AzMERIT | Arizona's Statewide Achievement Assessment for English Language Arts and Mathematics

Mathematics Item Specifications

GRADE 4

Arizona Department of Education with American Institutes for Research - 2018

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Introduction

The Arizona Statewide Achievement Assessment for English Language Arts and Mathematics (AzMERIT) is Arizona's statewide achievement test. AzMERIT assesses the Arizona English Language Arts Standards and Arizona Mathematics Standards adopted by the Arizona State Board of Education in December 2016. AzMERIT will inform students, teachers, and parents about preparedness for college and careers upon graduating from high school. AzMERIT tests are computer-based, meaning that they can better assess students' critical thinking skills and provide them with opportunities to demonstrate a deeper understanding of the materials. Computer-based testing also allows for the use of a variety of innovative items types.

During the item-development process, all AzMERIT items are written in accordance with the Item Specifications and are reviewed and approved by a committee of Arizona educators to confirm alignment and appropriateness for inclusion in the test. AzMERIT items are generally representative of Arizona's geographic regions and culturally diverse population. Items are reviewed for the following kinds of bias: gender, racial, ethnic, linguistic, religious, geographic, and socioeconomic. Item reviews also include consideration of issues related to individuals with disabilities. Arizona community members also have an opportunity to review items for issues of potential concern to members of the community at large. Reviewers are asked to consider the variety of cultural, regional, philosophical, political, and religious backgrounds throughout Arizona, and then to determine whether the subject matter will be acceptable to Arizona students, families, and other members of Arizona communities.

This *AzMERIT Item Specifications* is a resource document that defines the content and format of the test and test items for item writers and reviewers. Each *Item Specifications* document indicates the alignment of items with the Arizona Mathematics Standards. It also serves to provide all stakeholders with information about the scope and function of assessment items. This document can also serve to assist educators to understand how assessment items are developed in alignment with the standards for English language arts and math. These item specifications for AzMERIT are intended to provide information regarding standards, item formats and response types. The descriptions of blueprints, and depth of knowledge in this document are meant to provide an overview of the test. Item specifications are meant for the purposes of assessment, not instruction. They are not intended to be tools for instruction or the basis for curricula. AzMERIT has a test blueprint that was developed by Arizona and is different from any other state or consortium test blueprint.

For the math portion of AzMERIT, all of the test questions are aligned to the mathematic content standards for these subject areas. Any item specifications that are absent for standards listed in this document may be under development. This document does not endorse the exclusion of the instruction of any grade-level content standards. The test will ask questions that check a student's conceptual understanding of math as well as their procedural skills. These items have been written to be free from bias and sensitivity, and widely vary in their degree of difficulty.

Item Development Process

AzMERIT items go through a rigorous review before they are operational. When an item is "operational" it means it is used to determine a student's score on the assessment. This is a description of the process every item must go through before it is operational on AzMERIT.

Sample tests are available online for the math portion of AzMERIT. For more information view the Guide to the Sample Tests at www.azmeritportal.org.

Test Construction Guidelines

The construction of the AzMERIT assessment is guided by the depth and rigor of the Arizona College and Career Ready Standards. Items are created to address key components of the standards and assess a range of important skills. The AzMERIT Blueprint provides an overview of the distribution of items on the AzMERIT according to the standards. The standards for Math Practices are embedded within all AzMERIT items. Further, the AzMERIT blueprint outlines the Depth of Knowledge distribution of items.

Blueprint

Grade 4 AzMERIT Math Blueprint 2016 Standards		
Reporting Category	**Min.**	**Max.**
Operations and Algebraic Thinking and Numbers & Operations in Base Ten	**46%**	**54%**
Operations & Algebraic Thinking	22%	26%
Numbers in Base Ten	24%	28%
Numbers and Operations - Fractions	**29%**	**33%**
Measurement, Data, and Geometry	**15%**	**19%**
Measurement and Data	9%	13%
Geometry	4%	7%

Depth of Knowledge (DOK)

DOK refers to the level of rigor or sophistication of the task in a given item, designed to reflect the complexity of the Arizona Mathematics Standards. Items at DOK level 1 focus on the recall of information, such as definitions, terms, and simple procedures. Items at DOK 2 require students to make decisions, solve problems, or recognize patterns; in general, they require a greater degree of engagement and cognitive processing than items at DOK 1. Items at DOK 3 feature higher-order cognitive tasks that assess students' capacities to approach abstract or complex problems.

Percentage of Points by Depth of Knowledge (DOK) Level			
Grade 4	DOK Level 1	DOK Level 2	DOK Level 3
	10% - 20%	60% - 70%	12% - 30%

For more information on DOK go to www.azed.gov/AzMERIT.

Calculators

Arizona Desmos Graphing Calculator is not permitted for the paper-based and computer-based assessment for Grade 4 Math.

Item Formats

The AzMERIT Assessments are composed of item formats that include traditional multiple-choice response items and technology-enhanced response items (TEI). TEIs are computer-delivered response items that require students to interact with test content to select, construct, and/or support their responses. TEIs are better able to assess a deeper level of understanding.

Currently, there are nine types of TEIs that may appear on the Math computer-based assessment for AzMERIT:

- Editing Tasks (ET)
- Editing Task Choice (ETC)
- Equation Editor (EQ)
- Graphic Response Item Display (GRID)
- Hot Text (HT)
    - Selectable Hot Text
    - Drag-and-Drop Hot Text
- Matching Item (MI)
- Multi-Select (MS)
- Open Response
- Table Item (TI)

For paper-based assessments (including those for students with an IEP or 504 plan that specifies a paper based accommodation), TEIs will be modified so that they can be scanned and scored electronically or hand-scored.

See the table below for a description of each TEI. In addition, for examples of each response item format described, see the AzMERIT Training Tests at www.azmeritportal.org.

Item Format	Description
Editing Task (ET)	The student clicks on a highlighted word or phrase that may be incorrect, which reveals a text box. The directions in the text box direct the student to replace the highlighted word or phrase with the correct word or phrase. For paper-based assessments, this item type may be replaced with another item type that assesses the same standard and can be scanned and scored electronically.

Editing Task Choice (ETC)	The student clicks a highlighted word or phrase, which reveals a drop-down menu containing options for correcting an error as well as the highlighted word or phrase as it is shown in the sentence to indicate that no correction is needed. The student then selects the correct word or phrase from the drop-down menu. For paper-based assessments, the item is modified so that it can be scanned and scored electronically. The student fills in a circle to indicate the correct word or phrase.
Equation Editor (EQ)	The student is presented with a toolbar that includes a variety of mathematical symbols that can be used to create a response. Responses may be in the form of a number, variable, expression, or equation, as appropriate to the test item. For paper-based assessments, this item type may be replaced with a modified version of the item that can be scanned and scored electronically or replaced with another item type that assesses the same standard and can be scanned and scored electronically.
Graphic Response Item Display (GRID)	The student selects numbers, words, phrases, or images and uses the drag-and-drop feature to place them into a graphic. This item type may also require the student to use the point, line, or arrow tools to create a response on a graph. For paper-based assessments, this item type may be replaced with another item type that assesses the same standard and can be scanned and scored electronically.
Hot Text (HT)	**Selectable Hot Text -** Excerpted sentences from the text are presented in this item type. When the student hovers over certain words, phrases, or sentences, the options highlight. This indicates that the text is selectable ("hot"). The student can then click on an option to select it. For paper- based assessments, a "selectable" hot text item is modified so that it can be scanned and scored electronically. In this version, the student fills in a circle to indicate a selection.
	Drag-and-Drop Hot Text - Certain numbers, words, phrases, or sentences may be designated "draggable" in this item type. When the student hovers over these areas, the text highlights. The student can then click on the option, hold down the mouse button, and drag it to a graphic or other format. For paper-based assessments, drag- and-drop hot text items will be replaced with another item type that assesses the same standard and can be scanned and scored electronically.
Matching Item (MI)	The student checks a box to indicate if information from a column header matches information from a row. For paper-based assessments, this item type may be replaced with another item type that assesses the same standard and can be scanned and scored electronically.

