4th Grade Math

Pacing Guide and Unpacked Standards

GROVEPORT MADISON SCHOOLS

Developed by:
Jennifer Maille, GMLSD School Improvement Coordinator
Natalie Lewellen, GMLSD School Improvement Coordinator
Natalie, Blake, GMLSD School Improvement Coordinator
Kerri Lloyd, GMLSD School Improvement Coordinator
John Brown, GMLSD School Improvement Coordinator
Sheryl Hernandez, GMLSD School Improvement Coordinator
Carri Meek, School Improvement Specialist,
Instructional Growth Seminars and Support
Garilee Ogden, GMLSD Director of Curriculum, Instruction and Professional Development

Resources: School District U-46, of Chicago, IL, The Ohio Department of Education, Columbus City Schools, Common Core Institute and North Carolina Department of Public Instruction.

We would like to thank the teachers of GMLSD that provided feedback and support.

*Pacing Guides were revised Summer 2022

Groveport Madison Math Pacing Guide - Grade 4

4th	Operations & Algebraic Thinking	Number & Operations in Base Ten	Number & Operations in Fractions	Measurement & Data	Geometry	Standards for Mathematical Practice
1st 9wks	4.OA.1 - Interpret multiplication equation as a comparison 4.OA.2 - Multiply or divide to solve word problems using multiplicative comparison 4.OA.4 - Find all factor pairs & prime/composite whole numbers 1-100	4.NBT.1 - Recognize that a whole number represents ten times what it is in the palace to the right by applying concepts of place value, multiplication, or division up to 1,000,000 4.NBT.2 - Read & write whole numbers using standard form, word form & expanded form & compare using <,>,= 4.NBT.3 - Use place value to round whole numbers to 1,000,000 4.NBT.4 - Fluently add & subtract multi-digit whole numbers to 1,000,000 using the standard algorithm				MP.1 - Make sense of problems and persevere in solving them MP.2 - Reason abstractly and quantitatively MP.3 - Construct viable arguments and critique the reasoning of others MP.4 - Model with mathematics MP.5 - Use appropriate tools strategically MP.6 - Attend to precision MP.7 - Look for and make use of structure MP.8 - Look for and express regularity in repeated reasoning
2nd 9wks	4.OA.3 - Solve multi step word problems using four operations with reminders & represent using variables 4.OA.5 - Generate and identify a number or shape pattern that follows a given rule	4.NBT.5 - Illustrate and explain how to multiply whole numbers using equations, rectangular arrays & area modules 4.NBT.6 - Illustrate and explain how to divide whole numbers using equations, rectangular arrays & area models		4.MD.1 - Know the metric system to include km, m,cm, mm, kg, g, L, mL 4.MD.3 - Develop efficient strategies to determine the area & perimeter of rectangles in real-world situations		

Groveport Madison Math Pacing Guide - Grade 4

4th	Operations & Algebraic Thinking	Number & Operations in Base Ten	Number & Operations in Fractions	Measurement & Data	Geometry	Standards for Mathematical Practice
3rd 9wks			4.NF.1 - Explain, recognize & generate equivalent fractions using models 4.NF.2 - Compare fractions using <, >, = and justify using visual fraction model 4.NF.3(a,b,c,d) - Understand a fraction is <1, add & subtract fractions with mixed numbers & word problems 4.NF.4 - Multiply fractions with whole numbers & solve word problems 4.NF.5 - Express & add fractions with denominators 10 or 100 4.NF.6 - Use decimal notation for fractions with denominators 10 or 100 4.NF.7 - Compare and justify two decimals to hundredths using <, >, = and using visual models	4.MD.4 - Display & interpret data in graphs to solve problems using numbers & operations		MP.1 - Make sense of problems and persevere in solving them MP.2 - Reason abstractly and quantitatively MP.3 - Construct viable arguments and critique the reasoning of others MP.4 - Model with mathematics MP.5 - Use appropriate tools strategically MP.6 - Attend to precision MP.7 - Look for and make use of structure MP.8 - Look for and express regularity in repeated reasoning
4th 9wks				4.MD.2 - Solve real-world problems with money, time & metric system 4.MD.5 - Display & interpret data in graphs to solve problems and Recognize angles as geometric shapes & understand concepts of angle measurements 4.MD.6 - Measure and sketch angles in whole-number degrees using a protractor 4.MD.7 - Recognize angle measure as additive. Solve real world addition & subtraction problems	4.G.1 - Identify & draw points, lines, line segments, rays, angles and perpendicular & parallel lines 4.G.2 - Classify two-dimensional figures	

Ohio's Learning Standards-Clear Learning Targets
Math, Grade 4

4.OA.1

Interpret a multiplication equation as a comparison, e.g., interpret 35 = 5 × 7 as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations.

Essential Question(s)

How can I represent mathematics in an equation to solve a problem?

Common Misconceptions

Key words are misleading. Some key words typically mean addition or subtraction. But not always.
Consider: There were 4 jackets left on the playground on Monday and 5 jackets left on the playground on Tuesday. How many jackets were left on the playground? "Left" in this problem does not mean subtract.
Many problems have no key words. For example, How many legs do 7 elephants have? does not have a key word. However, any 4th grader should be able to solve the problem by thinking and drawing a picture or building a model.
Key words may encourage students to ignore meaning and look for a formula. The most important strategy when solving a problem is to make sense of the problem and to think deeply. Mathematics is about meaning (Van de Walle, 2012).

Vocabulary

- Multiplication
- Equation
- Multiplicative
- Interpret
- Represent
- Comparison

Essential Skills

Interpret a multiplication equation as a comparison.

Represent verbal statements of multiplicative comparisons as multiplication equations.

Examples	Questions
35 is 5 times bigger than 7 AND 35 is 7 times bigger than 5. Explain how the expression 3 x 7 = 21 tells you how many times larger 21 is than 3.	Write an expression that shows how much bigger 24 is than 8. (24 = 3 x 8) John says that he is thinking of a number that is 7 times bigger than 3. Write an equation to express this relationship

Performance Level Descriptors

Limited: Use the four operations to solve one-step problems.
Basic: N/A
Proficient: N/A
Accelerated: N/A
Advanced: N/A

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

Students need to solve word problems involving multiplicative comparison (product unknown, partition unknown) using multiplication or division as shown in Table 2 of the Common Core State Standards for Mathematics, page 89. http://www.corestandards.org/Math/
They should use drawings or equations with a symbol for the unknown number to represent the problem. Students need to be able to distinguish whether a word problem involves multiplicative comparison or additive comparison (solved when adding and subtracting in Grades 1 and 2).

3.OA.3 & 8 (Prior Grade Standard)	5.OA.2 (Future Grade Standard)
Use multiplication and division within 100 to solve word problems in Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem. See Table 2, page 96. Drawings need not show details, but should show the mathematics in the problem. (This applies wherever drawings are mentioned in the Standards.) Solve two-step word problems using the four operations. Represent these problems using equations with a letter or a symbol, which stands for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding. This standard is limited to problems posed with whole numbers and having whole-number answers. Students may use parentheses for clarification since algebraic order of operations is not expected.	Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them.

Ohio's Learning Standards-Clear Learning Targets
Math, Grade 4

4.OA.2

Multiply or divide to solve word problems involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison. See Table 2, page 96. Drawings need not show details, but should show details, but should show the mathematics in the problem. (This applies wherever drawings are mentioned in the Standards.)

Ohio's Learning Standards, Table 2, page 96

Essential Question(s)

How can I represent mathematics in an equation to solve a problem?

Common Misconceptions

Students may not realize that additive comparisons focus on the difference between two quantities. While multiplicative comparisons focus on comparing two quantities by showing that one quantity is a specified number of times larger or smaller than the other

Vocabulary

- Multiplication
- Equation
- Multiplicative
- Solve
- Comparison
- Distinguish

Essential Skills

Determine and use a variety of representations to model a problem involving multiplicative comparison.

Distinguish between multiplicative comparison and additive comparison (repeated addition).

Determine appropriate operation and solve word problems involving multiplicative comparison.

Examples	Questions
Draw a picture showing how to share 17 cookies among 5 friends. If a problem says "John has 9 cards and it is 1/3 as many as his friend. They represent it with 9 = 1/3 x	If Mary is 11 and her sister is 22 she can explain how her sister is 11 years older OR 2 times older. Write an equation and solve to find how many times larger 2 1/2 is than 1/4. Also show how this could be solved with pictures.

Performance Level Descriptors

Limited: Solve straightforward one-step word problems using basic multiplication and division facts.
Basic: Solve two-step word problems using visual representations.
Proficient: N/A
Accelerated: Select and accurately apply mental computation and estimation strategies to solve problems and/or assess reasonableness of answers.
Advanced: N/A

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

Students need to solve word problems involving multiplicative comparison (product unknown, partition unknown) using multiplication or division as shown in Table 2 of the Common Core State Standards for Mathematics, page 89. http://www.corestandards.org/Math/
They should use drawings or equations with a symbol for the unknown number to represent the problem. Students need to be able to distinguish whether a word problem involves multiplicative comparison or additive comparison (solved when adding and subtracting in Grades 1 and 2).

3.OA.3 & 8 (Prior Grade Standard)	5.OA.2 (Future Grade Standard)
Use multiplication and division within 100 to solve word problems in Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem. See Table 2, page 96. Drawings need not show details, but should show the mathematics in the problem. (This applies wherever drawings are mentioned in the Standards.) Solve two-step word problems using the four operations. Represent these problems using equations with a letter or a symbol, which stands for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding. This standard is limited to problems posed with whole numbers and having whole-number answers. Students may use parentheses for clarification since algebraic order of operations is not expected.	Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them.

