4})$ *and use a visual fraction model to show the quotient; use the relationship between multiplication and division to explain that* $(\frac{2}{3}) \div (\frac{3}{4}) = \frac{8}{9}$ *because* $\frac{3}{4}$ *of* $\frac{8}{9}$ *is* $\frac{2}{3}$*. (In general, (a /b) ÷ (c /d) = ad/bc.) How much chocolate will each person get if 3 people share* $\frac{1}{2}$ *pound of chocolate equally? How many* $\frac{3}{4}$ *cup servings are in* $\frac{2}{3}$ *of a cup of yogurt? How wide is a rectangular strip of land with length* $\frac{3}{4}$ *mi and area* $\frac{1}{2}$ *square mi.*

Ohio's Learning Standards-Clear Learning Targets

Math Grade 5

5.NF.4

Apply and extend previous understandings of multiplication to multiply a fraction or whole number by a fraction.

a. Interpret the product *(a /b)* × *q* as a parts of a partition of *q* into *b* equal parts, equivalently, as the result of a sequence of operations *a* × *q* ÷ *b*. For example, use a visual fraction model to show $(\frac{2}{3}) \times 4 = \frac{8}{3}$, and create a story context for this equation. Do the same with $(\frac{2}{3}) \times (\frac{4}{5}) = \frac{8}{15}$. (*In general, (a /b) × (c /d) = ac/bd.*)
b. Find the area of a rectangle with fractional side lengths by tiling it with unit squares of the appropriate unit fraction side lengths, and show that the area is the same as would be found by multiplying the side lengths. Multiply fractional side lengths to find areas of rectangles, and represent fraction products as rectangular areas.

Essential Understandings

- The idea of the numerator as a multiplier can be used when a fraction is being multiplied by a whole number, e.g., Just as $\frac{5}{8} = 5 \times \frac{1}{8}$, 5 groups of $\frac{3}{8}$ equals $5 \times \frac{3}{8} = (5 \times 3) \times \frac{1}{8}$ which equals $\frac{15}{8}$.
- Arrays, number lines, fraction strips, or sets can be used to find the solution to multiplying a whole number by a fraction.
- The relationship between multiplication and division is applied to fractions just as it is applied to whole numbers.
- The area of a rectangle with fractional side lengths can be computed.

Common Misconceptions

Students may believe that multiplication always results in a larger number. Using models when multiplying with fractions will enable students to see that the results will be smaller.

Academic Vocabulary/ Language

- fraction
- numerator
- denominator
- product
- partition
- equal parts
- equivalent
- factor
- unit fraction
- area
- side lengths

Tier 2

- apply
- extend
- interpret

Learning Targets	I can apply my understanding of the numerator as a multiplier when multiplying a fraction by a fraction or a fraction by a whole number. I can create models such as arrays, number lines, fraction strips, or sets of fractions to represent a fraction multiplied by a whole number or a fraction multiplied by a fraction. I can create a model to explain how a fraction times a whole number is dividing the whole into equal sized parts.

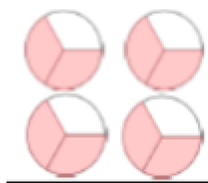
	I can apply my mathematical understanding of multiplying fractions when finding the areas of a rectangle that has fractions side lengths.

Assessment of Learning

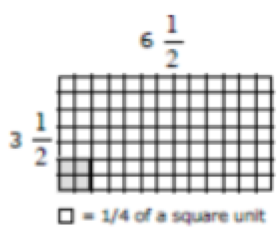
- Students will explore and explain that the product of a fraction ($\frac{a}{b}$) and a whole number (q) shown as ($\frac{a}{b}$ $\times q$) can be found by partitioning the whole number (q) into equal sized parts (b) with the results being a × q parts of size.
- Students will explore and explain that the product of two fractions ($\frac{a}{b}$ $\times$ $\frac{c}{d}$) is found by multiplying the numerators (a and c) and then multiplying the denominators (b and d) which is then shown as $(a \times c)/(b \times d)$.
- Students can model and find the area of a rectangular region with sides of fractional lengths by tiling.
- Students can scaffold the area of a rectangular region with sides of fractional lengths from concrete (tiling) to symbolic representation (equation).

Sample Questions

1. Draw a model to show $\frac{2}{3} \times \frac{3}{5}$.
2. Write a story to go with the expression $\frac{3}{4} \times 3$ and draw a visual representation to show the solution.
3. Andrew was absent. Explain to him how to solve $\frac{2}{3} \times 12$.
4. Explain how the model shown can be used to solve $4 \times \frac{2}{3}$ and what the answer is.



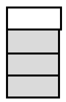
5. What is the area of the rectangle? Explain your thinking.



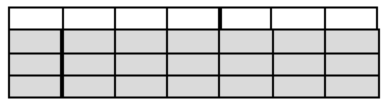
Ohio Department of Education Model Curriculum Instructional Strategies and Resources

Multiplication with fractions should feature diverse representations. Area models are good for making meaning of the concept. Ask questions such as, “What does 2×3 mean?” and “What does $12 \div 3$ mean?” Then, follow with questions for multiplication with fractions, such as, “What does $\frac{3}{4} \times \frac{1}{3}$ mean?” “What does $\frac{3}{4} \times 7$ mean?” (7 sets of $\frac{3}{4}$) and What does $7 \times \frac{3}{4}$ mean?” ($\frac{3}{4}$ of a set of 7)

The meaning of $4 \div \frac{1}{2}$ (how many $\frac{1}{2}$ are in 4) and $\frac{1}{2} \div 4$ (how many groups of 4 are in $\frac{1}{2}$) also should be illustrated with models or drawings like:



$\frac{3}{4}$



7 groups of $\frac{3}{4}$ or $\frac{21}{4}$

Encourage students to use models or drawings to multiply or divide with fractions. Begin with students modeling multiplication and division with whole numbers. Have them explain how they used the model or drawing to arrive at the solution.

Models to consider when multiplying or dividing fractions include, but are not limited to: area models using rectangles or squares, fraction strips/bars and sets of counters.

Connections Across Standards

Write and interpret numerical expressions (5.OA.1-2).

Generate a pattern given a rule (5.OA.3).

Multiply and divide decimals (5.NBT.7).

Represent and interpret data (5.MD.2).