Multi-Select (MS)	The student is directed to select all of the correct answers from among a number of options. These items are different from multiple-choice items, which allow the student to select only one correct answer. These items appear in the online and paper-based assessments.
Open Response	The student uses the keyboard to enter a response into a text field. These items can usually be answered in a sentence or two. For paper-based assessments, this item type may be replaced with another item type that assesses the same standard and can be scanned and scored electronically.

Arizona Math Standards

Operations and Algebraic Thinking (OA)		
4.OA.A **Use the four operations with whole numbers to solve problems.**	**4.OA.A.1**	Represent verbal statements of multiplicative comparisons as multiplication equations. Interpret a multiplication equation as a comparison (e.g., 35 is the number of objects in 5 groups, each containing 7 objects, and is also the number of objects in 7 groups, each containing 5 objects).
	4.OA.A.2	Multiply or divide within 1000 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.*
	4.OA.A.3	Solve multistep word problems using the four operations, including problems in which remainders must be interpreted. Understand how the remainder is a fraction of the divisor. Represent these problems using equations with a letter standing for the unknown quantity.
4.OA.B **Gain familiarity with factors and multiples.**	**4.OA.B.4**	Find all factor pairs for a whole number in the range 1 to 100 and understand that a whole number is a multiple of each of its factors.
4.OA.C **Generate and analyze patterns.**	**4.OA.C.5**	Generate a number pattern that follows a given rule. Identify apparent features of the pattern that were not explicit in the rule itself and explain the pattern informally (e.g., 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).
	4.OA.C.6	When solving problems, assess the reasonableness of answers using mental computation and estimation strategies including rounding.
Number and Operations in Base Ten (NBT) *Note: Grade 4 expectations in this domain are limited to whole numbers less than or equal to 1,000,000.*		
4.NBT.A **Generalize place value understanding for multi-digit whole numbers.**	**4.NBT.A.1**	Apply concepts of place value, multiplication, and division to understand that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right.
	4.NBT.A.2	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.
	4.NBT.A.3	Use place value understanding to round multi-digit whole numbers to any place.

4.NBT.B **Use place value understanding and properties of operations to perform multi-digit arithmetic.**	**4.NBT.B.4**	Fluently add and subtract multi-digit whole numbers using a standard algorithm.
	4.NBT.B.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.
	4.NBT.B.6	Demonstrate understanding of division by finding whole-number quotients and remainders with up to four-digit dividends and one-digit divisors.
Number and Operations – Fractions (NF) *Note: Grade 4 expectations in this domain are limited to fractions with denominators 2, 3, 4, 5, 6, 8, 10, 12, and 100.*		
4.NF.A **Extend understanding of fraction equivalence and ordering.**	**4.NF.A.1**	Explain why a fraction *a/b* is equivalent to a fraction (*n x a*)/(*n x 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 understand and generate equivalent fractions.
	4.NF.A.2	Compare two fractions with different numerators and different denominators (e.g., by creating common denominators or numerators and by comparing to a benchmark fraction). a. Understand that comparisons are valid only when the two fractions refer to the same size whole. b. Record the results of comparisons with symbols >, =, or <, and justify the conclusions.
4.NF.B **Build fractions from unit fractions by applying and extending previous understanding of operations on whole numbers.**	**4.NF.B.3**	Understand a fraction *a/b* with *a* > 1 as a sum of unit 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 (e.g., 3/8 = 1/8 + 1/8+1/8; 3/8 = 2/8 + 1/8; 2 1/8 = 1 + 1 + 1/8 + or 2 1/8 = 8/8 + 8/8 + 1/8). c. Add and subtract mixed numbers with like denominators (e.g., by using properties of operations and the relationship between addition and subtraction and/or by replacing each mixed number with an equivalent fraction). d. Solve word problems involving addition and subtraction of fractions referring to the same whole and having like denominators.
	4.NF.B.4	Build fractions from unit fractions. a. Understand a fraction $\frac{a}{b}$ as a multiple of a unit fraction $\frac{1}{b}$. In general, $\frac{a}{b} = a \times \frac{1}{b}$. b. Understand a multiple of $\frac{a}{b}$ as a multiple of a unit fraction $\frac{1}{b}$, and use this understanding to multiply a whole number by a fraction. In general, $n \times \frac{a}{b} = \frac{n \times a}{b}$. c. Solve word problems involving multiplication of a whole number by a fraction. *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?*

4.NF.C **Understand decimal notation for fractions, and compare decimal fractions.**	**4.NF.C.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 (tenths) and 100 (hundredths). *For example, express 3/10 as 30/100, and and 3/10 + 4/100 = 34/100.* (Note: Students who can generate equivalent fractions can develop strategies for adding fractions with unlike denominators in general. But addition and subtraction with unlike denominators, in general, is not a requirement at this grade.)
	4.NF.C.6	Use decimal notation for fractions with denominators 10 (tenths) or 100 (hundredths), and locate these decimals on a number line.
	4.NF.C.7	Compare two decimals to hundredths by reasoning about their size. Understand that comparisons are valid only when the two decimals refer to the same whole. Record the results of comparisons with the symbols >, =, or <.
Measurement and Data (MD)		
4.MD.A **Solve problems involving measurement and conversion of measurements from a larger unit to a smaller unit.**	**4.MD.A.1**	Know relative sizes of measurement units within one system of units which could include km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit and in a smaller unit in terms of a larger unit. *For example, know that 1 ft is 12 times as long as 1 in. Express the length of a 4 ft snake as 48 in. Generate a conversion table for feet and inches listing the number pairs (1,12), 2,24), (3,36).*
	4.MD.A.2	Use the four operations to solve word problems and problems in real-world context involving distances, intervals of time (hr, min, sec), liquid volumes, masses of objects, and money, including decimals and problems involving fractions with like denominators, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using a variety of representations, including number lines that feature a measurement scale.
	4.MD.A.3	Apply the area and perimeter formulas for rectangles in mathematical problems and problems in real-world contexts including problems with unknown side lengths. See *Table 2.*
4.MD.B **Represent and interpret data.**	**4.MD.B.4**	Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Solve problems involving addition and subtraction of fractions by using information presented in line plots.
4.MD.C **Geometric measurement: Understand concepts of angle and measure angles.**	**4.MD.C.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.
	4.MD.C.6	Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure.

4.MD.C (cont.)	**4.MD.C.7**	Understand angle measures 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 within mathematical problems as well as problems in real-world contexts.
Geometry (G)		
4.G.A **Draw and identify lines and angles, and classify shapes by properties of their lines and angles.**	**4.G.A.1**	Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.
	4.G.A.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 (e.g., understand right triangles as a category, and identify right triangles).
	4.G.A.3	Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded along the line into matching parts. Identify line-symmetric figures and draw lines of symmetry.

Grade 4 Item Specifications

Measurement and Data & Geometry

4.G.A.1

Content Standards	Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.
Explanations	Examples of points, line segments, lines, angles, parallelism, and perpendicularity can be seen daily. Students do not easily identify lines and rays because they are more abstract
Content Limits	All objects (point, line, line segment, angles) and properties (right, acute, obtuse, perpendicular, parallel) noted in the standard, as individual objects or within two-dimensional figures.
Context	Context is not allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to identify geometric objects and properties, either as individual objects or as part of a more complex figure.	• Graphic Response • Multiple Choice Response • Matching Item Response • Multi-Select Response
Students will be required to construct a geometric figure based on given constraints/properties.	

Performance Level Descriptors

Minimally Proficient	**Partially Proficient**
Identify points, lines, line segments, rays, angles, and lines in two-dimensional figures.	Identify and draw points, lines, line segments, rays, angles, and perpendicular and parallel lines in two-dimensional figures.
Proficient	**Highly Proficient**
Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.	Explain characteristics that define points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines.

