2021 Oregon Mathematics Standards

K-12 Mathematics

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Mathematical Practice Standards

1. Make sense of problems and persevere in solving them.

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

2. Reason abstractly and quantitatively.

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

3. Construct viable arguments and critique the reasoning of others.

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

4. Model with mathematics.

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and

approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

5. Use appropriate tools strategically.

Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

6. Attend to precision.

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

7. Look for and make use of structure.

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7×8 equals the well remembered $7 \times 5 + 7 \times 3$, in preparation for learning about the distributive property. In the expression $x2 + 9x + 14$, older students can see the 14 as 2×7 and the 9 as $2 + 7$. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 - 3(x - y)2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y.

8. Look for and express regularity in repeated reasoning

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation $(y - 2)/(x - 1) = 3$. Noticing the regularity in the way terms cancel when expanding $(x - 1)(x + 1)$, $(x - 1)(x2 + x + 1)$, and $(x - 1)(x3 + x2 + x + 1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

Kindergarten Standards

Algebraic Reasoning: Operations (K.OA)

K.OA.A *Understand addition and subtraction.*

K.OA.A.1 Represent addition as putting together and adding to and subtraction as taking apart and taking from using objects, drawings, physical expressions, numbers or equations.

K.OA.A.2 Add and subtract within 10. Model authentic contexts and solve problems that use addition and subtraction within 10.

K.OA.A.3 Using objects or drawings, and equations, decompose numbers less than or equal to 10 into pairs in more than one way.

K.OA.A.4 By using objects, drawings, or equations, find the unknown number that makes 10 when added to a given number from 1 - 9.

K.OA.A.5 Fluently add and subtract within 5 with accurate, efficient, and flexible strategies.

Numeric Reasoning: Counting and Cardinality (K.NCC)

K.NCC.A *Know number names and the count sequence.*

K.NCC.A.1 Orally count to 100 by ones and by tens in sequential order.

K.NCC.A.2 Count forward beginning from a given number within 100 of a known sequence.

K.NCC.A.3 Identify number names, write numbers, and the count sequence from 0-20. Represent a number of objects with a written number 0-20.

K.NCC.B *Count to tell the number of objects.*

K.NCC.B.4 Understand the relationship between numbers and quantities; connect counting to cardinality.

K.NCC.B.5 Count to answer “how many?” questions using up to 20 objects arranged in a variety of configurations or as 10 objects in a scattered configuration. Given a number from 1-20, count out that many objects.

K.NCC.C *Compare numbers.*

K.NCC.C.6 Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group.

K.NCC.C.7 Compare two numbers between 1 and 10 presented as written numerals.

Numeric Reasoning: Base Ten Arithmetic (K.NBT)

K.NBT.A *Work with numbers 11-19 to gain foundations for place value.*

K.NBT.A.1 Compose and decompose from 11 to 19 into groups of ten ones and some further ones using objects, drawings, or equations.

Geometric Reasoning and Measurement (K.GM)

K.GM.A *Identify and describe shapes.*

K.GM.A.1 Describe objects in the environment using names of shapes and describe the relative positions of these objects in their environment.

K.GM.A.2 Correctly name common two-dimensional and three-dimensional geometric shapes regardless of their orientations or overall size.

K.GM.A.3 Identify shapes as two-dimensional or three-dimensional.

K.GM.B *Analyze, compare, create, and compose shapes.*

K.GM.B.4 Analyze and compare two and three-dimensional shapes, in different sizes and orientations, using informal language to describe their similarities, differences, parts and attributes.

K.GM.B.5 Represent shapes in the world by building shapes from components and drawing shapes.

K.GM.B.6 Compose common shapes to form larger shapes.

K.GM.C *Describe and compare measurable attributes.*

K.GM.C.7 Describe several measurable attributes of a single object using measurable terms, such as length or weight.

K.GM.C.8 Directly compare two objects with a measurable attribute in common, and describe which object has “more” or “less” of the attribute.

Data Reasoning (K.DR)

K.DR.A *Pose investigative questions and collect/consider data.*

K.DR.A.1 Generate questions to investigate situations within the classroom. Collect or consider data that can naturally answer questions by sorting and counting.