4.NF.4 a,b (Prior Grade Standard)

Apply and extend previous understandings of multiplication to multiply a fraction by a whole number.

a. Understand a fraction *a /b* as a multiple of *1 /b*. *For example, use a visual fraction model to represent* $\frac{5}{4}$ *as the product* $5 \times (\frac{1}{4}$*, recording the conclusion by the equation* $\frac{5}{4} = 5 \times (\frac{1}{4})$ *or* $\frac{5}{4} = (\frac{1}{4}) + (\frac{1}{4}) + (\frac{1}{4}) + (\frac{1}{4}) + (\frac{1}{4})$.

b. Understand a multiple of a /b as a multiple of 1 /b, and use this understanding to multiply a fraction by a whole number. *For example, use a visual fraction model to express* $3 \times (\frac{2}{5})$ *as* $6 \times (\frac{1}{5})$*, recognizing this product as* $\frac{6}{5}$*. (In general,* $n \times (a/b) = (n \times a)/b$*.)*

6.EE.7 (Future Grade Standard)

Solve real-world and mathematical problems by writing and solving equations of the $x + p = q$ and $px = q$ for cases in which p, q and x are all nonnegative rational numbers.

Ohio's Learning Standards-Clear Learning Targets

Math Grade 5

<table>
<tr><td colspan="2">

5.NF.5

Interpret multiplication as scaling (resizing).
a. Compare the size of a product to the size of one factor on the basis of the size of the other factor, without performing the indicated multiplication.
b. Explain why multiplying a given number by a fraction greater than 1 results in a product greater than the given number (recognizing multiplication by whole numbers greater than 1 as a familiar case); explaining why multiplying a given number by a fraction less than 1 results in a product smaller than the given number; and relating the principle of fraction equivalence $\frac{a}{b} = \frac{(n \times a)}{(n \times b)}$ to the effect of multiplying $\frac{a}{b}$ by 1.

</td><td rowspan="2">

Common Misconceptions
Students may believe that multiplication always results in a larger number. Using models when multiplying with fractions will enable students to see that the results will be smaller.

</td><td rowspan="2">

Academic Vocabulary/ Language

- fraction
- numerator
- denominator
- product
- partition
- equal parts
- equivalent
- factor
- unit fraction
- scaling
- comparing

Tier 2

- interpret
- explain

</td></tr>
<tr><td colspan="2">

Essential Understandings

- Compare the size of a product to the size of one factor on the basis of the size of the other factor, without performing the indicated multiplication.
- Explore and explain the value of the solutions when multiplying the following:
  - a given number by a fraction greater than one; and
  - a given number by a fraction less than one.
- When a number is multiplied by a number greater than one, the product will be greater than the original number, e.g., $3 \times \frac{5}{4}$ will be greater than 3.
- When a number is multiplied by a fraction less than one the product is smaller than the original number, e.g., $5 \times \frac{3}{4}$ will be less than 5).
- When two fractions less than one are multiplied, the product is smaller than both of the original fractions.

</td></tr>
<tr><td>

Learning Targets

</td><td colspan="3">

I can apply my understanding of scaling to compare the size of a product to the size of one factor on the basis of the size of the other factor without solving the equation.
I can explain how to multiply a given number and make it smaller.
I can explain how to multiply a given number and make it larger.
I can generate equivalent fractions by multiplying by various versions of one. (2/2, 3/3, . . . n/n)

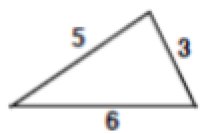
</td></tr>
</table>

Assessment of Learning

- Students can compare the size of a product to the size of one factor on the basis of the size of the other factor, without performing the indicated multiplication.
- Students can explore and explain the value of the solutions when multiplying a given number by a fraction greater than one and a given number by a fraction less than one.
- Students can relate the principle of fraction equivalence $a/b = (n \times a)/(n \times b)$ to the effect of multiplying a/b by 1.

Sample Questions

1. Explain why the product of 2×2 is greater than 2 and the product of $2 \times \frac{1}{2}$ is less than 2?
2. John wants to enlarge the triangle by a factor of $\frac{1}{2}$. What will the sides measure on the new triangle?



3. Explain why multiplying $\frac{2}{3}$ by $\frac{5}{5}$ does not change the value of the fraction.
4. When Mark solved the problem $\frac{1}{3} \times \frac{2}{3}$ he got an answer of $\frac{2}{9}$. This confused Corey. He thought the answer was incorrect because he always thought multiplication results in a product larger than the factors. Use what you know about multiplying fractions to explain why Mark's answer is correct.

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

The identity property of multiplication tells us that a number ×1 has a product equal to the number (itself). For example, $4 \times 1 = 4$. So when we multiply by a fraction that is less than 1, our product has to be less than the number we are multiplying the fraction. For example, $4 \times \frac{1}{3} = 1\frac{1}{3}$. The product ($1\frac{1}{3}$) is less than the original factor 4 because the second factor ($\frac{1}{3}$) is less than 1. When we multiply a fraction or mixed number by a number greater than 1 our product is greater than the original factor. For example $4 \times \frac{5}{4} = 5$. The product (5) is greater than the first factor (4) because the second product is greater than 1.

Have students use calculators or models to explain what happens to the result of multiplying a whole number by a fraction ($3 \times \frac{1}{2}$, $4 \times \frac{1}{2}$, $5 \times \frac{1}{2}$ …and $4 \times \frac{1}{2}$, $4 \times \frac{1}{3}$, $4 \times \frac{1}{4}$,…) and when multiplying a fraction by a number greater than 1.

Connections Across Standards

Write and interpret numerical expressions (5.OA.1-2).
Generate a pattern given a rule (5.OA.3).
Multiply and divide decimals (5.NBT.7).
Represent and interpret data (5.MD.2)

4.NF.4a,b (Prior Grade Standard)	**6.EE.7 (Future Grade Standard)**
Apply and extend previous understandings of multiplication to multiply a fraction by a whole number. a. Understand a fraction *a /b* as a multiple of *1 /b*. *For example, use a visual fraction model to represent* $\frac{5}{4}$ *as the product 5 ×* ($\frac{1}{4}$)*, recording the conclusion by the equation* $\frac{5}{4} = 5 \times (\frac{1}{4})$ *or* $\frac{5}{4} = (\frac{1}{4}) + (\frac{1}{4}) + (\frac{1}{4}) + (\frac{1}{4}) + (\frac{1}{4})$*.* b. Understand a multiple of a /b as a multiple of 1 /b, and use this understanding to multiply a fraction by a whole number. *For example, use a visual fraction model to express* $3 \times (\frac{2}{5})$ *as* $6 \times (\frac{1}{5})$*, recognizing this product as* $\frac{6}{5}$*. (In general, n × (a /b) = (n × a)/b.)*	Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p, q and x are all nonnegative rational numbers.

Ohio's New Learning Standards-Clear Learning Targets

Math Grade 5

5.NF.6

Solve real-world problems involving multiplication of fractions and mixed numbers, e.g., by using visual fraction models or equations to represent the problem

Essential Understanding

- Represent and create real-world problems with visual models and a corresponding equation, justifying the solution:
  - fractions by whole numbers;
  - fractions by unit fractions;
  - two fractions;
  - fractions and mixed numbers

Common Misconceptions

Students may believe that multiplication always results in a larger number. Using models when multiplying with fractions will enable students to see that the results will be smaller.