4.G.A.2

Content Standards	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 (e.g., understand right triangles as a category, and identify right triangles).
Explanations	Two-dimensional figures may be classified using different characteristics such as, parallel or perpendicular lines or by angle measurement. Students should become familiar with the concept of parallel and perpendicular lines. Two lines are parallel if they never intersect and are always equidistant. Two lines are perpendicular if they intersect in right angles (90°). Students may use transparencies with lines to arrange two lines in different ways to determine that the 2 lines might intersect in one point or may never intersect. This expectation is closely connected to 4.MD.5, 4.MD.6, and 4.G.1. Students' experiences with drawing and identifying right, acute, and obtuse angles support them in classifying two-dimensional figures based on specified angle measurements. They use the Right triangles can be a category for classification. A right triangle has one right angle. There are different types of right triangles. An isosceles right triangle has two or more congruent sides and a scalene right triangle has no congruent sides.
Content Limits	For this standard, classifications should focus on parallel/perpendicular lines and the size of angles rather than their side lengths. Triangles: Right triangles, acute triangles, obtuse triangles, scalene triangles, isosceles triangles, and equilateral triangles Quadrilaterals: parallelograms, rectangles, squares, rhombi, trapezoids. Other polygons may be included where appropriate. There are two competing definitions for trapezoids - one that requires exactly one pair or parallel sides, and another that requires at least one pair of parallel sides (using this definition, parallelograms are trapezoids). Thus, items that require the student to choose a definition in order to arrive at the correct answer should be avoided.
Context	Context is not allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to identify types of triangles.	• Graphic Response • Multiple Choice Response • Matching Item Response • Multi-Select Response • Proposition Response
Students will be required to construct a shape based on the shape name.	
Students will be required to given a set of shapes in two groups, explain why the shapes were classified this way.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Identify two-dimensional figures based on the presence or absence of parallel or perpendicular lines.	Identify 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.
Proficient	**Highly Proficient**
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 (e.g., understand right triangles as a category, and identify right triangles).	Classify two-dimensional figures into more than one category based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size (e.g., understand right triangles as a category, and identify right triangles).

4.G.A.3

Content Standards	Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded along the line into matching parts. Identify line-symmetric figures and draw lines of symmetry.
Explanations	Students need experiences with figures which are symmetrical and non-symmetrical. Figures include both regular and non-regular polygons. Folding cut-out figures will help students determine whether a figure has one or more lines of symmetry.
Content Limits	Be mindful of the graphic response answer space the students work with when considering the number of lines of symmetry of a shape. Avoid a busy figure with many of lines of symmetry that young students would find hard to work with. Items that require constructing a shape based on the number of lines of symmetry should specify the shape category with regards to the number of sides (quadrilateral, triangle, pentagon…).
Context	Context is not allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to identify symmetric figures.	• Equation Response • Graphic Response • Multiple Choice Response • Matching Item Response • Multi-Select Response
Students will be required to identify whether a line drawn on a figure represents a line of symmetry of the figure.	
Students will be required to determine the number of lines of symmetry a given figure has.	
Students will be required to construct lines of symmetry for a given shape.	
Students will be required to construct a complete figure based on half of the figure and its line of symmetry.	
Students will be required to construct a figure based on two attributes (e.g., the number of lines of symmetry and type of shape, or the lines of symmetry, already drawn, and type of shape).	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Identify a line of symmetry for a two-dimensional figure.	Identify line-symmetric figures and draw lines of symmetry.
Proficient	**Highly Proficient**
Recognize a line of symmetry for a two-dimensional figure as a line across the figure such that the figure can be folded along the line into matching parts. Identify line-symmetric figures and draw lines of symmetry.	Explain that a line of symmetry for a two-dimensional figure is a line across the figure such that the figure can be folded along the line into matching parts. Draw line-symmetric figures.

4.MD.A.1

Content Standards	Know relative sizes of measurement units within one system of units which could include km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit and in a smaller unit in terms of a larger unit. *For example, know that 1 ft is 12 times as long as 1 in. Express the length of a 4 ft snake as 48 in. Generate a conversion table for feet and inches listing the number pairs (1, 12), (2, 24), (3, 36).*
Explanations	The units of measure that have not been addressed in prior years are pounds, ounces, kilometers, milliliters, and seconds. Students' prior experiences were limited to measuring length, mass, liquid volume, and elapsed time. Students did not convert measurements. Students need ample opportunities to become familiar with these new units of measure.
Content Limits	Measurement units are within a single system. Measurement conversions are from larger units to smaller units. Multiplication is limited to 4-digit numbers by 1-digit numbers and two 2-digit numbers. (4.NBT.B.5) Units of measurement include: kilometer, meter, centimeter, millimeter, liter, milliliter, kilogram, gram, milligram, mile, yard, foot, inch, gallon, quart, pint, cup, ton, pound, and ounce.
Context	Context is allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to identify the relative size of a measurement unit.	• Equation Response • Graphic Response • Multiple Choice Response • Matching Item Response • Multi-Select Response • Table Response
Students will be required to calculate measurement conversions.	
Students will be required to order measurements given in different units within the same measurement system.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Identify the relative sizes of measurement units within one system of units which could include km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, identify measurements in a larger unit in terms of a smaller unit.	Identify the relative sizes of measurement units within one system of units which could include km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, identify measurements in a larger unit in terms of a smaller unit and in a smaller unit in terms of a larger unit.
Proficient	**Highly Proficient**
Know relative sizes of measurement units within one system of units which could include km, m, cm; kg, g; lb, oz.; l, ml; hr, min, sec. Within a single system of measurement, express measurements in a larger unit in terms of a smaller unit and in a smaller unit in terms of a larger unit. *For example, know that 1 ft is 12 times as long as 1 in. Express the length of a 4 ft snake as 48 in. Generate a conversion table for feet and inches listing the number pairs (1,12), (2,24), (3,36).*	Explain how different sizes of measurement units within one system of units relate to each other. Within a single system of measurement, explain how to convert measurements from a larger unit to a smaller unit and from a smaller unit to a larger unit. Generate a conversion table for measurements within one system of units.

4.MD.A.2

Content Standards	Use the four operations to solve word problems and problems in real-world context involving distances, intervals of time (hr, min, sec), liquid volumes, masses of objects, and money, including decimals and problems involving fractions with like denominators, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using a variety of representations, including number lines that feature a measurement scale.
Explanations	Number line diagrams that feature a measurement scale can represent measurement quantities. Examples include: ruler, diagram marking off distance along a road with cities at various points, a timetable showing hours throughout the day, or a volume measure on the side of a container.
Content Limits	Measurement conversions are from larger units to smaller units. Calculations are limited to simple fractions or decimals. Operations include addition, subtraction, multiplication, and division. Calculations involving fractions and decimals are limited to addition or subtraction.
Context	Context is required

Sample Task Demands	**Common Item Formats**
Students will be required to solve a word problem involving specified measurements.	• Equation Response • Graphic Response
Students will be required to represent/model a problem involving specified measurements.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Use the four operations to identify solutions to word problems and problems in real-world context involving distances, intervals of time (hr, min, sec), liquid volumes, masses of objects, and money, including decimals. Represent measurement quantities using number lines that feature a measurement scale.	Use the four operations to identify solutions to word problems and problems in real-world context involving distances, intervals of time (hr, min, sec), liquid volumes, masses of objects, and money, including decimals and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using a variety of representations, including number lines that feature a measurement scale.
Proficient	**Highly Proficient**
Use the four operations to solve word problems and problems in real-world context involving distances, intervals of time (hr, min, sec), liquid volumes, masses of objects, and money, including decimals and problems involving fractions with like denominators, and problems that require expressing measurements given in a larger unit in terms of a smaller unit. Represent measurement quantities using a variety of representations, including number lines that feature a measurement scale.	Explain how to use the four operations to solve word problems and problems in real-world context involving distances, intervals of time (hr, min, sec), liquid volumes, masses of objects, and money, including decimals and problems involving fractions with like denominators, and problems that require expressing measurements given in a smaller unit in terms of a larger unit. Represent measurement quantities using a variety of representations, including number lines that feature a measurement scale.