Ohio's Learning Standards-Clear Learning Targets
Math, Grade 4

4.OA.3

Solve multistep word problems posed with answers using the four operations, including whole numbers and having whole-number 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.

Essential Question(s)

How can I represent mathematics in an equation to solve a problem?

Common Misconceptions

Students have difficulty estimating for a two-step problem.

Students forget to round remainder to the nearest whole number for an approximate result

Vocabulary

- Operations
- Equations
- Mental Computation
- Estimation
- Rounding
- Remainder
- Unknown quantity
- Reasonableness
- Represent

Essential Skills

Divide whole numbers including division with remainders.

Represent multi-step word problems using equations with a letter standing for the unknown quantity.

Interpret multi-step word problems (including problems in which remainders must be interpreted) and determine the appropriate operations to solve.

Assess the reasonableness of an answer in solving a multi-step word problem using mental math and estimation strategies (including rounding).

Examples	Questions
Three balls of yarn have 18' of yarn each and I need seven 9' pieces. How much is left over? Explain how Jack could estimate how much he needs buy 32 pieces of candy at 19 cents each. Explain how Molly might estimate how much money needs to buy 4 items costing $4.12, $2.51, $7.99, and $1.48.	If a problem says "John has 1 more than twice as many cards as Sam", they can model and solve it using J = 2 x S + 1. There are 17 members on each of three teams. How many vans will to be necessary to carry them if each van carries 11 people. Lucy's room has an area of 165 sq. ft. Write an equation to find the she length if the width is 11 feet. Solve to find the length.

Performance Level Descriptors

Limited: N/A
Basic: Solve one-step problems involving addition, subtraction, multiplication or division and an unknown number.
Proficient: Solve routine multi-step word problems posed with whole numbers and whole-number answers using the four operations, including problems in which remainders must be interpreted.
Accelerated: Solve routine multi-step word problems posed with whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted. Represent the problems using equations with a letter standing for the unknown quantity.
Advanced: Use equations to solve non-routine multi-step word problems posed with whole numbers and having whole number answers using the four operations, including problems in which remainders must be interpreted. Select and accurately apply mental computation and estimation strategies to solve problems, assess reasonableness of answers or to interpret remainders.

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

Present multistep word problems with whole numbers and whole-number answers using the four operations. Students should know which operations are needed to solve the problem. Drawing pictures or using models will help students understand what the problem is asking. They should check the reasonableness of their answer using mental computation and estimation strategies.

3.OA.3 & 8 (Prior Grade Standard)	5.OA.1 (Future Grade Standard)
Use multiplication and division within 100 to solve word problems in Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem. See Table 2, page 96. Drawings need not show details, but should show the mathematics in the problem. (This applies wherever drawings are mentioned in the Standards.) Solve two-step word problems using the four operations. Represent these problems using equations with a letter or a symbol, which stands for the unknown quantity. Assess the reasonableness of answers using mental computation and estimation strategies including rounding. This standard is limited to problems posed with whole numbers and having whole-number answers. Students may use parentheses for clarification since algebraic order of operations is not expected.	Use parentheses, brackets, or braces in numerical expressions, and evaluate expressions with this symbol. Formal use of algebraic order of operations is not necessary.

Ohio's Learning Standards-Clear Learning Targets
Math, Grade 4

4.OA.4

Find all factor pairs for a whole number in the range 1–100. Recognize that a whole number is a multiple of each of its factors. Determine whether a given whole number in the range 1– 100 is a multiple of a given one-digit number. Determine whether a given whole number in the range 1–100 is prime or composite.

Essential Question(s)

How can I represent mathematics in an equation to solve a problem?

Common Misconceptions

When listing multiples of numbers, students may not list the number itself. Emphasize that the smallest multiple is the number itself.

Some students may think that larger numbers have more factors. Having students share all factor pairs and how they found them will clear up this misconception.

Vocabulary

- Factor
- Product
- Multiples
- Odd/Even Numbers
- Prime
- Composite
- Recognize
- Determine
- Explain
- Show
- Find

Essential Skills

Determine prime and composite numbers.

Concepts/Skills: Know strategies to determine whether a whole number is prime or composite.

Identify all factor pairs for any given number 1-100.

Determine if a given whole number (1-100) is a multiple of a given one- digit number.

Determine if a given whole number (1-100) is a multiple of a given one- digit number.

Evaluate if a given whole number (1-100) is prime or composite.

Questions

Explain how to find all the single digit factors of 24.

Carl says that 3 is a factor of 53. Explain why this is incorrect.

Name a prime number between 50 and 60.
Name a composite number between 50 and 60 that is not even.

Explain why 7 is a factor of 28 but 8 is not a factor of 28.

Name 3 numbers between 40 and 50 that have no other factors than one and itself.

Performance Level Descriptors

Limited: N/A
Basic: N/A
Proficient: N/A
Accelerated: N/A
Advanced: N/A

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

Students need to develop strategies for determining if a number is prime or composite, in other words, if a number has a whole number factor that is not one or itself. Starting with a number chart of 1 to 20, use multiples of prime numbers to eliminate later numbers in the chart. For example, 2 is prime but 4, 6, 8, 10, 12,... are composite. Encourage the development of rules that can be used to aid in the determination of composite numbers. For example, other than 2, if a number ends in an even number (0, 2, 4, 6 and 8), it is a composite number.

3.OA.1 (Prior Grade Standard)

Interpret products of whole numbers, e.g., interpret 5 x 7 as the total number of objects in 5 groups of 7 objects each. (Note: These standards are written with the convention that a x b means a groups of b objects each; however, because of the commutative property, students may also interpret 5 x 7 as the total number of objects in 7 groups of 5 objects each).

(Future Grade Standard)

N/A

Ohio's Learning Standards-Clear Learning Targets
Math, Grade 4

4.OA.5

Generate a number or shape pattern that follows pattern that were not explicit in the rule itself. 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.

Common Misconceptions

Students may assume all patterns have the same rule due to limited exposure. This standard is the first formal approach to patterns. Students should have ample opportunities working with and creating patterns.

Vocabulary

- Number Pattern
- Shape Pattern
- Generate
- Identify
- Apparent
- Features
- Explicit
- Rule

Essential Question(s)

Where can you see patterns in our world (music, art, architecture, nature, words, numbers)?

Essential Skills

Identify a number or shape pattern.

Analyze a pattern to determine features not apparent in the rule Generate a number or shape pattern that follows a given rule.

Examples	Questions
Generate the number pattern that follows the rule "half as big" and starts with 12. Generate a pattern of an arrow rotating clockwise 45 degrees each time.	Explain why the number pattern described to the left will never reach zero. Given the pattern of the arrow (described to the left), how many steps will be necessary to return the arrow to its original position? If a number pattern is created by the rule "add three", will there be more odd numbers or even numbers created?

Performance Level Descriptors

Limited: N/A
Basic: N/A
Proficient: N/A
Accelerated: N/A
Advanced: Use number patterning to solve problems and generalize rules.

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

In order for students to be successful later in the formal study of algebra, their algebraic thinking needs to be developed. Understanding patterns is fundamental to algebraic thinking. Students have experience in identifying arithmetic patterns, especially those included in addition and multiplication tables. Contexts familiar to students are helpful in developing students' algebraic thinking. Students should generate numerical or geometric patterns that follow a given rule. They should look for relationships in the patterns and be able to describe and make generalizations.

2.NBT.1 & 3.NBT.1(Prior Grade Standard)	5.NBT.1 (Future Grade Standard)
Use place value understanding and properties of operations to perform multi-digit arithmetic. A range of strategies and algorithms may be used.	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 1/10 of what it represents in the place to its left.

Ohio's Learning Standards-Clear Learning Targets
Math, Grade 4

4.NBT.1 Recognize that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right. For example, recognize that 700 ÷ 70 = 10 by applying concepts of place value, multiplication, and division.

Essential Question(s)

How does a digit's position affect its value?

Common Misconceptions

A strong foundation in whole-number place value and rounding is critical for the expansion to decimal place value and decimal rounding.

Vocabulary

- Place value
- Digit
- Recognize
- Represents

Essential Skills

Recognize that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right.

Extend their understanding of place value related to multiplying and dividing by multiples of 10.

Reason about the magnitude of digits in a number.

Students should be given opportunities to reason and analyze the relationships of numbers.

Examples	Questions
Explain why 700 + 70 = 10 without actually computing the problem.	What must you multiply 6 by to get the number 60? To get 600?
Explain why each column in a multi digit number increases by 10 times.	Describe the size difference between 120 and 12.

Performance Level Descriptors

Limited: N/A
Basic: Using a place value chart, determine the relationship of a digit to the digit to its right.
Proficient: Recognize that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right.
Accelerated: N/A
Advanced: N/A

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

Students also need to create numbers that meet specific criteria. For example, provide students with cards numbered 0 through 9. Ask students to select 4 to 6 cards; then, using all the cards make the largest number possible with the cards, the smallest number possible and the closest number to 5000 that is greater than 5000 or less than 5000.

2.NBT.1-4 & 3.NBT.1(Prior Grade Standard)	5.NBT.1 (Future Grade Standard)
Understand place value. Use place value understanding and properties of operations to perform multi-digit arithmetic. A range of strategies and algorithms may be used.	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 1/10 of what it represents in the place to its left.

Ohio's Learning Standards-Clear Learning Targets
Math, Grade 4

4.NBT.2

Read and write multi-digit whole numbers using standard form, word form, and expanded form. Compare two multi-digit numbers based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons.