K.DR.B *Analyze, represent, and interpret data.*

K.DR.B.2 Analyze data sets by counting the number of objects in each category and interpret results by classifying and sorting objects by count.

Grade 1 Standards

Algebraic Reasoning: Operations (1.OA)

1.OA.A *Represent and solve problems involving addition and subtraction.*

1.OA.A.1 Use addition and subtraction within 20 to solve and represent problems in authentic contexts involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions.

1.OA.A.2 Solve problems that call for addition of three whole numbers whose sum is less than or equal to 20 using objects, drawings or equations.

1.OA.B *Understand and apply properties of operations and the relationship between addition and subtraction.*

1.OA.B.3 Apply properties of operations as strategies to add and subtract.

1.OA.B.4 Understand subtraction as an unknown-addend problem.

1.OA.C *Add and subtract within 20.*

1.OA.C.5 Relate counting to addition and subtraction.

1.OA.C.6 Add and subtract within 20, demonstrating fluency for addition and subtraction within 10 with accurate, efficient, and flexible strategies.

1.OA.D *Work with addition and subtraction equations.*

1.OA.D.7 Use the meaning of the equal sign to determine whether equations involving addition and subtraction are true or false.

1.OA.D.8 Determine the unknown whole number in an addition or subtraction equation relating three whole numbers.

Numeric Reasoning: Base Ten Arithmetic (1.NBT)

1.NBT.A *Extend the counting sequence.*

1.NBT.A.1 Count to 120, starting at any number less than 120. In this range, read and write numerals and represent a number of objects with a written numeral.

1.NBT.B *Understand place value.*

1.NBT.B.2 Understand 10 as a bundle of ten ones and that the two digits of a two-digit number represent amounts of tens and ones.

1.NBT.B.3 Compare two two-digit numbers based on meanings of the tens and ones digits, recording the results of comparisons with the symbols >, =, and <.

1.NBT.C *Use place value understanding and properties of operations to add and subtract.*

1.NBT.C.4 Add within 100 using concrete or visual representations and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction. Relate the strategy to a written method and explain why sometimes it is necessary to compose a ten.

1.NBT.C.5 Without having to count, mentally find 10 more or 10 less than a given two-digit number and explain the reasoning used.

1.NBT.C.6 Subtract multiples of 10 in the range 10-90 from multiples of 10 in the range 10-90 using concrete or visual representations and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction. Relate the strategy and model used to a written method and explain the reasoning used.

Geometric Reasoning and Measurement (1.GM)

1.GM.A *Reason with shapes and their attributes.*

1.GM.A.1 Distinguish between defining attributes versus non-defining attributes for a wide variety of shapes. Build and draw shapes to possess defining attributes.

1.GM.A.2 Compose common two-dimensional shapes or three-dimensional shapes to create a composite shape, and create additional new shapes from composite shapes.

1.GM.A.3 Partition circles and rectangles into two and four equal shares. Describe the equal shares and understand that partitioning into more equal shares creates smaller shares.

1.GM.B *Describe and compare measurable attributes.*

1.GM.B.4 Order three objects by length; compare the lengths of two objects indirectly by using a third object.

1.GM.B.5 Express the length of an object as a whole number of non-standard length units, by laying multiple copies of a shorter object (the length unit) end to end.

1.GM.C *Tell and write time.*

1.GM.C.6 Tell and write time in hours and half-hours using analog and digital clocks.

Data Reasoning (1.DR)

1.DR.A *Pose investigative questions and collect/consider data.*

1.DR.A.1 Generate questions to investigate situations within the classroom. Collect or consider data that can naturally answer questions by representing data visually.

1.DR.B *Analyze, represent, and interpret data.*

1.DR.B.2 Analyze data sets with up to three categories by representing data visually, such as with graphs and charts, and interpret information presented to answer investigative questions.

Grade 2 Standards

Algebraic Reasoning: Operations (2.OA)

2.OA.A *Represent and solve problems involving addition and subtraction.*

2.OA.A.1 Use addition and subtraction within 100 to solve one- and two-step problems in authentic contexts by using drawings and equations with a symbol for the unknown.