4.MD.A.3

Content Standards	Apply the area and perimeter formulas for rectangles in mathematical problems and problems in real-world contexts including problems with unknown side lengths.
Explanations	Students developed understanding of area and perimeter in 3rd grade by using visual models. While students are expected to use formulas to calculate area and perimeter of rectangles, they need to understand and be able to communicate their understanding of why the formulas work.
Content Limits	Figures are limited to rectangles. Fractions are limited to like denominators. Products of factor pairs are limited to the range 1-100. Multiplication and division is limited to 2-digit by 1-digit, or 2-digit by 2-digit, where one number is a multiple of 10. Addition and subtraction within 1000. When constructing rectangles, the minimum grid size is 20 pixels, and in the context of a situation, one grid must be labeled with the appropriate dimension. That dimension should be "1 ____", as items at this standard should not assess scale.
Context	Context is allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to construct a rectangle with a given perimeter and/or area.	• Equation Response • Graphic Response • Multi-Select Response
Students will be required to calculate perimeter and/or area of a rectangle.	
Students will be required to calculate an unknown side length given an area or perimeter.	
Students will be required to model with an expression or equation the area or perimeter of a rectangle with an unknown side length.	
Students will be required to construct a rectangle based on given parameters (i.e. ranges of possible areas and/or perimeters.)	

Performance Level Descriptors

Minimally Proficient	**Partially Proficient**
Identify the area and perimeter for rectangles in mathematical problems.	Identify the area and perimeter for rectangles in mathematical problems and problems in real-world contexts.
Proficient	**Highly Proficient**
Apply the area and perimeter formulas for rectangles in mathematical problems and problems in real-world contexts including problems with unknown side lengths.	Explain the difference between the area and perimeter formulas for rectangles. Use the area and perimeter formulas to determine unknown side lengths of a rectangle.

4.MD.B.4

Content Standards	Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Solve problems involving addition and subtraction of fractions by using information presented in line plots.
Explanations	Represent and interpret data.
Content Limits	Measurement units are limited to halves, quarters, and eighths. Addition and subtraction of fractions is limited to fractions with the same denominators. Multiplication and division is limited to 2-digit by 1-digit, or 2-digit by 2-digit, where one number is a multiple of 10. Addition and subtraction within 1000.
Context	Context is allowed

Sample Task Demands	Common Item Formats
Students will be required to construct a line plot based on given data.	• Equation Response • Graphic Response
Students will be required to interpret data in a line plot to solve problems involving addition and subtraction.	
Students will be required to complete a line plot based on the information about the sum or difference of the data.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Identify a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Solve problems involving addition of fractions by using information presented in line plots.	Identify a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Solve problems involving addition and subtraction of fractions by using information presented in line plots.
Proficient	**Highly Proficient**
Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Solve problems involving addition and subtraction of fractions by using information presented in line plots.	Make a line plot to display a data set of measurements in fractions of a unit (1/2, 1/4, 1/8). Create problems involving addition and subtraction of fractions by using information presented in line plots.

4.MD.C.5, 4.MD.C.5a, and 4.MD.C.5b

Content Standards	**4.MD.C.5** Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement: **4.MD.C.5a** 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. **4.MD.C.5b** An angle that turns through *n* one-degree angles is said to have an angle measure of *n* degrees.
Explanations	Geometric measurement: understand concepts of angle and measure angles.
Content Limits	Whole-number degree measures. Angles are less than or equal to 360º.
Context	Context is allowed

Sample Task Demands	**Common Item Formats**
Students will be required to identify an angle.	• Graphic Response • Multiple Choice Response • Matching Item Response • Multi-Select Response
Students will be required to sort angles from other geometric objects.	
Students will be required to identify the unit used to measure angles.	
Students will be required to identify categories of angle measures.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement: a. Recognize that a “one-degree angle” turns through 1/360 of a circle. b. Recognize that an “*n* degree angle” turns through *n*/360 of a circle.	Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement: a. Identify a one-degree angle, with its common endpoint at the center of a circle, as being 1/360 of the circle. b. Identify an “*n* degree angle," with its common endpoint at the center of a circle, as being *n*/360 of the circle.
Proficient	**Highly Proficient**
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.	Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement: a. Explain how an angle is measured with reference to a circle with its center at the common endpoint of the rays and how the angle measure is the same as the fraction of the circular arc between the points where the two rays intersect the circle. b. Explain why an angle that turns through *n* one-degree angles is said to have an angle measure of *n* degrees.

4.MD.C.6

Content Standards	Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure.
Explanations	Before students begin measuring angles with protractors, they need to have some experiences with benchmark angles. They transfer their understanding that a 360º rotation about a point makes a complete circle to recognize and sketch angles that measure approximately 90º and 180º. They extend this understanding and recognize and sketch angles that measure approximately 45º and 30º. They use appropriate terminology (acute, right, and obtuse) to describe angles and rays (perpendicular).
Content Limits	Whole-number degree measures. For identification, angles are less than 360º. For construction, angles are less than 180º.
Context	Context is not allowed

Sample Task Demands	**Common Item Formats**
Students will be required to measure a given angle.	• Equation Response • Graphic Response
Students will be required to construct an angle based on a given measure.	

Performance Level Descriptors

Minimally Proficient	**Partially Proficient**
Identify angles measures in whole-number degrees using a protractor, when one of the rays is horizontal.	Identify angles measures in whole-number degrees using a protractor. Add a second ray to sketch angles of specified measure when given a horizontal ray.
Proficient	**Highly Proficient**
Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure.	Measure angles in whole-number degrees using a protractor, including when the angle does not have a horizontal ray.

4.MD.C.7

Content Standards	Understand angle measures 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 within mathematical problems as well as problems in real-world contexts.
Explanations	Geometric measurement: understand concepts of angle and measure angles.
Content Limits	Angles are less than or equal to 360º.
Context	Context is allowed

Sample Task Demands	Common Item Formats
Students will be required to calculate an angle measure from a given sum or difference and/or a decomposed larger angle.	• Equation Response • Multiple Choice Response • Matching Item Response • Multi-Select Response
Students will be required to identify angles that can be used to construct other angles.	
Students will be required to show how to find an angle measure from a given sum or difference using an equation.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Solve addition problems to find unknown angles on a diagram within mathematical problems as well as problems in real-world contexts.	Solve addition and subtraction problems to find unknown angles on a diagram within mathematical problems as well as problems in real-world contexts.
Proficient	**Highly Proficient**
Understand angle measures 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 within mathematical problems as well as problems in real-world contexts.	Understand angle measures 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.) Create addition and subtraction problems, mathematical problems as well as problems in real-world contexts, for angles represented on a diagram.

Numbers and Operations – Fractions

4.NF.A.1

Content Standards	Explain why a fraction *a*/*b* is equivalent to a fraction (*n* x *a*)/(*n* x *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 understand and generate equivalent fractions.
Explanations	This standard extends the work in third grade by using additional denominators (5, 10, 12, and 100).
Content Limits	Denominators limited to 2, 3, 4, 5, 6, 8, 10, 12, 100 For denominators of 10 and 100, focus should not be on equivalence between these 2 denominators since this is addressed specifically in standards 4.NF.5 – 7, but should be more on equivalence between fractions with denominators of 2, 4, and 5 and fractions with denominators of 10 and 100. E.g. ½ = 5/10, 2/5 = 40/100, etc. Refer to the same whole Fraction models are limited to number lines, rectangles, circles, and squares. (The focus should not be on complex visual models.) Fractions a/bcan be improper fractions and students should not be guided to put fractions in lowest terms or to simplify.
Context	Context is allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to identify/recognize fractions that are equivalent to a given fraction.	• Equation Response • Graphic Response • Multiple Choice Response • Matching Item Response • Multi-Select Response • Proposition Response
Students will be required to identify/recognize fraction models that represent equivalent fractions.	
Students will be required to generate fractions that are equivalent to a given fraction or equivalent to fractions represented by a given fraction model.	
Students will be required to construct models representing fractions that are equivalent to given fractions or equivalent to fractions represented by given fraction models.	
Students will be required to give evidence or an explanation to support why fractions are equivalent or why fractions represented by models are equivalent.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Identify equivalent fractions.	Generate equivalent fractions.
Proficient	**Highly Proficient**
Explain why a fraction a/b is equivalent to a fraction $(n \times a)/(n \times b)$ 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 understand and generate equivalent fractions.	Explain why a fraction a/b is equivalent to a fraction $(n \times a)/(n \times b)$ by using visual fraction models. Explain why the number and size of the parts is important in determining if two fractions are the same size. Use this principle to explain and generate equivalent fractions.