Academic Vocabulary/ Language

- fraction
- numerator
- denominator
- product
- quotient
- partition
- equal parts
- equivalent
- factor
- unit fraction
- fraction model

Tier 2

- solve
- represent

Learning Targets	I can solve real-world problems involving multiplication of fractions and mixed numbers by creating visual models or equations to represent the problem.

Assessment of Learning

- Students will solve real-world problems involving multiplication of fractions and mixed numbers with visual models and a corresponding equation, justifying the solution.

Sample Questions

1. How many pizzas need to be purchased if each person will eat $\frac{1}{5}$ of a pizza and there are 12 people? Explain your thinking.
2. David's family drove to the country. They drove for $1\frac{1}{4}$ hours to get there. The return trip took only $\frac{4}{5}$ of the time of the original trip. How long was the return trip? Use what you know about fractions to explain how you found your answer.
3. Michelle earns \$12 a week doing chores. How much money does she earn in $3\frac{1}{4}$ weeks? Provide a justification for your answer.
4. The distance around the school is $\frac{3}{4}$ of a mile. I have already walked $\frac{1}{2}$ way around the school. How far have I walked?

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

Pictures and diagrams are useful for understanding problems. Present problem situations and have students use models and equations to solve the problem. It is important for students to develop understanding of multiplication and division of fractions through contextual situations.

Connections Across Standards

Write and interpret numerical expressions (5.OA.1-2).
Generate a pattern given a rule (5.OA.3).
Multiply and divide decimals (5.NBT.7).
Represent and interpret data (5.MD.2)

4.NF.4c (Prior Grade Standard)	**6.EE.7 (Future Grade Standard)**
Apply and extend previous understandings of multiplication to multiply a fraction by a whole number. c. Solve word problems involving multiplication of a fraction by a whole number, e.g., by using visual fraction models and equations to represent the problem. *For example, if each person at a party will eat $\frac{3}{8}$ of a pound of roast beef, and there will be 5 people at the party, how many pounds of roast beef will be needed? Between what two whole numbers does your answer lie?*	Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which p, q and x are all nonnegative rational numbers.

Ohio’s Learning Standards-Clear Learning Targets

Math Grade 5

5.NF.7

Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions. In general, students able to multiply fractions can develop strategies to divide fractions, by reasoning about the relationship between multiplication and division, but division of a fraction by a fraction is not a requirement at this grade.

a. Interpret division of a unit fraction by a nonzero whole number, and compute such quotients. *For example, create a story context for* $(\frac{1}{3}) \div 4$, *and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that* $(\frac{1}{3}) \div 4 = \frac{1}{12}$ *because* $(\frac{1}{12}) \times 4 = \frac{1}{3}$.

b. Interpret division of a whole number by a unit fraction, and compute such quotients. *For example, create a story context for* $4 \div (\frac{1}{5})$, *and use a visual fraction model to show the quotient. Use the relationship between multiplication and division to explain that* $4 \div (1\frac{1}{5}) = 20$ *because* $20 \times (\frac{1}{5}) = 4$.

c. Solve real world problems involving division of unit fractions by non-zero whole numbers and division of whole numbers by unit fractions, e.g., by using visual fraction models and equations to represent the problem. *For example, how much chocolate will each person get if 3 people share* $\frac{1}{2}$ *lb of chocolate equally? How many* $\frac{1}{3}$*-cup servings are in 2 cups of raisins?*

Essential understandings

- A whole number can be divided by a non-zero fraction.
- A fraction can be divided by a non-zero whole number.

Common Misconceptions

Students may believe that division always results in a smaller number. Using models when dividing with fractions will enable students to see that the results will be larger.

Students may believe that multiplication always results in a larger number. Using models when multiplying with fractions will enable students to see that the results will be smaller.

Academic Vocabulary/ Language

- fraction
- numerator
- denominator
- quotient
- partition
- equal parts
- equivalent
- factor
- unit fraction

Tier 2

- apply
- extend

Learning Targets	I can create a visual fractional model to explain the meaning and process of dividing a unit fraction by a non-zero whole number. I can create a visual fraction model to explain the meaning and process of dividing a whole number by a unit fraction. I can apply the mathematical understanding of division of unit fractions by non-zero whole numbers and division of whole numbers by unit fractions to solve real-world problems.

Assessment of Learning

- Students will use the understanding of the relationship between whole number multiplication and division to reason about solving problems involving the division of a whole number by a unit fraction.
- Students will interpret division of a whole number by a unit fraction to solve real-world problems.
- Students will model, explain, and justify results of real-world problems.
- Students will interpret the division of a unit fraction by a whole number to solve real-world problems using visual models.

Sample Questions

1. How much chocolate will each person get if 3 people share $\frac{1}{2}$ lb of chocolate equally.
2. The recipe calls for $\frac{1}{3}$ cup of flour. If Bob has 2 cups of flour, how many times can he repeat the recipe?
3. Write a real-world problem where the solution involves taking 4 and dividing it by $\frac{1}{5}$ and then state the solution.
4. Everyday, Marwa's dog needs $\frac{1}{5}$ cup of dry food and $\frac{1}{4}$ cup of wet food. Marwa picks up one bag of dry dog food that contains 8 cups and a large container of wet dog food that contains 12 cups. How many days will Marwa be able to feed her dog?

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

5th grade students divide whole numbers by fractions and divide fractions by whole numbers. Although students reason about the solution of multiplication and division of whole numbers and fractions, there is no expectation that students divide fractions by fractions at this grade. Students continue to use models paired with expressions and equations to represent problem situations. Students may need a great deal of practice seeing the connection between the visual representation and the more abstract equations.

Connections Across Standards

Write and interpret numerical expressions (5.OA.1-2).
Generate a pattern given a rule (5.OA.3).
Multiply and divide decimals (5.NBT.7).
Represent and interpret data (5.MD.2).