2.OA.B *Add and subtract within 20.*

2.OA.B.2 Fluently add and subtract within 20 using accurate, efficient, and flexible strategies and algorithms based on place value and properties of operations.

2.OA.C *Work with equal groups of objects to gain foundations for multiplication.*

2.OA.C.3 Determine whether a group up to 20 objects has an odd or even number by pairing objects or counting them by 2s; record using drawings and equations including expressing an even number as a sum of two equal addends.

2.OA.C.4 Use addition to find the total number of objects arranged in rectangular arrays with up to 5 rows and up to 5 columns; write an equation to express the total as a sum of equal addends.

Numeric Reasoning: Base Ten Arithmetic (2.NBT)

2.NBT.A *Understand place value.*

2.NBT.A.1 Understand 100 as a bundle of ten tens and that the three digits of a three-digit number represent amounts of hundreds, tens, and ones.

2.NBT.A.2 Count within 1000; skip-count by 5's, 10's, and 100's.

2.NBT.A.3 Read and write numbers to 1000 using base-ten numerals, number names, and expanded form.

2.NBT.A.4 Compare two three-digit numbers based on meanings of the hundreds, tens, and ones digits, using >, =, and < symbols to record the results of comparisons.

2.NBT.B *Use place value understanding and properties of operations to add and subtract.*

2.NBT.B.5 Fluently add & subtract within 100 using accurate, efficient, & flexible strategies based on place value, properties of operations, and/or the relationship between addition and subtraction.

2.NBT.B.6 Add up to four two-digit numbers using strategies based on place value and properties of operations and describe how two different strategies result in the same sum.

2.NBT.B.7 Add and subtract within 1000 using concrete or visual representations and strategies based on place value, properties of operations, and/or the relationship between addition and subtraction. Relate the strategy to a written method and explain why sometimes it is necessary to compose or decompose tens or hundreds.

2.NBT.B.8 Without having to count, mentally find 10 more or 10 less and 100 more or 100 less than a given three-digit number.

2.NBT.B.9 Explain why strategies to add and subtract work using properties of operations and the relationship between addition and subtraction.

Geometric Reasoning and Measurement (2.GM)

2.GM.A *Reason with shapes and their attributes.*

2.GM.A.1 Recognize and draw shapes having specified attributes, such as a given number of angles or a given number of equal faces.

2.GM.A.2 Partition a rectangle into rows and columns of same-size squares and count to find the total number of them.

2.GM.A.3 Partition circles and rectangles into two, three, or four equal parts. Recognize that equal parts of identical wholes need not have the same shape.

2.GM.B *Measure and estimate lengths in standard units.*

2.GM.B.4 Measure the length of an object by selecting and using appropriate measurement tools.

2.GM.B.5 Measure the length of an object using two different length units and describe how the measurements relate to the size of the unit chosen.

2.GM.B.6 Estimate lengths using units of inches, feet, yards, centimeters, and meters.

2.GM.B.7 Measure two objects and determine the difference in their lengths in terms of a standard length unit.

2.GM.C *Relate addition and subtraction to length.*

2.GM.C.8 Use addition and subtraction within 100 to solve problems in authentic contexts involving lengths that are given in the same units.

2.GM.C.9 Represent whole number lengths on a number line diagram; use number lines to find sums and differences within 100.

2.GM.D *Work with time and money.*

2.GM.D.10 Tell and write time from analog and digital clocks to the nearest five minutes, using a.m. and p.m.

2.GM.D.11 Solve problems in authentic contexts involving dollar bills, quarters, dimes, nickels, and pennies, using $ (dollars) and c (cents) symbols appropriately.

Data Reasoning (2.DR)

2.DR.A *Pose investigative questions and collect/consider data.*

2.DR.A.1 Generate questions to investigate situations within the classroom. Collect or consider data that can naturally answer questions by using measurements with whole-number units.

2.DR.B *Analyze, represent, and interpret data.*

2.DR.B.2 Analyze data with a single-unit scale and interpret information presented to answer investigative questions.