4.NF.A.2, 4.NF.A.2a, and 4.NF.A.2b

Content Standards	**4.NF.A.2** Compare two fractions with different numerators and different denominators (e.g., by creating common denominators or numerators and by comparing to a benchmark fraction). **4.NF.A.2a** Understand that comparisons are valid only when the two fractions refer to the same size whole. **4.NF.A.2b** Record the results of comparisons with symbols >, =, or <, and justify the conclusions.
Explanations	Benchmark fractions include common fractions between 0 and 1 such as halves, thirds, fourths, fifths, sixths, eighths, tenths, twelfths, and hundredths. Fractions can be compared using benchmarks, common denominators, or common numerators. Symbols used to describe comparisons include <, >, =.
Content Limits	Denominators limited to 2, 3, 4, 5, 6, 8, 10, 12, 100 Benchmarks limited to 0, 1/4, 1/2, 3/4, 1 Fractions a/bcan be improper fractions and students should not be guided to put fractions in lowest terms or to simplify.
Context	Context is allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to compare fractions relating them to benchmark fractions using visual models (e.g. number lines) and/or numeric reasoning.	• Equation Response • Graphic Response • Multiple Choice Response • Matching Item Response • Multi-Select Response • Proposition Response
Students will be required to interpret information about fractions to compare fractions using visual models or numeric reasoning.	
Students will be required to compare fractions using symbols <, >, and = with no situational context or visual model.	
Students will be required to develop logical arguments, draw conclusions, and relate use of models to numeric strategies to compare fractional quantities	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Compare two fractions with different numerators and different denominators (e.g., by creating common denominators or numerators and by comparing to a benchmark fraction). a. Determine whether or not two fractions refer to the same size whole. b. Compare two fraction models using the symbols >, =, or <.	Compare two fractions with different numerators and different denominators (e.g., by creating common denominators or numerators and by comparing to a benchmark fraction). a. Determine whether or not comparing two fractions is valid based on whether or not the fractions refer to the same size whole. b. Compare two fractions using the symbols >, =, or <.
Proficient	**Highly Proficient**
Compare two fractions with different numerators and different denominators (e.g., by creating common denominators or numerators and by comparing to a benchmark fraction). a. Understand that comparisons are valid only when the two fractions refer to the same size whole. b. Record the results of comparisons with symbols >, =, or <, and justify the conclusions.	Compare two fractions with different numerators and different denominators (e.g., by creating common denominators or numerators and by comparing to a benchmark fraction). a. Explain why comparisons are valid only when two fractions refer to the same size whole. b. Record the results of comparing multiple fractions with symbols >, =, or <, and justify the conclusions.

4.NF.B.3, 4.NF.B.3a, 4.NF.B.3b, 4.NF.B.3c, and 4.NF.B.3d

Content Standards	**4.NF.B.3** Understand a fraction *a/b* with a > 1 as a sum of unit fractions (1/*b*). **4.NF.B.3a** Understand addition and subtraction of fractions as joining and separating parts referring to the same whole. **4.NF.B.3b** Decompose a fraction into a sum of fractions with the same denominator in more than one way (e.g., 3/8 = 1/8 + 1/8 + 1/8; 3/8 = 2/8 + 1/8; 2 1/8 = 1 + 1 + 1/8 + or 2 1/8 = 8/8 + 8/8 + 1/8). **4.NF.B.3c** Add and subtract mixed numbers with like denominators (e.g., by using properties of operations and the relationship between addition and subtraction and/or by replacing each mixed number with an equivalent fraction). **4.NF.B.3d** Solve word problems involving addition and subtraction of fractions referring to the same whole and having like denominators.
Explanations	A fraction with a numerator of one is called a unit fraction. When students investigate fractions other than unit fractions, such as 2/3, they should be able to decompose the non-unit fraction into a combination of several unit fractions. A separate algorithm for mixed numbers in addition and subtraction is not necessary. Students will tend to add or subtract the whole numbers first and then work with the fractions using the same strategies they have applied to problems that contained only fractions.
Content Limits	Denominators limited to 2, 3, 4, 5, 6, 8, 10, 12, 100 Use mixed numbers and fractions with like denominators Incorporate the concept of the same whole. Circle based models, rectangular models, and numbers line models, do not over use circle based area food models (i.e., pizza).
Context	Context is allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to add or subtract fractions with like denominators.	• Equation Response • Graphic Response • Multiple Choice Response • Matching Item Response • Multi-Select Response
Students will be required to decompose a fraction into a sum of fractions in multiple ways.	
Students will be required to add or subtract mixed numbers.	
Students will be required to solve word problems involving fractions or mixed numbers and represent sums and differences of fractions or mixed numbers.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Understand a fraction *a/b* with *a* > 1 as a sum of unit fractions (1/*b*). a. Recognize addition of fractions as joining parts referring to the same whole. b. Identify a correct decomposition of a fraction into a sum of fractions with the same denominator in one way (e.g., 3/8 = 1/8 + 1/8+1/8). c. Add mixed numbers with like denominators, where regrouping is not necessary. d. Identify the solution to word problems involving addition of fractions referring to the same whole and having like denominators.	Understand a fraction *a/b* with *a* > 1 as a sum of unit fractions (1/*b*). a. Recognize addition and subtraction of fractions as joining and separating parts referring to the same whole. b. Identify a correct decomposition of a fraction into a sum of fractions with the same denominator in more than one way (e.g., 3/8 = 1/8 + 1/8+1/8; 3/8 = 2/8 + 1/8; 2 1/8 = 1 + 1 + 1/8 + or 2 1/8 = 8/8 + 8/8 + 1/8). c. Add and subtract mixed numbers with like denominators where regrouping is not necessary. d. Identify the solution to word problems involving addition and subtraction of fractions referring to the same whole and having like denominators.
Proficient	**Highly Proficient**
Understand a fraction *a/b* with *a* > 1 as a sum of unit 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 (e.g., 3/8 = 1/8 + 1/8+1/8; 3/8 = 2/8 + 1/8; 2 1/8 = 1 + 1 + 1/8 + or 2 1/8 = 8/8 + 8/8 + 1/8). c. Add and subtract mixed numbers with like denominators (e.g., by using properties of operations and the relationship between addition and subtraction and/or by replacing each mixed number with an equivalent fraction). d. Solve word problems involving addition and subtraction of fractions referring to the same whole and having like denominators.	Understand a fraction *a/b* with *a* > 1 as a sum of unit fractions (1/*b*). a. Explain how addition and subtraction of fractions is joining and separating parts referring to the same whole. b. Explain how to decompose a fraction into a sum of fractions with the same denominator in more than one way (e.g., 3/8 = 1/8 + 1/8+1/8; 3/8 = 2/8 + 1/8; 2 1/8 = 1 + 1 + 1/8 + or 2 1/8 = 8/8 + 8/8 + 1/8). c. Explain how to add and subtract mixed numbers with like denominators (e.g., by using properties of operations and the relationship between addition and subtraction and/or by replacing each mixed number with an equivalent fraction). d. Solve word problems involving addition and subtraction of fractions referring to the same whole but having different denominators.