4.NF.4 (Prior Grade Standard)	**6.EE.7 (Future Grade Standard)**
Apply and extend previous understandings of multiplication to multiply a fraction by a whole number. a. Understand a fraction *a /b* as a multiple of *1 /b. For example, use a visual fraction model to represent* $\frac{5}{4}$ *as the product* $5 \times (\frac{1}{4}$*, recording the conclusion by the equation* $\frac{5}{4} = 5 \times (\frac{1}{4})$ *or* $\frac{5}{4} = (\frac{1}{4}) + (\frac{1}{4}) + (\frac{1}{4}) + (\frac{1}{4}) + (\frac{1}{4})$. b. Understand a multiple of a /b as a multiple of 1 /b, and use this understanding to multiply a fraction by a whole number. *For example, use a visual fraction model to express* $3 \times (\frac{2}{5})$ *as* $6 \times (\frac{1}{5})$*, recognizing this product as* $\frac{6}{5}$*. (In general, n × (a /b) = (n × a)/b.)* c. Solve word problems involving multiplication of a fraction by a whole number, e.g., by using visual fraction models and equations to represent the problem. *For example, if each person at a party will eat* $\frac{3}{8}$ *of a pound of roast beef, and there will be 5 people at the party, how many pounds of roast beef will be needed? Between what two whole numbers does your answer lie?*	Solve real world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$ for cases in which *p, q* and *x* are all nonnegative rational numbers

Ohio's Learning Standards-Clear Learning Targets

Math Grade 5

5.MD.1 Know relative sizes of these U.S. customary measurement units: pounds, ounces, miles, yards, feet, inches, gallons, quarts, pints, cups, fluid ounces, hours, minutes, and seconds. Convert between pounds and ounces; miles and feet; yards, feet, and inches; gallons, quarts, pints, cups, and fluid ounces; hours, minutes, and seconds in solving multistep, real-world problems.

Essential Understandings

- Two measurement systems (U.S. customary and metric) are currently used in the United States.
- Relationships between units vary depending on the measurement system.
- Conversions in the U.S. customary system vary depending upon what is being measured.
- Conversions in the metric system are based on powers of ten.
- When converting from a larger unit to a smaller unit, there will be more iterations of the smaller unit. For example, when converting from yards to feet, there will always be a greater number of feet than yards.
- When converting from a smaller unit to a larger unit, there will be less iterations of the larger unit. For example, when converting from cups to gallons, there will always be fewer gallons than cups.
- Measurements can be converted to solve multi-step real-world problems.

Common Misconceptions

When solving problems that require renaming units, students need to pay attention to the unit of measurement which dictates the renaming and the number to use. For example, when subtracting 5 inches from 2 feet. Students may simply subtract 2 from 5 and say the answer is 3. It is important to remind students that we need to have the same units when adding or subtracting. Therefore, 2 ft - 5 in would be the same as 24 in - 5 in.

Academic Vocabulary/ Language

- conversion
- convert
- measurement
- metric
- customary

U.S. customary units

- pounds
- ounces
- miles
- yards
- feet
- inches
- gallons
- quarts
- pints
- cups
- fluid ounces
- hours
- minutes
- seconds

Learning Targets	I can identify the relationships between the units of the U.S. customary system, and use the appropriate measurement depending upon what is being measured. I can explain how the units used in measurement relate and change depending on their size. I can convert to different size units within the U.S. customary measurement system by applying the mathematical understanding of multiplication and division as it relates to the relative size of the unit. (Students can use the conversion chart provided by the state.)

	I can solve multi-step, real-world problems involving measurement using the four properties of operation.

Assessment of Learning

- Students will explore the U.S.customary system using appropriate tools (rulers, yardsticks, scales, measuring containers, clocks, etc.)
- Students will explain relative sizes of U.S. customary units.
- Students will explore, record, and look for a pattern when doing conversions in a two-column table.
- Students will solve multi-step, real-world problems involving conversions using all four operations.

Sample Questions

1. Terry has a board measuring $5\frac{1}{2}$ feet long. How many smaller boards, each with a length of 10 inches, can he make from this board?
2. The total weight of 4 kittens is 19 oz. One kitten weighs $\frac{1}{4}$ pound. What could be the weight of the other three kittens? Explain.
3. How are a meter and a yard alike? Explain your thinking.

- Explore the U.S. customary system using appropriate tools (rulers, yardsticks, scales, measuring containers, clocks, etc.)
- Explain relative sizes of these U.S. customary units:
  - weight—pounds, ounces
  - length—miles, yards, feet, inches
  - capacity—gallons, quarts, pints, cups, fluid ounces
  - time—hours, minutes, seconds
- Convert between units using these conversions:
  - 1 pound = 16 ounces
  - 1 mile = 5,280 feet
  - 1 yard = 3 feet; 1 foot = 12 inches; 1 yard = 36 inches
  - 1 gallon = 4 quarts or 8 pints or 16 cups or 128 fluid ounces
  - 1 quart = 2 pints or 4 cups or 32 fluid ounces
  - 1 pint = 2 cups or 16 fluid ounces
  - 1 cup = 8 fluid ounces
  - 1 hour = 60 minutes; 1 minute = 60 seconds; 1 hour = 3,600 seconds
- Solve multi-step, real-world problems involving conversions using all four operations.

Note: See the Ohio State Test Grade 5 Reference Sheet for conversions that will be given.

Ohio Department of Education Model Curriculum Instructional Strategies and Resources Students should gain ease in converting units of measures in equivalent forms within the same system. To convert from one unit to another unit, the relationship between the units must be known. In order for students to have a better understanding of the relationships between units, they need to use measuring tools in class. The number of units must relate to the size of the unit. For example, students have discovered that there are 12 inches in 1 foot and 3 feet in 1 yard. This understanding is needed to convert inches to yards. Using 12-inch rulers and yardsticks, students can see that three of the 12-inch rulers are equivalent to one yardstick (3×12 inches = 36 inches; 36 inches = 1 yard). Using this knowledge, students can decide whether to multiply or divide when making conversions. Once students have an understanding of the relationships between units and how to do conversions, they are ready to solve multi-step problems that require conversions within the same system. Allow students to discuss methods used in solving the problems. Begin with problems that allow for renaming the units to represent the solution before using problems that require renaming to find the solution. **Career Connection** Students will use yardsticks and rulers to make conversions among inches, feet, and yards for measurement. Provide students with real-work examples of how this skill is applied (e.g., football field as an example of how yards are used; doorway height for feet; inseam of pants for inches) and discuss related careers (e.g., agriculture, design, construction).
Connections Across Standards Add, subtract, multiply, and divide decimals to hundredths (5.NBT.7). Perform operations with fractions (5.NF.1-7). Generate numerical patterns given rules (5.OA.3).

4.MD.1 (Prior Grade Standard) Know relative sizes of the metric measurement units within one system of units. Metric units include kilometer, meter, centimeter, and millimeter; kilogram and gram; and liter and milliliter. Express a larger measurement unit in terms of a smaller unit. Record measurement conversions in a two-column table. *For example, express the length of a 4-meter rope in centimeters. Because 1 meter is 100 times as long as a 1 centimeter, a two-column table of meters and centimeters includes the number pairs 1 and 100, 2 and 200, 3 and 300,...*	**6.SP.3 (Future Grade Standard)** Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.