Essential Question(s)

How does a digit's position affect its value?

Common Misconceptions

Students may have misconceptions about writing numerals from verbal descriptions. Numbers like one thousand do not cause a problem; however a number like one thousand two, causes problems for students.

Students need to be aware of the greatest place value.

Vocabulary

- Place value
- Digit
- Expanded form
- Greater than (>)
- Less than (<)
- Equal to (=)
- Compare
- Explain
- Standard Form
- Word Form

Essential Skills

Read and write multi-digit whole numbers using base-ten numerals, number names, and expanded form.

Compare two multi-digit numbers based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons.

Examples	Questions
Write the base-ten number name for307. (3 hundreds and 7 ones) Write the number name for 307.(3 hundred seven) Write the expanded form for 357. (300 + 50 + 7) Explain why 811 is greater than 799 and write the expression using < or >.	Write the number that represents 2 hundreds and seven ones. Write the number that represents three thousand sixty-four. Write the number represented by the expanded form 1000+300+9. Write an inequality comparing 813 and 831.

Performance Level Descriptors

Limited: N/A
Basic: Given a place value chart, compare two multi-digit whole numbers based on the meanings of the digits in each place, using <, >, = symbols to record the results of the comparisons.
Proficient: Read and write multi-digit whole numbers using base-ten numerals, number names, and expanded form. Compare two multi-digit whole numbers based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons.
Accelerated: Apply place value understanding to read, write, and compare multi-digit whole numbers less than or equal to 1,000,000.
Advanced: Compare multi-digit whole numbers using <, >, and =; then justify answers using place value understanding.

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

Provide multiple opportunities in the classroom setting and use real-world context for students to read and write multi-digit whole numbers. Students need to have opportunities to compare numbers with the same number of digits, e.g., compare 453, 698 and 215; numbers that have the same number in the leading digit position, e.g., compare 45, 495 and 41,223; and numbers that have different numbers of digits and different leading digits, e.g., compare 312, 95, 5245 and 10,002.

2.NBT.1-4 & 3.NBT.1(Prior Grade Standard)	5.NBT.3 (Future Grade Standard)
Use place value understanding and properties of operations to perform multi-digit arithmetic. A range of strategies and algorithms may be used.	Read, write, and compare decimals to thousandths. a. Read and write decimals to thousandths using base-ten numerals, number names, and expanded form, *e.g., 347.392 = 3 × 100 + 4 × 10 + 7 × 1 + 3 × (1/10) + 9 × (1/100) + 2 × (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.

Ohio's Learning Standards-Clear Learning Targets
Math, Grade 4

4.NBT.3

Use place value understanding to round multi-digit whole numbers to any place through 1,000,000.

Essential Question(s)

What is the half way point between two numbers?

Common Misconceptions

Students often can not explain the reason about the answers they get when they round.

Vocabulary

- Place value
- Digit
- Rounding
- Explain
- Half way point

Essential Skills

Round multi-digit whole numbers to any place using place value.
When students are asked to round large numbers, they first need to identify which digit is in the appropriate place.

Example	Questions
The number 2,341 is between what two "hundreds numbers"? (answer = 2,300 & 2,400)	Sue says that 245 rounds to 200 and Bill says that it rounds to 250. Who is correct and why?

Performance Level Descriptors

Limited: N/A
Basic: N/A
Proficient: N/A
Accelerated: N/A
Advanced: N/A

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

In Grade 4, rounding is not new, and students need to build on the Grade 3 skill of rounding to the nearest 10 or 100 to include larger numbers and place value. What is new for Grade 4 is rounding to digits other than the leading digit, e.g., round 23,960 to the nearest hundred. This requires greater sophistication than rounding to the nearest ten thousand because the digit in the hundreds place represents 900 and when rounded it becomes 1000, not just zero. Students should also begin to develop some rules for rounding, building off the basic strategy of; "Is 48 closer to 40 or 50?" Since 48 is only 2 away from 50 and 8 away from 40, 48 would round to 50. Now students need to generalize the rule for much larger numbers and rounding to values that are not the leading digit.

3.NBT.1(Prior Grade Standard)	5.NBT.4 (Future Grade Standard)
Use place value understanding to round whole numbers to the nearest 10 or 100. A range of strategies and algorithms may be used.	Use place value understanding to round decimals to any place, millions to hundredths.

Ohio's Learning Standards-Clear Learning Targets
Math, Grade 4

4.NBT.4

Fluently add and subtract multi-digit whole numbers using a standard algorithm.

Common Misconceptions

Often students mix up when to regroup, 'carry' and 'borrow'.

Students often do not notice the need of borrowing and just take the smaller digit from the larger one.

Emphasize place value and the meaning of each of the digits.

Vocabulary

- Add
- Subtract
- Algorithm
- Fluently

Essential Question(s)

Why is the standard algorithm an efficient method for addition and subtraction?

Essential Skills

Fluently add and subtract multi- digit whole numbers less than or equal to 1,000,000 using the standard algorithm.

Use place value in describing and justifying the processes they use to add and subtract.

Example	Question
513 - 248 = ?	Find 389 + 267 – 499

Performance Level Descriptors

Limited: N/A
Basic: N/A
Proficient: Accurately add and subtract multi-digit numbers.
Accelerated: N/A
Advanced: N/A

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

A crucial theme in multi-digit arithmetic is encouraging students to develop strategies that they understand, can explain, and can think about, rather than merely follow a sequence of directions that they don't understand. It is important for students to have seen and used a variety of strategies and materials to broaden and deepen their understanding of place value before they are required to use standard algorithms. The goal is for them to understand all the steps in the algorithm, and they should be able to explain the meaning of each digit. For example, a 1 can represent one, ten, one hundred, and so on. For multi-digit addition and subtraction in Grade 4, the goal is also fluency, which means students must be able to carry out the calculations efficiently and accurately. Start with a student's understanding of a certain strategy, and then make intentional, clear- cut connections for the student to the standard algorithm. This allows the student to gain understanding of the algorithm rather than just memorize certain steps to follow.

3.NBT.2-3 (Prior Grade Standard)	5.NBT.4 (Future Grade Standard)
Use place value understanding and properties of operations to perform multi-digit arithmetic. Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction. Multiply one-digit whole numbers by multiples of 10 in the range 10-90, e.g. 9 X 80, 5 X 60 using strategies based on place value and properties of operations.	Understand the place value system. Use place value understanding to round decimals to any place, millions through hundredths.

Ohio's Learning Standards-Clear Learning Targets
Math, Grade 4

4.NBT.5

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.

Common Misconceptions

Students who develop flexibility in breaking numbers apart (decomposing numbers) have a better understanding of the importance of place value and the distributive property in multi-digit multiplication..

Vocabulary

- Multiply
- Equation
- Area Model
- Rectangular arrays
- Illustrate
- Explain

Essential Question(s)

What is an efficient strategy for multiplying numbers?

Essential Skills

Multiply a whole number of up to four digits by a one-digit whole number.

Multiply two two-digit number algorithms.

Use strategies based on place value and the properties of operations to multiply whole numbers.

Illustrate and explain calculations by using written equations, rectangular arrays, and/or area models.

Examples	Questions
Explain two ways to multiply 23 x 15. Find 3,008 x 6 Explain how one might multiply 25 x 12 mentally without using the usual multiplication algorithm.	Draw an area model that shows the problem 23 x 15. 406 x 7 = ? Draw three different arrays that would model the product of 24.

Performance Level Descriptors

Limited: N/A
Basic: Multiply four digit by one digit numbers using manipulatives, place value strategies, or visual representations.
Proficient: 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.
Accelerated: Use efficient procedures for multiplying whole numbers to solve routine problems; use understanding of place value and properties of operations to explain why the procedures work.
Advanced: Use efficient procedures to accurately multiply multi-digit whole numbers and to find quotients involving multi-digit dividends in solving non-routine problems.

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

As students developed an understanding of multiplying a whole number up to four digits by a one-digit whole number, and multiplying two two-digit numbers through various strategies, they should do the same when finding whole-number quotients and remainders. By relating division to multiplication and repeated subtraction, students can find partial quotients. An explanation of partial quotients or this video can be viewed at http://www.teachertube.com, search for Outline of partial quotients. This strategy will help them understand the division algorithm. Students will have a better understanding of multiplication or division when problems are presented in context. Students should be able to illustrate and explain multiplication and division calculations by using equations, rectangular arrays and the properties of operations. These strategies were used in Grade 3 as students developed an understanding of multiplication. To give students an opportunity to communicate their understandings of various strategies, organize them into small groups and ask each group to create a poster to explain a particular strategy and then present it to the class.

3.NBT.2-3 (Prior Grade Standard)	5.NBT.4 (Future Grade Standard)
Use place value understanding and properties of operations to perform multi-digit arithmetic. Fluently add and subtract within 1000 using strategies and algorithms based on place value, properties of operations, and/or the relationship between addition and subtraction. Multiply one-digit whole numbers by multiples of 10 in the range 10-90, e.g. 9 X 80, 5 X 60 using strategies based on place value and properties of operations.	Understand the place value system. Use place value understanding to round decimals to any place, millions through hundredths.

Ohio's Learning Standards-Clear Learning Targets
Math, Grade 4

4.NBT.6 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.

Essential Question(s)

What is an efficient strategy for dividing numbers?

Common Misconceptions

Students often do not see that multiple strategies for multiplication, transfer to understanding of division.

Vocabulary

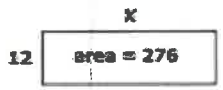
- Quotient
- Remainder
- Dividend
- Divisor
- Illustrate
- Explain

Essential Skills

Find whole number quotients and remainders with up to four-digit dividends and one-digit divisors.