4.NF.B.4, 4.NF.B.4a, 4.NF.B.4b, and 4.NF.B.4c

Content Standards	**4.NF.B.4** Build fractions from unit fractions. **4.NF.B.4a** Understand a fraction *a*/*b* as a multiple of a unit fraction 1/*b*. In general, *a*/*b* = *a* x 1/*b*. **4.NF.B.4b** Understand a multiple of *a*/*b* as a multiple of a unit fraction 1/*b*, and use this understanding to multiply a whole number by a fraction. In general, *n* x *a*/*b* = (*n* x *a*)/*b*. **4.NF.B.4c** Solve word problems involving multiplication of a whole number by a fraction. *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?*
Explanations	Students need many opportunities to work with problems in context to understand the connections between models and corresponding equations. Contexts involving a whole number times a fraction lend themselves to modeling and examining patterns.
Content Limits	Fractions will only be multiplied by a whole number. Limit denominators to 2, 3, 4, 5, 6, 8, 10, 12, 100
Context	Context is allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to model a non-unit fraction as the product of a whole number and a unit fraction.	• Equation Response • Graphic Response • Multiple Choice Response • Multi-Select Response
Students will be required to multiply a fraction by a whole number.	
Students will be required to identify a missing number in an equation that multiplies a fraction by a whole number.	
Students will be required to solve a word problem that involves multiplying a fraction by a whole number within a real-world context.	
Students will be required to create and/or solve an equation that models a word problem involving multiplying a fraction by a whole number within a real-world context.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Build fractions from unit fractions. a. Identify the product when a whole number is multiplied by a unit fraction. In general, $a/b = a \times 1/b$. b. Identify the product when a whole number is multiplied by a fraction. In general, $n \times a/b = (n \times a)/b$. c. Identify the solution to word problems involving multiplication of a whole number by a fraction.	Build fractions from unit fractions. a. Determine the product when a whole number is multiplied by a unit fraction. In general, $a/b = a \times 1/b$. b. Determine the product when a whole number is multiplied by a fraction. In general, $n \times a/b = (n \times a)/b$. c. Determine the solution to word problems involving multiplication of a whole number by a fraction.
Proficient	**Highly Proficient**
Build fractions from unit fractions. a. Understand a fraction a/b as a multiple of a unit fraction $1/b$. In general, $a/b = a \times 1/b$. b. Understand a multiple of a/b as a multiple of a unit fraction $1/b$, and use this understanding to multiply a whole number by a fraction. In general, $n \times a/b = (n \times a)/b$. c. Solve word problems involving multiplication of a whole number by a fraction. *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?*	Build fractions from unit fractions. a. Explain why a fraction a/b is a multiple of a unit fraction $1/b$. b. Understand a multiple of a/b as a multiple of a unit fraction $1/b$, and use this understanding to multiply a whole number by a fraction. In general, $n \times a/b = (n \times a)/b$. c. Create word problems involving multiplication of a whole number by a fraction.

4.NF.C.5

Content Standards	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 (tenths) and 100 (hundredths). *For example, express 3/10 as 30/100, and add 3/10 + 4/100 = 34/100.* (Note: Students who can generate equivalent fractions can develop strategies for adding fractions with unlike denominators in general. But addition and subtraction with unlike denominators, in general, is not a requirement at this grade.)
Explanations	Students can use base ten blocks, graph paper, and other place value models to explore the relationship between fractions with denominators of 10 and denominators of 100. Students may represent 3/10 with 3 longs and may also write the fraction as 30/100 with the whole in this case being the flat (the flat represents one hundred units with each unit equal to one hundredth). Students begin to make connections to the place value chart as shown in 4.NF.6. This work in fourth grade lays the foundation for performing operations with decimal numbers in fifth grade.
Content Limits	Denominators must be either 10 or 100 Decimal notation is not assessed in this standard Equivalent fractions is an acceptable vocab word
Context	Context is allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to express a fraction with denominator 10 as a fraction with denominator 100, and vice-versa.	• Equation Response • Multiple Choice Response • Matching Item Response • Multi-Select Response
Students will be required to add two fractions with different denominators of 10 and 100.	
Students will be required to determine a fraction equivalent to another fraction represented by a model.	
Students will be required to identify a missing addend.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Identify equivalent fractions, one with denominator 10 and one with denominator 100. *For example, identify 3/10 as equivalent to 30/100.*	Identify equivalent fractions, one with denominator 10 and one with denominator 100. Identify the sum of two fractions with respective denominators 10 (tenths) and 100 (hundredths). *For example, identify 3/10 as equivalent to 30/100, and identify that 3/10 + 4/100 = 34/100.*
Proficient	**Highly Proficient**
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 (tenths) and 100 (hundredths). *For example, express 3/10 as 30/100, and add 3/10 + 4/100 = 34/100.* (Note: Students who can generate equivalent fractions can develop strategies for adding fractions with unlike denominators in general. But addition and subtraction with unlike denominators, in general, is not a requirement at this grade.)	Express a fraction with denominator 10 as an equivalent fraction with denominator a multiple of 10, and use this technique to add two fractions with the respective denominators. *For example, express 3/10 as 300/1000, and add 3/10 + 40/1000 = 340/1000.*

4.NF.C.6

Content Standards	Use decimal notation for fractions with denominators 10 (tenths) or 100 (hundredths), and locate these decimals on a number line.
Explanations	Students make connections between fractions with denominators of 10 and 100 and the place value chart. By reading fraction names, students say 32/100 as thirty-two hundredths and rewrite this as 0.32 or represent it on a place value model. Students use the representations explored in 4.NF.5 to understand 32/100 can be expanded to 3/10 and 2/100. Students represent values such as 0.32 or 32/100 on a number line. 32/100 is more than 30/100 (or 3/10) and less than 40/100 (or 4/10). It is closer to 30/100 so it would be placed on the number line near that value.
Content Limits	Denominators of 10 and 100 Decimal notation to tenths and hundredths
Context	Context is not allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to express a fraction or mixed number in decimal notation in 10ths or 100ths.	• Equation Response • Graphic Response • Multiple Choice Response • Matching Item Response • Multi-Select Response
Students will be required to locate or plot a decimal on a number line/model.	
Students will be required to relate two fractional representations (denominators of 10 and 100) to one decimal representation. (Medium and Hard difficulty only)	

Performance Level Descriptors

Minimally Proficient	**Partially Proficient**
Identify decimal notation for fractions with denominators 10 (tenths) or 100 (hundredths).	Identify decimal notation for fractions with denominators 10 (tenths) or 100 (hundredths), and locate these decimals on a number line.
Proficient	**Highly Proficient**
Use decimal notation for fractions with denominators 10 (tenths) or 100 (hundredths), and locate these decimals on a number line.	Use decimal notation for fractions and mixed numbers with denominators a multiple of 10. Explain the location of these decimals on a number line.

4.NF.C.7

Content Standards	Compare two decimals to hundredths by reasoning about their size. Understand that comparisons are valid only when the two decimals refer to the same whole. Record the results of comparisons with the symbols >, =, or <.
Explanations	Students build area and other models to compare decimals. Through these experiences and their work with fraction models, they build the understanding that comparisons between decimals or fractions are only valid when the whole is the same for both cases. When the wholes are the same, the decimals or fractions can be compared.
Content Limits	Examples reference the same whole value. Decimals limited to 10ths and 100ths Decimals should not be limited to values less than 1 Use mathematical symbols appropriately to compare values represented by models and not to compare models. (e.g., 0.62<0.89 instead of [model] < [model])
Context	Context is allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to compare two decimals using a model (i.e., numerical, number line, visual model) - can vary models (10ths and 100ths) as long as they both relate to the same whole.	• Equation Response • Graphic Response • Multiple Choice Response • Matching Item Response • Multi-Select Response • Table Response
Students will be required to compare decimals by converting decimals to fractions with common denominators and/or by reasoning about place value.	
Students will be required to write or identify true comparisons between decimal numbers using symbols <, >, and =. Enter decimals or symbols to complete comparisons.	
Students will be required to explain conclusions about relationships and comparisons between decimals.	

Performance Level Descriptors

Minimally Proficient	**Partially Proficient**
Compare two decimals, referring to the same whole, to hundredths.	Compare two decimals, referring to the same whole, to hundredths. Record the results of comparisons with the symbols >, =, or <.

Proficient	Highly Proficient
Compare two decimals to hundredths by reasoning about their size. Understand that comparisons are valid only when the two decimals refer to the same whole. Record the results of comparisons with the symbols >, =, or <.	Compare two decimals to hundredths by reasoning about their size. Explain why comparisons are valid only when the two decimals refer to the same whole. Record the results of comparisons with the symbols >, =, or <.