Grade 3 Standards

Algebraic Reasoning: Operations (3.OA)

3.OA.A *Represent and solve problems involving multiplication and division.*

3.OA.A.1 Represent and interpret multiplication of two factors as repeated addition of equal groups.

3.OA.A.2 Represent and interpret whole-number quotients as dividing an amount into equal sized groups.

3.OA.A.3 Use multiplication and division within 100 to solve problems in authentic contexts involving equal groups, arrays, and/or measurement quantities.

3.OA.A.4 Determine the unknown number in a multiplication or division equation relating three whole numbers by applying the understanding of the inverse relationship of multiplication and division.

3.OA.B *Understand properties of multiplication and the relationship between multiplication and division.*

3.OA.B.5 Apply properties of operations as strategies to multiply and divide.

3.OA.B.6 Understand division as an unknown-factor in a multiplication problem.

3.OA.C *Multiply and divide within 100.*

3.OA.C.7 Fluently multiply and divide within 100 using accurate, efficient, and flexible strategies and algorithms based on place value and properties of operations.

3.OA.D *Solve problems involving the four operations, and identify and explain patterns in arithmetic.*

3.OA.D.8 Solve two-step problems in authentic contexts that use addition, subtraction, multiplication, and division in equations with a letter standing for the unknown quantity.

3.OA.D.9 Identify and explain arithmetic patterns using properties of operations, including patterns in the addition table or multiplication table.

Numeric Reasoning: Base Ten Arithmetic (3.NBT)

3.NBT.A *Use place value understanding and properties of operations to perform multi-digit arithmetic.*

3.NBT.A.1 Use place value understanding to round whole numbers within 1000 to the nearest 10 or 100.

3.NBT.A.2 Fluently add and subtract within 1000 using accurate, efficient, and flexible strategies and algorithms based on place value and properties of operations.

3.NBT.A.3 Find the product of one-digit whole numbers by multiples of 10 in the range 10-90, such as 9 x 80. Students use a range of strategies and algorithms based on place value and properties of operations.

Numeric Reasoning: Fractions (3.NF)

3.NF.A *Develop understanding of fractions as numbers.*

3.NF.A.1 Understand the concept of a unit fraction and explain how multiple copies of a unit fraction form a non-unit fraction.

3.NF.A.2 Understand a fraction as a number on the number line; Represent fractions on a number line diagram.

3.NF.A.3 Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size.

Geometric Reasoning and Measurement (3.GM)

3.GM.A *Reason with shapes and their attributes.*

3.GM.A.1 Understand that shapes in different categories may share attributes and that shared attributes can define a larger category.

3.GM.A.2 Partition shapes into parts with equal areas and express the area of each part as a unit fraction of the whole.

3.GM.B *Solve problems involving measurement and estimation.*

3.GM.B.3 Tell, write, and measure time to the nearest minute. Solve problems in authentic contexts that involve addition and subtraction of time intervals in minutes.

3.GM.B.4 Measure, estimate and solve problems in authentic contexts that involve liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l).

3.GM.C *Geometric measurement: understand concepts of area and relate area to multiplication and to addition.*

3.GM.C.5 Recognize area as an attribute of plane figures and understand concepts of area measurement presented in authentic contexts by tiling and counting unit squares.

3.GM.C.6 Measure areas by counting standard and non-standard unit squares.

3.GM.C.7 Relate area to multiplication and addition. Use relevant representations to solve problems in authentic contexts.

3.GM.D *Geometric measurement: recognize perimeter.*

3.GM.D.8 Solve problems involving authentic contexts for perimeters of polygons.

Data Reasoning (3.DR)

3.DR.A *Pose investigative questions and collect/consider data.*

3.DR.A.1 Generate questions to investigate situations within the classroom, school or community. Collect or consider measurement data that can naturally answer questions by using information presented in a scaled picture and/or bar graph.

3.DR.B *Analyze, represent, and interpret data.*

3.DR.B.2 Analyze measurement data with a scaled picture graph or a scaled bar graph to represent a data set with several categories. Interpret information presented to answer investigative questions.