Ohio's Learning Standards-Clear Learning Targets

Math Grade 5

5.MD.2 Display and interpret data in graphs (picture graphs, bar graphs, and line plots[G]) to solve problems using numbers and operations for this grade, e.g., including U.S. customary units in fractions $\frac{1}{2}$, $\frac{1}{4}$, $\frac{1}{8}$, or decimals

Essential Understandings

- Picture graphs, bar graphs, and line plots are used to display data.
- The key of a picture graph tells how many items each picture or symbol represents.
- The scale of a bar graph varies depending on the data set.
- The scale of a line plot can be whole numbers, halves, quarters, eighths, sixteenths, tenths, or hundredths.
- Symbols used in picture graphs and line plots should be consistently spaced and sized.
- Information presented in a graph can be used to solve problems using metric or U.S. customary measurements.

.

Common Misconceptions

Some students may not know what measurement to use if the object measures between 1/8 and ¼ inch.

Academic Vocabulary/ Language

- line plot
- picture graph
- bar graph
- length
- mass
- liquid volume
- fair share
- U.S. customary units

Tier 2

- solve

Learning Targets	I can organize and order data to create a line plot, picture graph and bar graph with fractional scales and interpret the data to solve problems. I can apply mathematical understanding of the four operations to solve problems including situations using U.S. customary units in fractions or decimals.

Assessment of Learning

- Students will display and interpret data using real-world problems with grade-level appropriate units for data sets. (picture graph, bar graph, line plots, and circle graphs)
- Students will apply mathematical understanding of the four operations to solve problems including situations using U.S. customary units in fractions or decimals.

Sample Questions

1. Each week Tawana has been measuring the growth of her plant and recording it in her journal. Create a line plot using her data: $\frac{1}{2}$ inch; 1 $\frac{1}{2}$ inches; $\frac{3}{4}$ inch; 1inch; $\frac{1}{2}$ inch; 1 $\frac{1}{4}$ inch; $\frac{3}{4}$ inch; 1inch; $\frac{3}{4}$ inch; $\frac{3}{4}$ inch; 1inch; $\frac{3}{4}$ inch; 1 $\frac{1}{4}$ inch. What is the difference between the least amount of growth and the most growth? What was the most common amount the plant grew?
2. The fifth graders did a survey about what students do after school. They found that 45 play sports, 99 students said they visit friends, 53 said they go home and watch TV, and 25 said they read. Create a graph to show this data. Explain why you chose the graph type.
3. Joe has been timing himself each day as he practices the 50 year dash. Here are his times: 8.3 seconds, 8.2 seconds, 7.9 seconds, 8.4 seconds, 8.5 seconds, 8.6 seconds, 8.0 seconds, 7.9 seconds, 8.2 seconds, 8.2 seconds, 8.3 seconds. Graph his times and write three statements that explain the data.

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

Using a line plot to solve problems involving operations with unit fractions now includes multiplication and division. Revisit using a number line to solve multiplication and division problems with whole numbers. In addition to knowing how to use a number line to solve problems, students also need to know which operation to use to solve problems. Allow students to share methods used to solve the problems. Also have students create problems to show their understanding of the meaning of each operation.

TABLE 2. COMMON MULTIPLICATION AND DIVISION SITUATIONS[1]

	UNKNOWN PRODUCT 3 X 6 = ?	GROUP SIZE UNKNOWN ("HOW MANY IN EACH GROUP?" DIVISION) 3 X ? = 18, AND 18 ÷ 3 = ?	NUMBER OF GROUPS UNKNOWN ("HOW MANY GROUPS?" DIVISION) ? X 6 = 18, AND 18 ÷ 6 = ?
EQUAL GROUPS	There are 3 bags with 6 plums in each bag. How many plums are there in all? **Measurement example.** You need 3 lengths of string, each 6 inches long. How much string will you need altogether?	If 18 plums are shared equally into 3 bags, then how many plums will be in each bag? **Measurement example.** You have 18 inches of string, which you will cut into 3 equal pieces. How long will each piece of string be?	If 18 plums are to be packed 6 to a bag, then how many bags are needed? **Measurement example.** You have 18 inches of string, which you will cut into pieces that are 6 inches long. How many pieces of string will you have?
ARRAYS[2], AREA[3]	There are 3 rows of apples with 6 apples in each row. How many apples are there? **Area example.** What is the area of a 3 cm by 6 cm rectangle?	If 18 apples are arranged into 3 equal rows, how many apples will be in each row? **Area example.** A rectangle has area 18 square centimeters. If one side is 3 cm long, how long is a side next to it?	If 18 apples are arranged into equal rows of 6 apples, how many rows will there be? **Area example.** A rectangle has area 18 square centimeters. If one side is 6 cm long, how long is a side next to it?
COMPARE	A blue hat costs \$6. A red hat costs 3 times as much as the blue hat. How much does the red hat cost? **Measurement example.** A rubber band is 6 cm long. How long will the rubber band be when it is stretched to be 3 times as long?	A red hat costs \$18 and that is 3 times as much as a blue hat costs. How much does a blue hat cost? **Measurement example.** A rubber band is stretched to be 18 cm long and that is 3 times as long as it was at first. How long was the rubber band at first?	A red hat costs \$18 and a blue hat costs \$6. How many times as much does the red hat cost as the blue hat? **Measurement example.** A rubber band was 6 cm long at first. Now it is stretched to be 18 cm long. How many times as long is the rubber band now as it was at first?
GENERAL	$a \times b = ?$	$a \times ? = p$, and $p \div a = ?$	$? \times b = p$, and $p \div b = ?$

Connections Across Standards

Apply fraction operations and ordering (5.NF.1-7).
Solve real-world problems with decimal operations (5.NBT.7).

4.MD.1 (Prior Grade Standard)

Know relative sizes of the metric measurement units within one system of units. Metric units include kilometer, meter, centimeter, and millimeter; kilogram and gram; and liter and milliliter. Express a larger measurement unit in terms of a smaller unit. Record measurement conversions in a two-column table. *For example, express the length of a 4-meter rope in centimeters. Because 1 meter is 100 times as long as a 1 centimeter, a two-column table of meters and centimeters includes the number pairs 1 and 100, 2 and 200, 3 and 300,...*

6.SP.3 (Future Grade Standard)

Recognize that a measure of center for a numerical data set summarizes all of its values with a single number, while a measure of variation describes how its values vary with a single number.

Ohio's Learning Standards-Clear Learning Targets

Math Grade 5

<table>
<tr>
<td colspan="2">

5.MD.3

Recognize volume as an attribute of solid figures and understand concepts of volume measurement.

a. A cube with side length 1 unit, called a "unit cube," is said to have "one cubic unit" of volume, and can be used to measure volume.
b. A solid figure which can be packed without gaps or overlaps using *n* unit cubes is said to have a volume of *n* cubic units.

</td>
<td rowspan="2">

Common Misconceptions

When students hear the word volume, they often think of sound. Students will need real world examples of mathematical volume as well as hands-on experiences in order to fully grasp this concept.