Operations and Algebraic Thinking & Numbers in Base Ten

4.NBT.A.1

Content Standards	Apply concepts of place value, multiplication, and division to understand that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right.
Explanations	Students should be familiar with and use place value as they work with numbers.
Content Limits	Whole numbers within 1,000,000
Context	Context is not allowed.

Sample Task Demands	Common Item Formats
Students will be required to when presented with a multiplication problem, identify the power of 10 by which one number is greater than another.	• Equation Response
Students will be required to compare the value of a digit in different place values of two given numbers and identify the power of 10 by which one number is greater.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Identify which place value in a multi-digit whole number represents ten times the value of a given place value.	Given two multi-digit whole numbers, with a digit in different place values in each number, identify how many times the value of the digit is in one number compared to the other number.
Proficient	**Highly Proficient**
Apply concepts of place value, multiplication, and division to understand that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right.	Apply concepts of place value, multiplication, and division to explain why a digit in one place represents ten times what it represents in the place to its right.

4.NBT.A.2

Content Standards	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.
Explanations	The expanded form of 275 is 200 + 70 + 5. Students use place value to compare numbers. For example, in comparing 34,570 and 34,192, a student might say, both numbers have the same value of 10,000s and the same value of 1000s however, the value in the 100s place is different so that is where I would compare the two numbers.
Content Limits	Whole numbers within 1,000,000
Context	Context is allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to write a number with a given name in numeric form.	• Equation Response • Graphic Response • Multiple Choice Response • Matching Item Response • Multi-Select Response
Students will be required to identify the name of a given number.	
Students will be required to write a number given in expanded form in numeric form or vice versa.	
Students will be required to compare two whole numbers in numeric form.	
Students will be required to order more than two whole numbers in numeric form.	

Performance Level Descriptors

Minimally Proficient	**Partially Proficient**
Identify three-digit whole numbers using base-ten numerals and number names. Compare two three-digit numbers based on meanings of the digits in each place.	Identify 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.
Proficient	**Highly Proficient**
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.	Read, write, and order multi-digit whole numbers using base-ten numerals, number names, and expanded form. Compare more than two multi-digit numbers based on meanings of the digits in each place, using >, =, and < symbols to record the results of comparisons.

4.NBT.A.3

Content Standards	Use place value understanding to round multi-digit whole numbers to any place.
Explanations	When students are asked to round large numbers, they first need to identify which digit is in the appropriate place.
Content Limits	Greater than 1000 and within 1,000,000
Context	Context is not allowed.

Sample Task Demands	Common Item Formats
Students will be required to identify the value of a given number rounded to the nearest place value.	• Equation Response • Matching Item Response • Multi-Select Response • Table Response
Students will be required to identify the numbers that round to a given value.	
Students will be required to identify what place value a number was rounded to.	
Students will be required to interpret and distinguish between different rounding procedures used in rounding to a number in order to create a number that fits certain parameters.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Use place value understanding to round three-digit whole numbers to the hundreds place.	Use place value understanding to round multi-digit whole numbers to the largest place.
Proficient	**Highly Proficient**
Use place value understanding to round multi-digit whole numbers to any place.	Explain how to round multi-digit whole numbers to any place.

4.NBT.B.4

Content Standards	Fluently add and subtract multi-digit whole numbers using a standard algorithm.
Explanations	Students build on their understanding of addition and subtraction, their use of place value and their flexibility with multiple strategies to make sense of the standard algorithm. They continue to use place value in describing and justifying the processes they use to add and subtract. When students begin using the standard algorithm their explanation may be quite lengthy. After much practice with using place value to justify their steps, they will develop fluency with the algorithm. Students should be able to explain why the algorithm works. Note: Students should know that it is mathematically possible to subtract a larger number from a smaller number but that their work with whole numbers does not allow this as the difference would result in a negative number.
Content Limits	Whole numbers greater than 1,000 and within 1,000,000
Context	Context is not allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to calculate the sum or difference of two or more numbers.	• Equation Response
Students will be required to identify a missing digit in an addition or subtraction problem.	

Performance Level Descriptors

Minimally Proficient	**Partially Proficient**
Fluently add and subtract multi-digit whole numbers using strategies and algorithms based on the relationship between addition and subtraction.	Fluently add and subtract multi-digit whole numbers using strategies and algorithms based on place value and/or the relationship between addition and subtraction.
Proficient	**Highly Proficient**
Fluently add and subtract multi-digit whole numbers using a standard algorithm.	Recognize and explain an error made while finding a sum or a difference, and give the correct answer.

4.NBT.B.5

Content Standards	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.
Explanations	Students who develop flexibility in breaking numbers apart have a better understanding of the importance of place value and the distributive property in multi-digit multiplication. Students use base ten blocks, area models, partitioning, compensation strategies, etc. when multiplying whole numbers and use words and diagrams to explain their thinking. They use the terms factor and product when communicating their reasoning. Multiple strategies enable students to develop fluency with multiplication and transfer that understanding to division. Use of the standard algorithm for multiplication is an expectation in the 5th grade.
Content Limits	Products up to 89,991 (9,999 x 9). Multiply four digits by one digit, three digits by one digit, two digits by one digit, and two digits by two digits
Context	Context is not allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to calculate the product of 2 numbers.	• Equation Response • Multi-Select Response
Students will be required to select expressions that are equivalent to a given product.	

Performance Level Descriptors

Minimally Proficient	**Partially 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 visual models.	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 the calculation by using rectangular arrays and/or area models.
Proficient	**Highly 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. Illustrate and explain the calculation by using equations, rectangular arrays, and/or area models.	Multiply a whole number of up to four digits by a one-digit whole number, and multiply two two-digit numbers. Explain the calculation by using equations.

4.NBT.B.6

Content Standards	Demonstrate understanding of division by finding whole-number quotients and remainders with up to four-digit dividends and one-digit divisors.
Explanations	In fourth grade, students build on their third grade work with division within 100. Students need opportunities to develop their understandings by using problems in and out of context.
Content Limits	3-digit dividend and 1-digit divisor and 4-digit dividend and 1-digit divisor
Context	Context is not allowed.

Sample Task Demands	Common Item Formats
Students will be required to calculate the quotient of 2 numbers.	• Equation Response • Multi-Select Response
Students will be required to select expressions that are equivalent to a given quotient.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Identify whole-number quotients with up to four-digit dividends and one-digit divisors.	Demonstrate understanding of division by identifying whole-number quotients and remainders with up to four-digit dividends and one-digit divisors.
Proficient	**Highly Proficient**
Demonstrate understanding of division by finding whole-number quotients and remainders with up to four-digit dividends and one-digit divisors.	Demonstrate understanding of division by explaining the meaning of whole-number quotients and remainders with up to four-digit dividends and one-digit divisors.

4.OA.A.1

Content Standards	Represent verbal statements of multiplicative comparisons as multiplication equations. Interpret a multiplication equation as a comparison (e.g., 35 is the number of objects in 5 groups, each containing 7 objects, and is also the number of objects in 7 groups, each containing 5 objects).
Explanations	A multiplicative comparison is a situation in which one quantity is multiplied by a specified number to get another quantity (e.g., "a is n times as much as b"). Students should be able to identify and verbalize which quantity is being multiplied and which number tells how many times.
Content Limits	Whole numbers within 100. Item must either include a verbal description of a multiplication equation or a division equation. Multiplication situation must be a comparison, e.g. three times as many
Context	Context is allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to given a verbal description, create an equation that models the multiplication context.	• Equation Response • Multiple Choice Response • Matching Item Response • Multi-Select Response
Students will be required to given a multiplication equation, select a multiplicative comparison that describes the equation or vice versa.	

Performance Level Descriptors

Minimally Proficient	**Partially Proficient**
Identify multiplication equations that represent verbal statements of multiplicative comparisons with visual support.	Interpret multiplication equations that represent verbal statements of multiplicative comparisons with visual support. Recognize that a multiplication equation is a comparison.
Proficient	**Highly Proficient**
Represent verbal statements of multiplicative comparisons as multiplication equations. Interpret a multiplication equation as a comparison (e.g., 35 is the number of objects in 5 groups, each containing 7 objects, and is also the number of objects in 7 groups, each containing 5 objects).	Create verbal statements of multiplicative comparisons to represent a given multiplication equation. Explain how a multiplication equation is a comparison.