Use the strategies based on place value, the properties of operations, and/or the relationship between multiplication and division.

Illustrate and explain the calculation by using written equations, rectangular arrays, and/ or area models.

Examples	Questions
Explain how knowing that 4 x 23 = 92 and 4 X 50 = 200 would allow you to more easily solve the problem of 292 ÷ 4. Write an equation for this area model and solve for X.  	Divide 584 by 4 in two different ways. Draw and explain an area model for 426 ÷ 4.

Performance Level Descriptors

Limited: Divide up to four digit dividends and one digit divisors with no remainders using manipulatives strategies, or visual representations.
Basic: Divide 4 digit dividends by 1 digit divisors with remainders using manipulatives, strategies, or visual representations.
Proficient: 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.
Accelerated: Use efficient procedures by applying understanding of models for division, place value, properties of operations, and the relationship of division to multiplication to find quotients involving multi-digit dividends; and use them to solve routine problems.
Advanced: N/A

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

As students developed an understanding of multiplying a whole number up to four digits by a one-digit whole number, and multiplying two two-digit numbers through various strategies, they should do the same when finding whole-number quotients and remainders. By relating division to multiplication and repeated subtraction, students can find partial quotients. An explanation of partial quotients or this video can be viewed at http://www.teachertube.com, search for Outline of partial quotients. This strategy will help them understand the division algorithm. Students will have a better understanding of multiplication or division when problems are presented in context. Students should be able to illustrate and explain multiplication and division calculations by using equations, rectangular arrays and the properties of operations. These strategies were used in Grade 3 as students developed an understanding of multiplication. To give students an opportunity to communicate their understandings of various strategies, organize them into small groups and ask each group to create a poster to explain a particular strategy and then present it to the class. Vocabulary is important. Students should have an understanding of terms such as, sum, difference, fewer, more, less, ones, tens, hundreds, thousands, digit, whole numbers, product, factors and multiples.

3.NBT.3 (Prior Grade Standard)	5.NBT.6 (Future Grade Standard)
Multiply one-digit whole numbers by multiples of 10 in the range 10–90 (e.g., 9 × 80, 5 × 60) using strategies based on place value and properties of operations.	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.

Ohio's Learning Standards-Clear Learning Targets

Math, Grade 4

4.NF.1

Explain why a fraction a/b is equivalent to a fraction (n × a)/(n × b) by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to recognize and generate equivalent fractions.

Essential Question(s)

How do I know when fractions are equivalent?

Common Misconceptions

Students think that when generating equivalent fractions they need to multiply or divide either the numerator or denominator, such as, changing 1/2 to sixths. They would multiply the denominator by 3 to get 1/6 , instead of multiplying the numerator by 3 also. Their focus is only on the multiple of the denominator, not the whole fraction. Students need to use a fraction in the form of one such as 3/3 so that the numerator and denominator do not contain the original numerator or denominator.

Vocabulary

- Fractions
- Equivalent
- Explain
- Recognize
- Generate

Essential Skills

Recognize and identify equivalent fractions with unlike denominators.

Explain why a/b is equal to (n x a)/(n x b) by using fraction models with attention to how the number and size of the parts differ even though the two fractions themselves are the same size.

Use visual fraction models to show why fractions are equivalent. Generate equivalent fractions using visual fraction models and explain why they can be called "equivalent."

Examples	Questions
 Explain how this model shows that 1/3 = 2/6. Explain how $\frac{2 \times 5}{3 \times 5}$ creates an equivalent fraction and what the top and bottom numbers mean.	Draw a picture to show that 3/4 and 6/8 are equivalent fractions. Write five fractions that are equivalent to 3/5.

Performance Level Descriptors

Limited: Use visual models to determine whether two common fractions are equivalent.

Basic: N/A

Proficient: N/A

Accelerated: N/A

Advanced: N/A

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

Students' initial experience with fractions began in Grade 3. They used models such as number lines to locate unit fractions, and fraction bars or strips, area or length models, and Venn diagrams to recognize and generate equivalent fractions and make comparisons of fractions. Students extend their understanding of unit fractions to compare two fractions with different numerators and different denominators. Students should use models to compare two fractions with different denominators by creating common denominators or numerators. The models should be the same (both fractions shown using fraction bars or both fractions using circular models) so that the models represent the same whole. The models should be represented in drawings. Students should also use benchmark fractions such as 1/2 to compare two fractions. The result of the comparisons should be recorded using >, < and = symbols.

3.NF.3 (Prior Grade Standard)

Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size.

a. Understand two fractions as equivalent (equal) if they are the same size or the same point on a number line.

b. Recognize and generate simple equivalent fractions, e.g., 1/2 = 2/4, 4/6 = 2/3. Explain why the fractions are equivalent, e.g., by using a visual fraction model.

c. Express whole numbers as fractions, and recognize fractions that are equivalent to whole numbers. Examples: Express 3 in the form 3 = 3/1; recognize that 6/1 = 6; locate 4/4 and 1 at the same point of a number line diagram.

d. Compare two fractions with the same numerator or the same denominator by reasoning about their size. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model.

5.NF.1-2 (Future Grade Standard)

Use equivalent fractions as a strategy to add and subtract fractions (Fractions need not be simplified.) 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 2/3 + 5/4 = 8/12 + 15/12 = 23/12. In general, a/b + c/d = (a/b x d/d) + (c/d x b/b) = (ad + bc)/bd.

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 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 2/5 + 1/2 = 3/7, by observing that 3/7 < 1/2.

Ohio's Learning Standards-Clear Learning Targets
Math, Grade 4

4.NF.2

Compare two fractions with different numerators and different denominators, e.g., by creating common denominators or numerators, or by comparing to a benchmark fraction such as 1/2. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model.

Essential Question(s)

How can I compare two fractions?

How can a common numerators and common denominators or thinking about size help me compare fractions?

Common Misconceptions

Students often fail to recognize that they must consider the size of the whole when comparing fractions (ie,1/2 and 1/8 of two medium pizzas is very different from1/2 of one medium and 1/8 of one large).

Vocabulary

- Fractions
- Equivalent
- Numerator
- Denominator
- Visual fraction model
- >, <, =
- Compare
- Create
- Recognize
- Valid
- Record

Essential Skills

Recognize fractions as being greater than, less than, or equal to other fractions.

Record comparison results with symbols: <, >, =.

Use benchmark fractions such as 1/2 for comparison purposes.

Make comparisons based on parts of the same whole.
Compare fractions by creating visual fraction models or finding common denominators or numerators.

Compare two fractions with different numerators or denominators by creating common denominators or comparing to a benchmark fraction.

Justify the results of a comparison of two fractions by using a visual fraction model.

Examples	Questions
Find the larger fraction between 3/5 and 3/7.	Paul's pizza sells a 1/2 pizza that feeds 3.
Find the larger fraction between 3/5 and 3/7.	Patty's pizza says that half of their pizza only feeds one person.
Find the larger fraction between 5/8 and 3/7 by comparing each to 1/2.	How is this possible?
Write the expression for 3/8 is smaller than 3/5 and explain why.	
Put the following fractions in order from smallest to largest.	Draw a model that shows why 3/5 < 3/4.
4/5, 3/4, 5/8, 7/10	What fraction is smaller between 15/16 and 3/2?

Performance Level Descriptors

Limited: N/A
Basic: Compare two fractions with different numerators and different denominators using the symbols <, >, =, with the assistance of visual models (denominators limited to 2, 3, 4, 10, and 100).
Proficient: Compare two fractions with different numerators and different denominators using visual models or by creating common denominators or numerators; record using the symbols <, >, =.
Accelerated: Compare two fractions with different numerators and different denominators using the symbols <, >, and =.
Advanced: Solve problems by comparing two fractions with different numerators and different denominators using the symbols <, >, and =, and justifying the conclusion using a visual fraction model.

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

Students' initial experience with fractions began in Grade 3. They used models such as number lines to locate unit fractions, and fraction bars or strips, area or length models, and Venn diagrams to recognize and generate equivalent fractions and make comparisons of fractions. Students extend their understanding of unit fractions to compare two fractions with different numerators and different denominators. Students should use models to compare two fractions with different denominators by creating common denominators or numerators. The models should be the same (both fractions shown using fraction bars or both fractions using circular models) so that the models represent the same whole. The models should be represented in drawings. Students should also use benchmark fractions such as 1/2 to compare two fractions. The result of the comparisons should be recorded using >, < and = symbols.

3.NF.3 (Prior Grade Standard)

Develop understanding of fractions as numbers. Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size. a. Understand two fractions as equivalent (equal) if they are the same size or the same point on a number line. b. Recognize and generate simple equivalent fractions, e.g., 1/2 = 2/4, 4/6 = 2/3. Explain why the fractions are equivalent, e.g., by using a visual fraction model. c. Express whole numbers as fractions, and recognize fractions that are equivalent to whole numbers. Examples: Express 3 in the form 3 = 3/1; recognize that 6/1 = 6; locate 4/4 and 1 at the same point of a number line diagram. d. Compare two fractions with the same numerator or the same denominator by reasoning about their size. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model.

5.NF.1-2 (Future Grade Standard)

Add and subtract fractions with unlike denominators (including mixed numbers) 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, 2/3 + 5/4 = 8/12 + 15/12 = 23/12. (In general, a/b + c/d = (ad + bc)/bd.)
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 or equations to represent the problem. Use benchmark fractions and number sense of fractions to estimate mentally and assess the reasonableness of answers.