</td>
<td rowspan="2">

Academic Vocabulary/ Language

- measurement
- attribute
- volume
- solid figure
- unit cube
- gap
- overlap
- cubic units

Tier 2

- recognize

</td>
</tr>
<tr>
<td colspan="2">

Essential Understandings

- Volume is an attribute of a three-dimensional solid figure that is measured in cubic units.
- Volume can be measured (or determined) by finding the total number of cubic units required to fill the space without gaps or overlaps.

</td>
</tr>
<tr>
<td>

Learning Targets

</td>
<td colspan="3">

I can identify volume as an attribute of a solid figure.
I can identify that volume is measured in a unit cube that has a side length of 1 unit.
I can create a model to find the volume of a solid figure by packing the figure with unit cubes without gaps or overlaps.

</td>
</tr>
</table>

Assessment of Learning

- Students will explore and develop the conceptual understanding of “a unit cube” with volume measured in “one cubic unit”.
- Students will recognize volume as an attribute of a three-dimensional object.
- Students will use packing of unit cubes (without gaps or overlaps) to find the volume of a rectangular prism by counting the unit cubes.

Sample Questions

1. Juan found he could put exactly 40 one inch cubes in a box. What is the volume of the box?
2. A box has dimensions of 3 cm by 8 cm by 12 cm. Can you create a box with different dimensions that holds the same number of cubic centimeters?
3. How many ways can you pack twelve brownies, all the same size, to fit into a box?

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

Volume refers to the amount of space that an object takes up and is measured in cubic units such as cubic inches or cubic centimeters.
Students need to experience finding the volume of rectangular prisms by counting unit cubes, in metric and standard units of measure, before the formula is presented.

Provide multiple opportunities for students to develop the formula for the volume of a rectangular prism with activities similar to the one described below.

Give students one block (a 1- or 2- cubic centimeter or cubic-inch cube), a ruler with the appropriate measure based on the type of cube, and a small rectangular box. Ask students to determine the number of cubes needed to fill the box.

Connections Across Standards

There are no direct connections to these standards within Grade 5. The ideas developed in these standards will be used in later grades

4.NBT.5 (Prior Grade Standard)	**6.G.4 (Future Grade Standard)**
Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.	Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.

Ohio's Learning Standards-Clear Learning Targets

Math Grade 5

<table>
<tr><td colspan="2">5.MD.4 Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units.</td><td rowspan="2">Common Misconceptions
By stacking geometric solids with cubic units in layers, students can begin understanding the concept of how addition plays a part in finding volume. This will lead to an understanding of the formula for the volume of a right rectangular prism, $b \times h$, where b is the area of the base.</td><td rowspan="2">Academic Vocabulary/ Language
▪ volume
▪ solid figure
▪ cubic units
▪ improvised units
▪ multiplication
▪ addition
▪ edge lengths
▪ height
▪ area of base

Tier 2
▪ measure
▪ count</td></tr>
<tr><td colspan="2">Essential Understanding
● The process of finding volume shifts from building with cubes and counting to the multiplication of side lengths.</td></tr>
<tr><td>Learning Targets</td><td colspan="3">I can model the multiplication used to find the volume of a right rectangular prism or a cube by packing units cubes to represent the length, the width, and the height.
I can apply the mathematical understanding of addition and multiplication to find the volume of a right rectangular prism or a cube that is represented by various unit sizes.</td></tr>
</table>

Assessment of Learning
- Students will use appropriate units (cubic cm, cubic in, cubic ft, and improvised units)
- Students will explore and explain finding the volume of a rectangular prism with whole number side lengths by packing with unit cubes to find that the volume is the same as would be by multiplying the side lengths.
- Students will decompose a prism built from cubes into layers.

Sample Questions
1. A prism was made with four layers each of nine cubes. What other ways can you make a prism with the same volume as that one? Explain.
2. Two prisms are joined together and have a combined volume of 60 cubic units. What could be the dimensions of the two prisms?
3. A rectangular prism has a volume of 36 cubic units and one of its dimensions is 3. What might the other dimensions be?

Ohio Department of Education Model Curriculum Instructional Strategies and Resources
Have students share their strategies with the class using words, drawings or numbers. Allow them to confirm the volume of the box by filling the box with cubes of the same size.

By stacking geometric solids with cubic units in layers, students can begin understanding the concept of how addition plays a part in finding volume. This will lead to an understanding of the formula for the volume of a right rectangular prism, $b \times h$, where b is the area of the base. A right rectangular prism has three pairs of parallel faces that are all rectangles.

Connections Across Standards
There are no direct connections to these standards within Grade 5. The ideas developed in these standards will be used in later grades

4.NBT.5 (Prior Grade Standard)	**6.G.4 (Future Grade Standard)**
Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.	Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.

Ohio's Learning Standards-Clear Learning Targets

Math Grade 5

5.MD.5	Common Misconceptions	Academic Vocabulary/Language
Relate volume to the operations of multiplication and addition and solve real-world and mathematical problems involving volume. a. Find the volume of a right rectangular prism with whole-number side lengths by packing it with unit cubes, and show that the volume is the same as would be found by multiplying the edge lengths, equivalently by multiplying the height by the area of the base. Represent threefold whole-number products as volumes, e.g., to represent the Associative Property of Multiplication. b. Apply the formulas $V = \ell \times w \times h$ and $V = b \times h$ for rectangular prisms to find volumes of right rectangular prisms with whole number edge lengths in the context of solving real-world and mathematical problems. c. Recognize volume as additive. Find volumes of solid figures composed of two non-overlapping right rectangular prisms by adding the volumes of the non-overlapping parts, applying this technique to solve real-world problems.	When solving volume of composite shapes, students often struggle to properly visualize the shape as two separate rectangular prisms. Provide several hands on examples of composite shapes. Work with students to model the composite shape as two separate rectangular prisms prior to solving for volume.	▪ volume ▪ solid figure ▪ cubic units ▪ multiplication ▪ addition ▪ edge lengths ▪ height ▪ area of base ▪ right rectangular prism ▪ Associative Property of Multiplication **Tier 2** ▪ relate ▪ apply ▪ recognize
Essential Understandings ● The area of a base of a rectangular prism is found by multiplying the length by width ($b = \ell \times w$). ● In a right rectangular prism, any two parallel faces can be the Bases. ● The volume of a rectangular prism can be found by multiplying the length by width by height ($\ell \times w \times h$) or by multiplying the area of the base by height (b x h). ● A figure composed of rectangular prisms may be decomposed into two non overlapping rectangular prisms whose volumes may be added to find the volume of the figure.		