4.OA.A.2

Content Standards	Multiply or divide within 1000 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).
Explanations	Students need many opportunities to solve contextual problems.
Content Limits	Multiplication situation must be a comparison, e.g. three times as many Operations limited to multiplication and division. Whole numbers within 100.
Context	Context is required.

Sample Task Demands	**Common Item Formats**
Students will be required to given a situation involving multiplicative comparison, create a multiplication or division equation (with an unknown value) to represent the situation.	• Equation Response • Multiple Choice Response
Students will be required to given a situation involving multiplicative comparison, solve a multiplication or division word problem.	

Performance Level Descriptors

Minimally Proficient	**Partially Proficient**
Identify products and quotients within 1000 to solve word problems involving multiplicative comparison when a visual model is given.	Multiply or divide within 1000 to solve word problems involving multiplicative comparison when a visual model is given.
Proficient	**Highly Proficient**
Multiply or divide within 1000 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).	Identify a word problem involving multiplicative comparison within 1000 that is solved by a given multiplication or division expression.

4.OA.A.3

Content Standards	Solve multistep word problems using the four operations, including problems in which remainders must be interpreted. Understand how the remainder is a fraction of the divisor. Represent these problems using equations with a letter standing for the unknown quantity.
Explanations	Students need many opportunities solving multistep story problems using all four operations. In division problems, the remainder is the whole number left over when as large a multiple of the divisor as possible has been subtracted. Estimation skills include identifying when estimation is appropriate, determining the level of accuracy needed, selecting the appropriate method of estimation, and verifying solutions or determining the reasonableness of situations using various estimations.
Content Limits	Whole numbers Only easy- and medium- difficulty addition and subtraction problems of numbers up to 1 million Multiplication of numbers of up to four digits by a one-digit number or of two numbers with two digits Quotients and remainders with up to four-digit dividends and one-digit divisors Only 2- and 3-step problems Problems involving remainders should require the student to interpret and use the remainder with respect to context Variables must be represented by a letter. Variables should be introduced in a separate phrase like "Use p to represent the number of pages in the book" rather than using an appositive clause.
Context	Context is allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to interpret remainders within the context of a division situation by giving a numeric answer or interpretation.	• Equation Response • Multiple Choice Response • Multi-Select Response • Proposition Response
Students will be required to explain the reasonableness of a solution in words.	
Students will be required to reason through a word problem to find an unknown value (either the final answer or a key piece of information, given the final solution – e.g., working backward).	
Students will be required to reason through a word problem to find an unknown value given only some information.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Solve two-step word problems using the four operations with visual support. Identify the remainder as a fraction of the divisor. Identify equations with a letter standing for the unknown quantity that represents these problems.	Solve multistep word problems using the four operations. Identify the remainder as a fraction of the divisor. Identify equations with a letter standing for the unknown quantity that represents these problems.
Proficient	**Highly Proficient**
Solve multistep word problems using the four operations, including problems in which remainders must be interpreted. Understand how the remainder is a fraction of the divisor. Represent these problems using equations with a letter standing for the unknown quantity.	Solve multistep word problems using the four operations, including problems in which remainders must be interpreted. Explain why the remainder is a fraction of the divisor. Create word problems that can be solved using equations with a letter standing for the unknown quantity.

4.OA.B.4

Content Standards	Find all factor pairs for a whole number in the range 1 to 100 and understand that a whole number is a multiple of each of its factors.
Explanations	Students should understand the process of finding factor pairs so they can do this for any number 1 -100. Multiples can be thought of as the result of skip counting by each of the factors. When skip counting, students should be able to identify the number of factors counted e.g., 5, 10, 15, 20 (there are 4 fives in 20). A prime number is a number greater than 1 that has only 2 factors, 1 and itself. Composite numbers have more than 2 factors. Students investigate whether numbers are prime or composite by building rectangles (arrays) within the given area and finding which numbers have more than two rectangles (e.g. 7 can be made into only 2 rectangles, 1 x 7 and 7 x 1, therefore it is a prime number) or finding factors of the number.
Content Limits	Whole numbers in the range 1-100 Vocabulary includes prime, composite, factor or multiple
Context	Context is allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to identify factors or multiples of a given number.	• Equation Response • Graphic Response • Multiple Choice Response • Matching Item Response • Multi-Select Response • Table Response
Students will be required to given a set of conditions (related to prime/composite, and factors), identify a number (or numbers) that meets those criteria.	
Students will be required to classify numbers as prime or composite.	
Students will be required to apply the concepts of prime numbers, composite numbers, and factors in problem-solving contexts.	

Performance Level Descriptors

Minimally Proficient	**Partially Proficient**
Identify a factor pair for a whole number in the range 1 to 100.	Identify all factor pairs for a whole number in the range 1 to 100 and identify whole numbers that are a multiple of a given factor.
Proficient	**Highly Proficient**
Find all factor pairs for a whole number in the range 1 to 100 and understand that a whole number is a multiple of each of its factors.	Explain why a whole number is a multiple of each of its factors.

4.OA.C.5

Content Standards	Generate a number pattern that follows a given rule. Identify apparent features of the pattern that were not explicit in the rule itself and explain the pattern informally (e.g., 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).
Explanations	Patterns involving numbers or symbols either repeat or grow. Students need multiple opportunities creating and extending number and shape patterns. Numerical patterns allow students to reinforce facts and develop fluency with operations. Patterns and rules are related. A pattern is a sequence that repeats the same process over and over. A rule dictates what that process will look like. Students investigate different patterns to find rules, identify features in the patterns, and justify the reason for those features. After students have identified rules and features from patterns, they need to generate a numerical or shape pattern from a given rule.
Content Limits	Whole numbers Operations in patterns limited to addition, subtraction, multiplication, and division Growing shape patterns If generating a pattern from a given rule, ask for the next two to four terms.
Context	Context is allowed.

Sample Task Demands	**Common Item Formats**
Students will be required to generate a number or shape pattern that follows a given rule.	• Equation Response • Graphic Response • Multiple Choice Response • Multi-Select Response • Proposition Response • Table Response
Students will be required to identify apparent features (such as the pattern of odd and even numbers, all numbers are even, all numbers are odd, etc.) of the pattern.	

Performance Level Descriptors

Minimally Proficient	**Partially Proficient**
Identify a number pattern that follows a given rule.	Identify a number pattern that follows a given rule. Identify apparent features of the pattern that were not explicit in the rule itself.

Proficient	Highly Proficient
Generate a number pattern that follows a given rule. Identify apparent features of the pattern that were not explicit in the rule itself and explain the pattern informally (e.g., 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).	Create a rule for a given number pattern. Explain features of the pattern that are not explicit in the rule and explain the rule informally.

4.OA.C.6

Content Standards	When solving problems, assess the reasonableness of answers using mental computation and estimation strategies including rounding.
Explanations	Generate and analyze pattern.
Content Limits	Multiplication is within 1000, up to 4 digits by 1 digit or 2 digits by 2 digits Addition and subtraction within 1,000,000 Can add fractions with common denominators.
Context	Context is allowed.

Sample Task Demands	Common Item Formats
Students will be required to determine the best estimation strategy given the context of a situation.	• Equation Response • Multiple Choice Response • Editing Task Response
Students will be required to determine whether an answer is appropriate in a given context.	
Students will be required to recognize when an estimation strategy is or is not appropriate.	
Students will be required to use estimation strategies to solve a problem.	

Performance Level Descriptors

Minimally Proficient	Partially Proficient
Recognize whether an answer is reasonable or not when rounding.	Use rounding to determine the reasonableness of answers when using the four operations to solve problems.
Proficient	**Highly Proficient**
When solving problems, assess the reasonableness of answers using mental computation and estimation strategies including rounding.	Recognize the reasonableness of answers using different types of estimation strategies when using the four operations to solve problems. Choose the best estimation strategy for a specific purpose.