Ohio's Learning Standards-Clear Learning Targets
Math, Grade 4

4.NF.3

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. Examples: 3/8 = 1/8 + 1/8 + 1/8 ; 3/8 = 1/8 + 2/8 ; 2 1/8 = 1 + 1 + 1/8 = 8/8 + 8/8 + 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.

Essential Question(s)

What is a unit fraction?

How can I apply my understanding of operations (+, -, /,*) on whole numbers to build fractions?

Common Misconceptions

Students think that it does not matter which model to use when finding the sum or difference of fractions. They may represent one fraction with a rectangle and the other fraction with a circle. They need to know that the models need to represent the same whole.

Vocabulary

- Fractions
- Equivalent
- Numerator
- Denominator
- Decompose
- Ordering
- Solve
- Represent

Essential Skills

Understand accumulating unit fractions (1/b) results in a fraction (a/b), where a is greater than 1.

Using fraction models, reason that addition of fractions is joining parts that are referring to the same whole.

Using fraction models, reason that subtraction of fractions is separating parts that are referring to the same whole.

Examples	Questions
Find the larger fraction between 3/5 and 3/7. Find the larger fraction between 5/8 and 3/7 by comparing each to 1/2. Put the following fractions in order from smallest to largest. 4/5, 3/4, 5/8, 7/10. Explain a situation when 1/4 could be larger than 1/2. Draw a model that shows why 3/5 < 3/4. Use fraction bars to show the combined distance of 2 3/8 miles and 3 1/8 miles.	Paul's Pizza sells a 1/2 pizza that feeds 3. Patty's Pizza says that half of their pizza only feeds one person. How is this possible? What fraction is smaller between 15/16 and 3/2? Write the expression for 3/8 is smaller than 3/5 and explain why. Bob walked 2 3/8 miles and Sue walked 3 1/8 miles. How far did they walk together? Bob walked 2 3/8 miles and Sue walked 3 1/8 miles. What is the difference in their distance? Draw two fraction bars to show the difference between 2 3/8 miles and 3 1/8 miles.

Performance Level Descriptors

Limited: Add and subtract fractions with like denominators using visual models.
Basic: Using visual models, add and subtract fractions with like denominators in reference to the same whole.
Proficient: Identify and generate equivalent forms of a fraction including mixed numbers with like denominators using visual models. Add and subtract to solve routine word problems involving like denominators in reference to the same whole using visual models and/or equations.
Accelerated: N/A
Advanced: N/A

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

Students also represented whole numbers as fractions. They use this knowledge to add and subtract mixed numbers with like denominators using properties of number and appropriate fraction models. It is important to stress that whichever model is used, it should be the same for the same whole. For example, a circular model and a rectangular model should not be used in the same problem. Understanding of multiplication of whole numbers is extended to multiplying a fraction by a whole number. Allow students to use fraction models and drawing to show their understanding. Present word problems involving multiplication of a fraction by a whole number. Have students solve the problems using visual models and write equations to represent the problems.

(Prior Grade Standard)	5.NF.1-2 (Future Grade Standard)
N/A	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 2/3 + 5/4 = 8/12 + 15/12 = 23/12. In general, a/b + c/d = (a/b x d/d) + (c/d x b/b) = (ad + bc)/bd. 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 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 2/5 + 1/2 = 3/7, by observing that 3/7 < 1/2.

Ohio's Learning Standards-Clear Learning Targets
Math, Grade 4

4.NF.4

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 5/4 as the product 5 × (1/4), recording the conclusion by the equation 5/4 = 5 × (1/4), or 5/4 = 1/4 + 1/4 + 1/4 + 1/4 + 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 × (2/5) as 6 × (1/5), recognizing this product as 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 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?*

Essential Question(s)

What is a unit fraction? How can I apply my understanding of operations (+, -, /,*) on whole numbers to build fractions?

Common Misconceptions

Students think that it does not matter which model to use when finding the sum or difference of fractions. They may represent one fraction with a rectangle and the other fraction with a circle. They need to know that the models need to represent the same whole.

Vocabulary

- Fractions
- Whole number
- Multiple
- Apply
- Extend
- Solve
- Represent

Essential Skills

Represent a fraction a/b as a multiple of 1/b (unit fractions).

Apply multiplication of whole numbers to multiplication of a fraction by a whole number using visual fraction models.

Examples	Questions
Explain how many eighths are in 5/4 and write an equation that shows this relationship. Explain another way to regroup the fraction parts to get the correct answer to 3 x (2/5). If each person at a party will eat 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? Show the answer models or drawings.	What number should go in the blank? (1/6) x_____= 7/6? What number should go in the blank? 3 x (2/5) =_____x (1/5) fraction by a whole number? If the fraction bar shown below represents 2/5, then what would three of these bars represent?  If each person at a party will eat 3/8 of a pound of roast beef, and using fraction there will be 5 people at the party, how many pounds of roast beef will be needed?

Performance Level Descriptors

Limited: N/A
Basic: Solve mathematical problems involving multiplication of a fraction by a whole number, with the assistance of a visual model.
Proficient: Solve routine word problems involving multiplication of a fraction by a whole number.
Accelerated: N/A
Advanced: N/A

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

Understanding of multiplication of whole numbers is extended to multiplying a fraction by a whole number. Allow students to use fraction models and drawing to show their understanding. Present word problems involving multiplication of a fraction by a whole number. Have students solve the problems using visual models and write equations to represent the problems.

3.NF.3 (Prior Grade Standard)	5. NF.3-4 (Future Grade Standard)
Develop understanding of fractions as numbers. Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size. a. Understand two fractions as equivalent (equal) if they are the same size or the same point on a number line. b. Recognize and generate simple equivalent fractions, e.g., 1/2 = 2/4, 4/6 = 2/3. Explain why the fractions are equivalent, e.g., by using a visual fraction model. c. Express whole numbers as fractions, and recognize fractions that are equivalent to whole numbers. Examples: Express 3 in the form 3 = 3/1; recognize that 6/1 = 6; locate 4/4 and 1 at the same point of a number line diagram. d. Compare two fractions with the same numerator or the same denominator by reasoning about their size. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model.	Interpret a fraction as division of the numerator by the denominator (a /b = a ÷ 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 3/4 as the result of dividing 3 by 4, noting that 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 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?

Ohio's Learning Standards-Clear Learning Targets
Math, Grade 4

4.NF.5

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 3/10 as 30/100, and add 3/10 + 4/100 = 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.

Essential Question(s)

How do I know when fractions are equivalent?

Common Misconceptions

Students may need to further to explore the relationship between fractions with denominators of 10 and denominators of 100, they can also use base ten blocks and other place value models.

Vocabulary

- Fractions
- Whole number
- Multiple
- Equivalent fraction
- Express
- Respective (denominators)

Essential Skills

Rename and recognize a fraction with a denominator of 10 as a fraction with a denominator of 100.

Recognize that two fractions with unlike denominators can be equivalent.

Use knowledge of renaming tenths to hundredths to add two fractions with denominators 10 and 100.

Examples	Questions
Explain how to change 7/10 to an equal fraction with a denominator of 100. Explain how you could add 3/10 and 4/100 together.	Change 7/10 to an equal fraction with a denominator of 100. Add 3/10 to 4/100.

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

The place value system developed for whole numbers extends to fractional parts represented as decimals. This is a connection to the metric system. Decimals are another way to write fractions. The place-value system developed for whole numbers extends to decimals. The concept of one whole used in fractions is extended to models of decimals. Students can use base-ten blocks to represent decimals. A 10 x 10 block can be assigned the value of one whole to allow other blocks to represent tenths and hundredths. They can show a decimal representation from the base-ten blocks by shading on a 10 x 10 grid. Students need to make connections between fractions and decimals. They should be able to write decimals for fractions with denominators of 10 or 100. Have students say the fraction with denominators of 10 and 100 aloud. For example 4 /10 would "four tenths" or 27/100 would be "twenty- seven hundredths." Also, have students represent decimals in word form with digits and the decimal place value, such as 4 10 would be 4 tenths. Students should be able to express decimals to the hundredths as the sum of two decimals or fractions. This is based on understanding of decimal place value. For example 0.32 would be the sum of 3 tenths and 2 hundredths. Using this understanding students can write 0.32 as the sum of two fractions (3 /10 + 2 /100).

3.NF.3 (Prior Grade Standard)

Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size.

a. Understand two fractions as equivalent (equal) if they are the same size or the same point on a number line.

b. Recognize and generate simple equivalent fractions, e.g., 1/2 = 2/4, 4/6 = 2/3. Explain why the fractions are equivalent, e.g., by using a visual fraction model.

c. Express whole numbers as fractions, and recognize fractions that are equivalent to whole numbers. Examples: Express 3 in the form 3 = 3/1; recognize that 6/1 = 6; locate 4/4 and 1 at the same point of a number line diagram.

d. Compare two fractions with the same numerator or the same denominator by reasoning about their size. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model.

6.NF.4 (Future Grade Standard)

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

a. Interpret the product $(a/b) \times q$ as a parts of a partition of q into b equal parts; equivalently, as the result of a sequence of operations $a \times q \div b$.

For example, use a visual fraction model to show (2/3) × 4 = 8/3, and create a story context for this equation. Do the same with (2/3) × (4/5) = 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.

Ohio's Learning Standards-Clear Learning Targets
Math, Grade 4

4.NF.6

Use decimal notation for fractions with denominators 10 or 100. For example, rewrite 0.62 as 62/100; describe a length as 0.62 meters; locate 0.62 on a number line diagram.

Common Misconceptions

Students have trouble making connections between fractions with denominators of 10 and 100 and the place value chart.