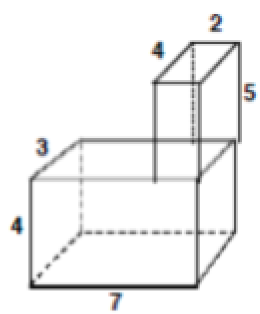
Learning Targets	I can apply the mathematical understanding of the associative property of multiplication when finding the volume of a right rectangular prism by multiplying the length × width × height with whole-number sides. I can apply the understanding of area when finding the volume of a right rectangular prism by translating it to the base of the figure. I can solve real-world volume problems by applying the conventional formulas of V = l • w • h and V = B • h. I can decompose a solid figure into two non-overlapping rectangular prisms and find the volume of each. I can then use the additive property to find the total volume of the figure.

Assessment of Learning

- Students will develop a connection between building layers from the base to applying formulas for finding volume.
- Students will explore and explain the volume of a figure composed of two non-overlapping right rectangular prisms by adding the volumes of the non-overlapping parts.
- Students will solve real-world volume problems by applying the conventional formulas of V = l • w • h and V = B • h.

Sample Questions

1. A box has dimensions of 3 cm by 8 cm by 12 cm. Can you create a box with different dimensions but that holds the same number of cubic centimeters?
2. Draw two solid figures that have a volume of 25 cubic units.
3. A box 2 centimeters high, 3 centimeters wide, and 5 centimeters long can hold 40 grams of clay. A second box has twice the height, three times the width, and the same length as the first box. How many grams of clay can it hold? Explain.
4. Eliza found that she could put exactly 14 one centimeter cubes to cover the bottom of a box. If the box is 7 cm high, how many one centimeter cubes will the box hold in all?
5. Find the total volume of the two boxes below.



Ohio Department of Education Model Curriculum Instructional Strategies and Resources Have students build a prism in layers. Then, have students determine the number of cubes in the bottom layer and share their strategies. Students should use multiplication based on their knowledge of arrays and its use in multiplying two whole numbers. Ask what strategies can be used to determine the volume of the prism based on the number of cubes in the bottom layer. Expect responses such as "adding the same number of cubes in each layer as were on the bottom layer" or multiply the number of cubes in one layer times the number of layers.	
Connections Across Standards There are no direct connections to these standards within Grade 5. The ideas developed in these standards will be used in later grades	
4.NBT.5 (Prior Grade Standard) Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers, using strategies based on place value and the properties of operations. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.	**6.G.4 (Future Grade Standard)** Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.

Ohio's Learning Standards-Clear Learning Targets

Math Grade 5

5.G.1 Use a pair of perpendicular number lines, called axes, to define a coordinate system, with the intersection of the lines (the origin) arranged to coincide with the 0 on each line and a given point in the plane located by using an ordered pair of numbers, called its coordinates. Understand that the first number indicates how far to travel from the origin in the direction of one axis, and the second number indicates how far to travel in the direction of the second axis, with the convention that the names of the two axes and the coordinates correspond, e.g., x-axis and x-coordinate, y-axis and y-coordinate. **Essentials Understandings** • Coordinate graphs show relationships between numbers on a coordinate grid. • The coordinate system is created from a horizontal number line (x-axis) and a vertical number line (y-axis) with the intersection of the lines at zero (the origin). • A given point can be located in the plane by using an ordered pair of numbers (x, y). • The origin of the coordinate plane is represented by the ordered pair (0, 0). • The first number in an ordered pair, the x-coordinate or x, indicates how far to travel from the origin in the horizontal direction. • The second number in an ordered pair, the y-coordinate or y, indicates how far to travel in the vertical direction. • Distance is found by counting intervals rather than counting the grid marks.	**Common Misconceptions** When playing games with coordinates or looking at maps, students may think the order in plotting a coordinate point is not important. Have students plot points so that the position of the coordinates is switched. For example, have students plot (3, 4) and (4, 3) and discuss the order used to plot the points. Have students create directions for others to follow so that they become aware of the importance of direction and distance.	**Academic Vocabulary/ Language** ▪ coordinate system ▪ coordinate plane ▪ first quadrant ▪ point ▪ lines ▪ axis ▪ x-axis ▪ y-axis ▪ origin ▪ ordered pairs ▪ x-coordinate ▪ y-coordinate ▪ vertical ▪ horizontal

Learning Targets	I can graph points on a coordinate plane. I can explain how each number in an ordered pair affects the direction and distance of the point. I can create, plot, and label ordered pairs of numbers on a coordinate plane.

Assessment of Learning

- Students will identify the horizontal number line as the *x*-axis.
- Students will identify the vertical number line as the *y*-axis.
- Students will identify the intersection of the number lines as the origin (0,0).
- Students will identify *x*- and *y*-coordinates within an ordered pair (limited to whole numbers)
- Students will identify ordered pairs when given points in the first quadrant.
- Students will graph points in the first quadrant when given ordered pairs.
- Students will explain how each number in an ordered pair affects the direction and distance of the point.

Sample Questions

1. Label the axis and the center of the coordinate plane.
2. Starting at the origin, explain the direction and distance you would move to plot the point (4, 7).
3. Without actually graphing the points (4, 3), (4, 6) and (4, 1), will the graph result in a horizontal, diagonal, or vertical line? Explain.

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

Students need to understand the underlying structure of the coordinate system and see how axes make it possible to locate points anywhere on a coordinate plane. This is the first time students are working with coordinate planes, and only in the first quadrant. It is important that students create the coordinate grid themselves. This can be related to two number lines and reliance on previous experiences with moving along a number line. Multiple experiences with plotting points are needed. Provide points plotted on a grid and have students name and write the ordered pair. Have students describe how to get to the location. Encourage students to articulate directions as they plot points.

Connections Across Standards

Use patterns to create ordered pairs, and graph them in the first quadrant of a coordinate plane (5.OA.3).

(Prior Grade Standard)	**(Future Grade Standard)**
N/A	N/A

Ohio's Learning Standards-Clear Learning Targets

Math Grade 5

5.G.2	Represent real-world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation.

Essential Understandings

- Real-world situations can be represented by graphing points in the coordinate plane.
- Coordinate values can be interpreted in the context of real-world situations.

Common Misconceptions

When playing games with coordinates or looking at maps, students may think the order in plotting a coordinate point is not important. Have students plot points so that the position of the coordinates is switched. For example, have students plot (3, 4) and (4, 3) and discuss the order used to plot the points. Have students create directions for others to follow so that they become aware of the importance of direction and distance.

Academic Vocabulary/ Language

- coordinate system
- coordinate plane
- first quadrant
- point
- lines
- axis
- x-axis
- y-axis
- origin
- ordered pairs
- x-coordinate
- y-coordinate

Tier 2

- represent

Learning Targets	I can graph points in the first quadrant and explain the paths between two ordered pairs. I can use the context of real-world problems to interpret the graphed points represented on a coordinate plane. I can interpret the information from a table and graph the points on a coordinate plane to solve real-world problems.