Vocabulary

- Fractions
- Decimal
- Number line
- Notation
- Rewrite
- Describe
- Locate

Essential Question(s)

How are fractions and decimals related?

Essential Skills

Explain the values of digits in the decimal places.

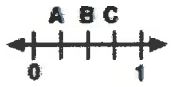
Read and write decimals through hundredths.

Rename fractions with 10 and 100 in the denominator as decimals.

Recognize multiple representations of fractions with denominators 10 or 100.

Represent fractions with denominators 10 or 100 with multiple representations and decimal notation.

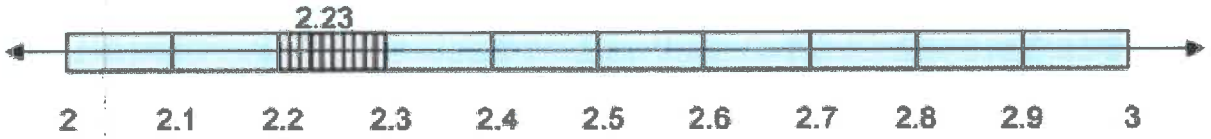
Explain how decimals and fractions relate.

Examples	Question
Change 32/100 to a decimal. Locate 0.32 on the number line.	Rewrite 0.62 as a fraction with a denominator of 100. Which letter on the number line would represent 0.75? 

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

Students' understanding of decimals to hundredths is important in preparation for performing operations with decimals to hundredths in Grade 5.

In decimal numbers, the value of each place is 10 times the value of the place to its immediate right. Students need an understanding of decimal notations before they try to do conversions in the metric system. Understanding of the decimal place value system is important prior to the generalization of moving the decimal point when performing operations involving decimals.



Students extend fraction equivalence from Grade 3 with denominators of 2, 3 4, 6 and 8 to fractions with a denominator of 10. Provide fraction models of tenths and hundredths so that students can express a fraction with a denominator of 10 as an equivalent fraction with a denominator of 100.

3.NF.2 (Prior Grade Standard)	5.NF.1 (Future Grade Standard)
Understand a fraction as a number on the number line; represent fractions on a number line diagram. a. Represent a fraction 1/b on a number line diagram by defining the interval from 0 to 1 as the whole and partitioning it into b equal parts. Recognize that each part has size 1/b and that the endpoint of the part based at 0 locates the number 1/b on the number line. b. Represent a fraction 1/b on a number line diagram by marking off a lengths 1/b from 0. Recognize that the resulting interval has size 1/b and that its endpoint locates the number a/b on the number line.	Use equivalent fractions as a strategy to add and subtract fractions (Fractions need not be simplified.) 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 2/3 + 5/4 = 8/12 + 15/12 = 23/12. In general, a/b + c/d = (a/b x d/d) + (c/d x b/b) = (ad + bc)/bd.

Ohio's Learning Standards-Clear Learning Targets
Math, Grade 4

4.NF.7

Compare two decimals to hundredths by reasoning about their size. Recognize that comparisons are valid only when the two decimals refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using a visual model.

Common Misconceptions

Students treat decimals as whole numbers when making comparison of two decimals. They think the longer the number, the greater the value. For example, they think that)
.03 is greater than 0.3.

Vocabulary

- Fractions
- Decimal
- <, >, =
- Compare
- Justify

Essential Question(s)

How do you compare decimals?

Essential Skills

Recognize that comparisons are valid only when the two decimals refer to the same whole.

Compare two decimals to hundredths by reasoning about their size.

Record the results of comparisons with the symbols >, =, or <.

Justify the conclusions using visual models and other methods.

Students build area and other models to compare decimals.

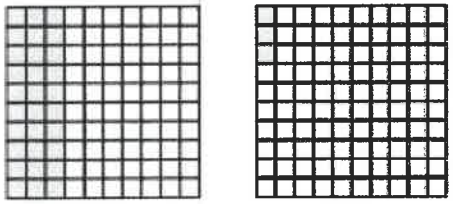
Example	Question
Explain how you could determine which is larger, 0.45 or 0.51.	Which symbol (<, >, =) should be put into the blank to make the expression true? 0.45_____0.51

Performance Level Descriptors

Limited: Compare two decimals using visual models.
Basic: N/A
Proficient: Compare two decimals to the hundredths place by using place value understanding, models, or number lines; record using <, >, =.
Accelerated: Compare two decimals to the hundredths place using the symbols <, >, and =.
Advanced: N/A

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

When comparing two decimals, remind students that as in comparing two fractions, the decimals need to refer to the same whole. Allow students to use visual models to compare two decimals. They can shade in a representation of each decimal on a 10 x 10 grid. The 10 x 10 grid is defined as one whole. The decimal must relate to the whole.



0.3 0.03

Flexibility with converting fractions to decimals and decimals to fractions provides efficiency in solving problems involving all four operations in later grades.

3.NF.3d (Prior Grade Standard)

d. Compare two fractions with the same numerator or the same denominator by reasoning about their size. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model.

5.NF.2 (Future Grade Standard)

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 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 2/5 + 1/2 = 3/7, by observing that 3/7 < 1/2.

Ohio's Learning Standards-Clear Learning Targets
Math, Grade 4

4.MD.1

Know relative sizes of 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 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,…

Common Misconceptions

Students believe that larger units will give the larger measure. Students should be given multiple opportunities to measure the same object with different measuring units. For example, have the students measure the length of a room with one-inch tiles, with one-foot rulers, and with yard sticks. Students should notice that it takes fewer yard sticks to measure the room than rulers or tiles.

Vocabulary

- Kilometer
- Meter
- Centimeter
- Millimeter
- Kilogram
- Gram
- Liter
- Milliliter
- Conversions

Essential Question(s)

What is the relationship and size of the measurement units within one system of units?

Essential Skills

Know relative size of measurement units (km, m; kg, g; L, mL).

Compare the different units within the same system of measurement.

Convert larger units of measurement within the same system to smaller units and record conversions in a 2-column table.

Examples	Questions
Explain how a kilometer, a meter, and a centimeter are different.	

Performance Level Descriptors

Limited: N/A
Basic: N/A
Proficient: Make conversions within a given measurement system by expressing measurements in a larger unit in terms of a smaller unit.
Accelerated: Know and be able to use conversions in multiple measurement units to solve real world problems.
Advanced: N/A

Ohio Department of Education Model Curriculum Instructional Strategies and Resources
In order for students to have a better understanding of the relationships between units, they need to use measuring devices in class. The number of units needs to relate to the size of the unit. They need to discover that there are 12 inches in 1 foot and 3 feet in 1 yard. Allow students to use rulers and yardsticks to discover these relationships among these units of measurements. Using 12-inch rulers and yardstick, students can see that three of the 12-inch rulers, which is the same as 3 feet since each ruler is 1 foot in length, are equivalent to one yardstick. Have students record the relationships in a two column table or t-charts. A similar strategy can be used with rulers marked with centimeters and a meter stick to discover the relationships between centimeters and meters.

Career Connection
Students will use yard and meter sticks and rulers with inches and centimeters to solve problems with different units. Host a career speaker in the classroom to discuss how measurement and various units are used across their career field (e.g., construction, carpentry, design). Consider inviting a speaker who works on a school-based project, at your school or nearby, to share information about their work on school campuses. Lead a discussion that allows students to reflect on their work with different units and how it applies to the careers shared in the speaker's presentation.

3.MD.4 (Prior Grade Standard)	5.MD.1 (Future Grade Standard)
Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by creating a line plot, where the horizontal scale is marked off in appropriate units— whole numbers, halves, or quarters.	Convert like measurement units within a given measurement system. 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 multi-step, real-world problems.

Ohio's Learning Standards-Clear Learning Targets
Math, Grade 4

4.MD.2 Solve real-world problems involving money, time and metric measurement.

a. Using models, and subtract money and express the answer in decimal notation.

b. Using number line diagrams, clocks or other models, add and subtract intervals of time in hours and minutes.

c. Add, subtract, and multiply whole numbers to solve metric measurement problems involving distances, liquid volumes, and masses of objects.

Essential Question(s)

How do I apply my understanding of operations and conversion of measurements to solve word problems?

Common Misconceptions

Students may struggle with multi-step word problems related to expressing measurements from a larger unit in terms of a smaller unit (e.g., feet to inches, meters to centimeter, dollars to cents, hours to minutes)

Vocabulary

- Decimal notation
- Line diagram
- Mass

Essential Skills

Express measurements given in a larger unit in terms of a smaller unit.

Represent measurement quantities using diagrams such as number line diagrams that feature a measurement scale.

Solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money.

Solve word problems involving measurement that include simple fractions or decimals.

Solve word problems that require expressing measurements given in a larger unit in terms of a smaller unit.

Examples	Questions
How much time will elapse between 2:45 and 6:30? How many cups holding 150 milliliters will it take to fill a 2 liter bottle?	John has run 2 km. What is that distance in meters? Mary wants to divide 1 liter of soda between 12 party cups. How many milliliters will each cup contain?

Performance Level Descriptors

Limited: N/A

Basic: N/A

Proficient: Use the four operations to solve routine word problems (metric and US standard units where applicable) involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit.

Accelerated: N/A

Advanced: Use the four operations to solve non-routine word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit.

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

Present word problems as a source of students' understanding of the relationships among inches, feet and yards.

Students are to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals, and problems that require expressing measurements given in a larger unit in terms of a smaller unit.

Career Connection

Students will use yard and meter sticks and rulers with inches and centimeters to solve problems with different units. Host a career speaker in the classroom to discuss how measurement and various units are used across their career field (e.g., construction, carpentry, design). Consider inviting a speaker who works on a school-based project, at your school or nearby, to share information about their work on school campuses. Lead a discussion that allows students to reflect on their work with different units and how it applies to the careers shared in the speaker's presentation.

3.MD.1-3 (Prior Grade Standard)

Solve problems involving money, measurement, and estimation of intervals of time, liquid volumes, and masses of objects. 3.MD.1 Work with time and money. a. Tell and write time to the nearest minute. Measure time intervals in minutes (within 90 minutes). Solve realworld problems involving addition and subtraction of time intervals (elapsed time) in minutes, e.g., by representing the problem on a number line diagram or clock. b. Solve word problems by adding and subtracting within 1,000, dollars with dollars and cents with cents (not using dollars and cents simultaneously) using the $ and ¢ symbol appropriately (not including decimal notation).
Measure and estimate liquid volumes and masses of objects using standard units of grams, kilograms, and liters. Add, subtract, multiply, or divide whole numbers to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement scale) to represent the problem. Excludes multiplicative comparison problems involving notions of "times as much"; See Table 2, page 96.
Create scaled picture graphs to represent a data set with several categories. Create scaled bar graphs to represent a data set with several categories. Solve twostep "how many more" and "how many less" problems using information presented in the scaled graphs. For example, create a bar graph in which each square in the bar graph might represent 5 pets, then determine how many more/less in two given categories.

5.MD.1 (Future Grade Standard)

Convert like measurement units within a given measurement system. 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 multi-step, real-world problems.

Ohio's Learning Standards-Clear Learning Targets
Math, Grade 4

4.MD.3

Develop efficient strategies to determine the area and perimeter of rectangles in real-world situations and mathematical problems. For example, given the total area and one side length of a rectangle, solve for the unknown factor, and given two adjacent side lengths of a rectangle, find the perimeter.

Common Misconceptions

Students have trouble explaining the difference between the perimeter and area and when to find each one.

Vocabulary

- Perimeter
- Area
- Formula
- Apply
- Solve
- Explain

Essential Question(s)

Why is it important to draw or select an accurate line plot to interpret data?

Essential Skills

Add and subtract fractions.

Analyze and interpret a line plot to solve problems involving addition and subtraction of fractions.

Create a line plot to display a data set of measurements given in fractions of a unit.

Examples	Questions
Draw at least three different rectangles that have a perimeter of 24 feet. The area of the floor of the living room is 210 square feet. If it has a width of 14 feet, what is the length? Explain how to make the largest rectangular area give 24 feet of fence. If the perimeter of a rectangle is 50 meters and the width is 10 meters, what is the length?	

Performance Level Descriptors

Limited: Solve straightforward real-world area and perimeter problems of rectangles involving basic computations.
Basic: N/A
Proficient: Apply the formulas for area and perimeter to rectangles with whole number sides in real-world problems.
Accelerated: N/A
Advanced: Apply perimeter and area formulas in solving non-routine real-world problems.

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

Students used models to find area and perimeter in Grade 3. They need to relate discoveries from the use of models to develop an understanding of the area and perimeter formulas to solve real-world and mathematical problems.

Career Connection

Students will use yard and meter sticks and rulers with inches and centimeters to solve problems with different units. Host a career speaker in the classroom to discuss how measurement and various units are used across their career field (e.g., construction, carpentry, design). Consider inviting a speaker who works on a school-based project, at your school or nearby, to share information about their work on school campuses. Lead a discussion that allows students to reflect on their work with different units and how it applies to the careers shared in the speaker's presentation.

3.MD.5-8 (Prior Grade Standard)

Geometric measurement: understand concepts of area and relate area to multiplication and to addition. Recognize area as an attribute of plane figures and understand concepts of area measurement. a. A square with side length 1 unit, called "a unit square," is said to have "one square unit" of area, and can be used to measure area. b. A plane figure which can be covered without gaps or overlaps by n unit squares is said to have an area of n square units.

Measure areas by counting unit squares (square cm, square m, square in, square ft, and improvised units).

Relate area to the operations of multiplication and addition. a. Find the area of a rectangle with whole-number side lengths by tiling it, and show that the area is the same as would be found by multiplying the side lengths. b. Multiply side lengths to find areas of rectangles with whole- number side lengths in the context of solving real-world and mathematical problems, and represent whole number products as rectangular areas in mathematical reasoning. c. Use tiling to show in a concrete case that the area of a rectangle with whole-number side lengths a and b + c is the sum of a × b and a × c (represent the distributive property with visual models including an area model). d. Recognize area as additive. Find the area of figures composed of rectangles by decomposing into non overlapping rectangles and adding the areas of the non-overlapping parts, applying this technique to solve real-world problems.

Solve real world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters.

5.MD.3-5c (Future Grade Standard)

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.

Measure volumes by counting unit cubes, using cubic cm, cubic in, cubic ft, and improvised units.

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 = l × w × h and V = B × 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.

Ohio's Learning Standards-Clear Learning Targets
Math, Grade 4

4.MD.4	Display and interpret data in graphs (picture graphs, bar graphs, and line plots) to solve problems using numbers and operations for this grade.	**Common Misconceptions** Students may not understand a fraction as a number on the number line.	**Vocabulary** ▪ Picture Graphs ▪ Bar Graphs ▪ Line Plots
Essential Question(s) Why is it important to draw or select an accurate line plot to interpret data?			
Essential Skills	Add and subtract fractions. Analyze and interpret a line plot to solve problems involving addition and subtraction of fractions. Create a line plot to display a data set of measurements given in fractions of a unit.		

Examples	Questions
What is the difference in length between the most common length pencil in the classroom and the shortest pencil.	

Performance Level Descriptors

Limited: N/A
Basic: Solve simple addition and subtraction problems involving fractions from data in a line plot.
Proficient: Create a line plot to represent a data set using the fractions ½, ¼, and ⅛; then solve problems involving addition and subtraction.
Accelerated: N/A
Advanced: Interpret line plot data including fractions to solve non-routine real-world problems.

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

3.MD.3 (Prior Grade Standard)	5.MD.2 (Future Grade Standard)
Represent and interpret data. Create scaled picture graphs to represent a data set with several categories. Create scaled bar graphs to represent a data set with several categories. Solve twostep "how many more" and "how many less" problems using information presented in the scaled graphs. For example, create a bar graph in which each square in the bar graph might represent 5 pets, then determine how many more/less in two given categories.	Represent and interpret data. Display and interpret data in graphs (picture graphs, bar graphs, and line plots) to solve problems using numbers and operations for this grade, e.g., including U.S. customary units in fractions 1/2, 1/4, 1/8, or decimals.

Ohio's Learning Standards-Clear Learning Targets
Math, Grade 4

4.MD.5

Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement:

a. An angle is measured with reference to a circle with its center at the common endpoint of the rays, by considering the fraction of the circular arc between the points where the two rays intersect the circle. An angle that turns through 1/360 of a circle is called a "one-degree angle," and can be used to measure angles.
b. An angle that turns through n one-degree angles is said to have an angle measure of n degrees.

Essential Question(s)

What is an angle and how can I measure it?

Common Misconceptions

Students may not make the connection between angles (measure of rotation) and circular measurement (360 degrees).

Vocabulary

- Angle
- Degree
- Ray
- Circle
- Protractor
- Endpoint
- Recognize
- Reference

Essential Skills

Define angle.

Recognize a circle as a geometric figure that has 360 degrees.

Recognize and identify an angle as a geometric shape formed from 2 rays with a common endpoint.

Recognize that an angle is a fraction of a 360 degree circle.

Explain the angle measurement in terms of degrees.

Examples	Questions
Draw and explain the parts of an angle.	Which letter shows the vertex of the angle?
Explain how to measure an angle.	
Explain how the units used to measure angles (degrees) are defined and used.	
Explain how many "one degree angles" it takes to be equivalent to another given angle.	What fractional part of a circle is an angle measure of one degree?

Performance Level Descriptors

Limited: N/A
Basic: N/A
Proficient: N/A
Accelerated: N/A
Advanced: N/A

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

Angles are geometric shapes composed of two rays that are infinite in length. Students can understand this concept by using two rulers held together near the ends. The rulers can represent the rays of an angle. As one ruler is rotated, the size of the angle is seen to get larger. Ask questions about the types of angles created. Responses may be in terms of the relationship to right angles. Introduce angles as acute (less than the measure of a right angle) and obtuse (greater than the measure of a right angle). Have students draw representations of each type of angle. They also need to be able to identify angles in two-dimensional figures.

3.MD.4 (Prior Grade Standard)

Represent and interpret data. 3.MD.4 Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by creating a line plot, where the horizontal scale is marked off in appropriate units—whole numbers, halves, or quarters.

5.MD.1 (Future Grade Standard)

Convert like measurement units within a given measurement system. 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 multi-step, real-world problems.

Ohio's Learning Standards-Clear Learning Targets
Math, Grade 4

4.MD.6

Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure.

Essential Question(s)

How can I accurately measure an angle?

Common Misconceptions

Students are confused as to which number to use when determining the measure of an angle using a protractor because most protractors have a double set of numbers. Students should decide first if the angle appears to be an angle that is less than the measure of a right angle (90°) or greater than the measure of a right angle (90°). If the angle appears to be less than 90°, it is an acute angle and its measure ranges from 0° to 89°. If the angle appears to be an angle that is greater than 90°, it is an obtuse angle and its measures range from 91° to 179°. Ask questions about the appearance of the angle to help students in deciding which number to use.

Vocabulary

- Angle
- Degree
- Protractor
- Sketch
- Draw
- Explain

Essential Skills

Recognize that angles are measured in degrees (°).