Assessment of Learning

- Students will represent real-world and mathematical problems by graphing points in the first quadrant.
- Students will explore and explain paths (horizontally and vertically) between the two sets of ordered pairs on a coordinate plane.
- Students will interpret coordinate values of points within the context of a situation.
- Students will represent geometric shapes on the coordinate grid, e.g., Given three points, plot the fourth point to create a rectangle.

Sample Questions

1. Tommy's house can be located on a coordinate plane. Label his school which is 5 blocks east and 8 blocks north.
2. Plot (2, 3), (7, 3), and (2, 5). What shape did you create from these three points? Where can you add a point to create a quadrilateral?
3. If Joe's house is at (5, 8) and his friend Case's house is at (3, 1), and each square on the grid represents one block. How many blocks would Joe have to ride his bike to get to Case's house?

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

Multiple experiences with plotting points are needed. Provide points plotted on a grid and have students name and write the ordered pair. Have students describe how to get to the location. Encourage students to articulate directions as they plot points.

Present real-world and mathematical problems and have students graph points in the first quadrant of the coordinate plane. Gathering and graphing data is a valuable experience for students. It helps them to develop an understanding of coordinates and what the overall graph represents. Students also need to analyze the graph by interpreting the coordinate values in the context of the situation.

Connections Across Standards

Use patterns to create ordered pairs, and graph them in the first quadrant of a coordinate plane (5.OA.3).

4. (Prior Grade Standard)	**6. (Future Grade Standard)**
N/A	N/A

Ohio’s Learning Standards-Clear Learning Targets

Math Grade 5

5.G.3 Identify and describe commonalities and differences between types of triangles based on angle measures (equiangular, right, acute, and obtuse triangles) and side lengths (isosceles, equilateral, and scalene triangles).	**Common Misconceptions** Students think that when describing geometric shapes and placing them in subcategories, the last category is the only classification that can be used.	**Academic Vocabulary/ Language** ▪ attribute ▪ category ▪ subcategory ▪ hierarchy ▪ properties ▪ two dimensional ▪ equiangular triangle ▪ right triangle ▪ acute triangle ▪ obtuse triangles ▪ isosceles triangle ▪ equilateral triangle ▪ scalene triangles **Tier 2** ▪ understand
Essential Understandings ● Triangles can be named and classified by angle measures (equiangular, acute, right, and obtuse) and/or side lengths (scalene, isosceles, and equilateral). ● Triangles can be compared.		

Learning Targets	I can explain the attributes of triangles. I can identify the name of a triangle by applying the attributes of angle measures and side lengths . I can compare the similarities and differences of the attributes of a set of triangles and use the information to classify the shapes.

Assessment of Learning

- Students will identify and describe triangles by the side lengths (isosceles, equilateral, scalene) and the angle measures (obtuse, acute, right, equiangular).
- Students will sort and compare types of triangles.
- Students will describe an equilateral triangle as having three equal side lengths.
- Students will describe a scalene triangle as having three different side lengths.
- Students will explore and describe an isosceles triangle as having at least two sides the same length.
- Students explore and describe an equilateral triangle as a special type of an isosceles triangle.

Sample Questions

1. Provide students with examples of triangles and ask them to classify each based on their attributes.
2. Provide students with examples of triangles and have them identify the similarities and differences.

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

In Grade 5, students explore the commonalities and differences of triangles and quadrilaterals. They classify triangles by angle measures (equiangular, right, acute, and obtuse triangles) and side lengths (isosceles, equilateral, and scalene triangles).
Details learned in earlier grades need to be used in the descriptions of the attributes of shapes. The more ways that students can classify and discriminate shapes, the better they can understand them. The shapes are not limited to quadrilaterals.

Connections Across Standards

There are no direct connections to these standards within Grade 5. The ideas developed in these standards will be used in later grades, including grade 7 and high school.

4.G.2 (Prior Grade Standard)	**6.G.4 (Future Grade Standard)**
Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size.	Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.

Ohio's Learning Standards-Clear Learning Targets

Math Grade 5

<table>
<tr>
<td>5.G.4 Identify and describe commonalities and differences between types of quadrilaterals based on angle measures, side lengths, and the presence or absence of parallel and perpendicular lines, e.g., squares, rectangles, parallelograms, trapezoids[G], and rhombuses.

Essential Understandings
● Quadrilaterals can be named and classified by angle measures, side lengths, or the presence or absence of parallel and perpendicular lines.
● Quadrilaterals can be compared.</td>
<td>Common Misconceptions
Students think that when describing geometric shapes and placing them in subcategories, the last category is the only classification that can be used.</td>
<td>Academic Vocabulary/ Language
▪ attribute
▪ category
▪ subcategory
▪ hierarchy
▪ properties
▪ two dimensional
▪ quadrilateral
▪ parallel lines
▪ perpendicular lines
▪ squares
▪ rectangles
▪ parallelograms
▪ trapezoid
▪ rhombus

Tier 2
▪ classify</td>
</tr>
<tr>
<td>Learning Targets</td>
<td colspan="2">I can identify the attributes of quadrilaterals such as the angle measures, side lengths and the presence or absence of parallel and perpendicular lines.
I can compare the similarities and differences of the attributes of a set of quadrilaterals and use the information to classify the shapes.</td>
</tr>
</table>

Assessment of Learning

- Students will explore and describe squares, rectangles, parallelograms, trapezoids, and rhombuses based on the attributes of side lengths, angle measures, and the presence or absence of parallel and/or perpendicular sides.
- Students will identify and describe quadrilaterals by the side lengths, angle measures, the presence or absence of parallel and/or perpendicular lines and/or the presence of absence of symmetry.
- Students will sort and compare types of quadrilaterals.

Sample Questions

1. Melanie made a rectangle, but the teacher said it is not a rectangle. How can Melanie check to know if it is a rectangle or not?
2. Can a square be identified as a rectangular and a parallelogram? Explain using what you know about the properties of quadrilaterals.
3. Engage students in discussions where they have to describe how shapes are alike and different. (e.g., Square, quadrilateral, rhombus, rectangle, parallelogram, and trapezoid).

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

Students can use graphic organizers such as flow charts or T-charts to compare and contrast the attributes of geometric figures. Have students create a T-chart with a shape on each side. Have them list attributes of the shapes, such as number of sides, number of angles, types of lines, etc. they need to determine what's alike or different about the two shapes to get a larger classification for the shapes.

Pose questions such as, "Why is a square always a rectangle?" and "Why is a rectangle not always a square?"

Connections Across Standards

There are no direct connections to these standards within Grade 5. The ideas developed in these standards will be used in later grades, including grade 7 and high school.

4.G.2 (Prior Grade Standard)	**6.G.4 (Future Grade Standard)**
Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size.	Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.