Read a protractor.

Determine which scale on the protractor to use, based on the direction the angle is open.

Determine the kind of angle based on the specified measure to decide reasonableness of a sketch.

Measure angles in whole-number degrees using a protractor.

Sketch angles of specified measure.

Examples	Questions
The student can use a protractor to properly measure an angle. The student can draw an angle of a given size with a protractor. Draw an angle of 80 degrees with the given protractor.	Measure angle C. 

Performance Level Descriptors

Limited: Measure angles in whole number degrees using a protractor.
Basic: Measure and/or draw angles in whole number degrees using a protractor.
Proficient: N/A
Accelerated: Measure and/or draw angles in whole number degrees using a protractor to solve problems.
Advanced: Demonstrate an understanding of the concepts of angles by determining the measure of complex angles using appropriate strategies (protractors, equations).

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

Students are ready to use a tool to measure angles once they understand the difference between an acute angle and an obtuse angle. Angles are measured in degrees. There is a relationship between the number of degrees in an angle and circle which has a measure of 360 degrees. Students are to use a protractor to measure angles in whole-number degrees. They can determine if the measure of the angle is reasonable based on the relationship of the angle to a right angle. They also make sketches of angles of specified measure.

3.MD.4 (Prior Grade Standard)	5.MD.5 (Future Grade Standard)
Represent and interpret data. 3.MD.4 Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by creating a line plot, where the horizontal scale is marked off in appropriate units—whole numbers, halves, or quarters.	Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition. 5.MD.5 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 $V = l \times w \times h$ 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.

Ohio's Learning Standards-Clear Learning Targets
Math, Grade 4

4.MD.7

Recognize angle measure as additive. When an angle is decomposed into non-overlapping parts, the angle measure of the whole is the sum of the angle measures of the parts. Solve addition and subtraction problems to find unknown angles on a diagram in real world and mathematical problems, e.g., by using an equation with a symbol for the unknown angle measure.

Essential Question(s)

How can I accurately find an angle when I only know one part of the angle?

Common Misconceptions

Students are confused as to which number to use when determining the measure of an angle

Students need to have some experiences with benchmark angles.

Vocabulary

- Angle
- Degree
- Protractor
- Additive
- Decompose
- Equation
- Symbol
- Unknown angle measure
- Recognize
- Solve
- Diagram

Essential Skills

Recognize that an angle can be divided into smaller angles.

Solve addition and subtraction equations to find unknown angle measurements on a diagram.

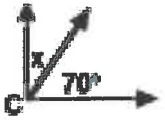
Find an angle measure by adding the measurements of the smaller angles that make up the larger angle.

Find an angle measure by subtracting the measurements of the smaller angle from the larger angle.

Examples

Explain how angle A and angle B are related in this diagram.

Write an equation and and solve for x if angle C is a right angle.



Questions

What is the measure of angle A?

Performance Level Descriptors

Limited: N/A
Basic: N/A
Proficient: Determine the measure of an angle by using the sum of two angle parts.
Accelerated: Solve addition and subtraction problems to find unknown angles in a diagram with a symbol for the unknown angle measure.
Advanced: Write and solve equations to find the measure of angles including those with multiple parts or missing parts from real world problems.

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

Students are ready to use a tool to measure angles once they understand the difference between an acute angle and an obtuse angle. Angles are measured in degrees. There is a relationship between the number of degrees in an angle and circle which has a measure of 360 degrees. Students are to use a protractor to measure angles in whole-number degrees. They can determine if the measure of the angle is reasonable based on the relationship of the angle to a right angle. They also make sketches of angles of specified measure.

3.MD.4 (Prior Grade Standard)

Represent and interpret data. Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by creating a line plot, where the horizontal scale is marked off in appropriate units—whole numbers, halves, or quarters.

5.MD.5 (Future Grade Standard)

Geometric measurement: understand concepts of volume and relate volume to multiplication and to addition. 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 $V = l \times w \times h$ 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.

Ohio's Learning Standards-Clear Learning Targets
Math, Grade 4

4.G.1	Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.	**Common Misconceptions** Students do not easily identify lines and rays because they are more abstract	**Vocabulary** ▪ Angles (right, acute, obtuse) ▪ two –dimensional figures ▪ Point ▪ Line (perpendicular, parallel) ▪ Line segments ▪ Rays ▪ Draw ▪ Identify
Essential Question(s) What geometric attributes can I find in a 2 dimensional shape?			
Essential Skills	Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Analyze two-dimensional figures to identify points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines.		

Examples	Questions
These are pretty straight forward skills of having a student properly represent a drawing of each of these and be able to identify each one. Be careful to not always orient these drawings the same each time.	

Performance Level Descriptors

Limited: Identify points, perpendicular and parallel lines, right, acute and obtuse angles.
Basic: Identify points, perpendicular and parallel lines, right, acute and obtuse angles in two-dimensional figures.
Proficient: Draw and identify in two dimensional figures; lines, line segments, rays, perpendicular and parallel lines and angles.
Accelerated: N/A
Advanced: N/A

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

- Angles

Students can and should make geometric distinctions about angles without measuring or mentioning degrees. Angles should be classified in comparison to right angles, such as larger than, smaller than or the same size as a right angle. Students can use the corner of a sheet of paper as a benchmark for a right angle. They can use a right angle to determine relationships of other angles.

- Symmetry

When introducing line of symmetry, provide examples of geometric shapes with and without lines of symmetry. Shapes can be classified by the existence of lines of symmetry in sorting activities. This can be done informally by folding paper, tracing, creating designs with tiles or investigating reflections in mirrors. With the use of a dynamic geometric program, students can easily construct points, lines and geometric figures. They can also draw lines perpendicular or parallel to other line segments.

- Two-dimensional shapes

Two-dimensional shapes are classified based on relationships by the angles and sides. Students can determine if the sides are parallel or perpendicular, and classify accordingly. Characteristics of rectangles (including squares) are used to develop the concept of parallel and perpendicular lines. The characteristics and understanding of parallel and perpendicular lines are used to draw rectangles. Repeated experiences in comparing and contrasting shapes enable students to gain a deeper understanding about shapes and their properties.

3.MD.4 (Prior Grade Standard)	5.MD.1 (Future Grade Standard)
Represent and interpret data. 3.MD.4 Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by creating a line plot, where the horizontal scale is marked off in appropriate units—whole numbers, halves, or quarters.	Convert like measurement units within a given measurement system. 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 multi-step, real-world problems.

Ohio's Learning Standards-Clear Learning Targets
Math, Grade 4

4.G.2

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.

Recognize right triangles as a category, and identify right triangles.

Essential Question(s)

What geometric attributes classify 2 dimensional shapes and angles?

Common Misconceptions

Students confuse the concept of parallel and perpendicular lines

Vocabulary

- Angles (right, acute, obtuse)
- two –dimensional figures
- Point
- Line (perpendicular, parallel)
- Line segments
- Rays
- Classify
- Presence
- Absence
- Recognize
- Identify

Essential Skills

Identify parallel or perpendicular lines in two dimensional figures.

Recognize acute, obtuse, and right angles.

Identify right triangles.

Classify two-dimensional figures based on parallel or perpendicular lines and size of angles.

Classify triangles as right triangles or not right.

Examples **Questions**

Give students an array of shapes and have the students sort them in the appropriate groups. Students should be able to articulate in precise mathematical language why the groups are classified the way they are.
The student can group shapes based on whether the sides are parallel or perpendicular.
The student can group shapes based on the types of angles.
The student can group triangles based on whether they contain a right angle or not.

Performance Level Descriptors

Limited: Sort two-dimensional figures by perpendicular or parallel sides and presence or absence of right angles.
Basic: Sort two-dimensional figures by their perpendicular and parallel sides and angle sizes.
Proficient: Classify two-dimensional figures (e.g. squares, rectangles and right triangles) based on the properties of parallel or perpendicular lines and/or angle sizes.
Accelerated: Classify two-dimensional shapes by the properties of their lines and angles.
Advanced: N/A

Ohio Department of Education Model Curriculum Instructional Strategies and Resources

- Angles

Students can and should make geometric distinctions about angles without measuring or mentioning degrees. Angles should be classified in comparison to right angles, such as larger than, smaller than or the same size as a right angle. Students can use the corner of a sheet of paper as a benchmark for a right angle. They can use a right angle to determine relationships of other angles.

- Symmetry

When introducing line of symmetry, provide examples of geometric shapes with and without lines of symmetry. Shapes can be classified by the existence of lines of symmetry in sorting activities. This can be done informally by folding paper, tracing, creating designs with tiles or investigating reflections in mirrors. With the use of a dynamic geometric program, students can easily construct points, lines and geometric figures. They can also draw lines perpendicular or parallel to other line segments.

- Two-dimensional shapes

Two-dimensional shapes are classified based on relationships by the angles and sides. Students can determine if the sides are parallel or perpendicular, and classify accordingly. Characteristics of rectangles (including squares) are used to develop the concept of parallel and perpendicular lines. The characteristics and understanding of parallel and perpendicular lines are used to draw rectangles. Repeated experiences in comparing and contrasting shapes enable students to gain a deeper understanding about shapes and their properties.

3.G.1 (Prior Grade Standard)
Reason with shapes and their attributes. 3.G.1 Draw and describe triangles, quadrilaterals (rhombuses, rectangles, and squares), and polygons (up to 8 sides) based on the number of sides and the presence or absence of square corners (right angles).

5.MD.1 (Future Grade Standard)
Convert like measurement units within a given measurement system. 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 multi-step, real-world problems.