Grade 4 Standards

Algebraic Reasoning: Operations (4.OA)

4.OA.A *Use the four operations with whole numbers to solve problems.*

4.OA.A.1 Interpret a multiplication equation as comparing quantities. Represent verbal statements of multiplicative comparisons as equations.

4.OA.A.2 Multiply or divide to solve problems in authentic contexts involving multiplicative comparison, distinguishing multiplicative comparison from additive comparison.

4.OA.A.3 Solve multistep problems in authentic contexts using whole numbers and having whole-number answers using the four operations, including problems in which remainders must be interpreted.

4.OA.B *Gain familiarity with factors and multiples.*

4.OA.B.4 Find all factor pairs for a whole number in the range 1-100. Determine whether a given whole number in the range of 1-100 is a multiple of a given one-digit number, and whether it is prime or composite.

4.OA.C *Generate and analyze patterns.*

4.OA.C.5 Analyze a number, visual, or contextual pattern that follows a given rule.

Numeric Reasoning: Base Ten Arithmetic (4.NBT)

4.NBT.A *Generalize place value understanding for multi-digit whole numbers.*

4.NBT.A.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.

4.NBT.A.2 Read and write multi-digit whole numbers using base-ten numerals, number names, and expanded form. Use understandings of place value within these forms to compare two multi-digit numbers using >, =, and < symbols.

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 accurate, efficient, and flexible strategies and algorithms based on place value and properties of operations.

4.NBT.B.5 Use representations and strategies to multiply a whole number of up to four digits by a one-digit number, and a two-digit number by a two-digit number using strategies based on place value and the properties of operations.

4.NBT.B.6 Use representations and strategies to 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.

Numeric Reasoning: Fractions (4.NF)

4.NF.A *Extend understanding of fraction equivalence and ordering.*

4.NF.A.1 Use visual fraction representations to recognize, generate, and explain relationships between equivalent fractions.

4.NF.A.2 Compare two fractions with different numerators and/or different denominators, record the results with the symbols >, =, or <, and justify the conclusions.

4.NF.B *Build fractions from unit fractions.*

4.NF.B.3 Understand a fraction (a/b) as the sum (a) of fractions of the same denominator (1/b). Solve problems in authentic contexts involving addition and subtraction of fractions referring to the same whole and having like denominators.

4.NF.B.4 Apply and extend previous understandings of multiplication to multiply a fraction by a whole number. Represent and solve problems in authentic contexts involving multiplication of a fraction by a whole number.

4.NF.C *Understand decimal notation for fractions, and compare decimal fractions.*

4.NF.C.5 Demonstrate and explain the concept of equivalent fractions with denominators of 10 and 100, using concrete materials and visual models. Add two fractions with denominators of 10 and 100.

4.NF.C.6 Use and interpret decimal notation for fractions with denominators 10 or 100.

4.NF.C.7 Use decimal notation for fractions with denominators 10 or 100. Compare two decimals to hundredths place by reasoning about their size, and record the comparison using the symbols >, =, or <.

Geometric Reasoning and Measurement (4.GM)

4.GM.A *Draw and identify lines and angles, and classify shapes by properties of their lines and angles.*

4.GM.A.1 Explore, investigate, and draw points, lines, line segments, rays, angles, and perpendicular and parallel lines. Identify these in two-dimensional figures.

4.GM.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.

4.GM.A.3 Recognize and draw a line of symmetry for a two dimensional figure.

4.GM.B *Solve problems involving measurement and conversion of measurements.*

4.GM.B.4 Know relative sizes of measurement units and express measurements in a larger unit in terms of a smaller unit.

4.GM.B.5 Apply knowledge of the four operations and relative size of measurement units to solve problems in authentic contexts that include familiar fractions or decimals.

4.GM.B.6 Apply the area and perimeter formulas for rectangles in authentic contexts and mathematical problems.

4.GM.C *Geometric measurement: understand concepts of angle and measure angles.*

4.GM.C.7 Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint. Understand and apply concepts of angle measurement.

4.GM.C.8 Measure angles in whole-number degrees using a protractor. Sketch angles of specified measure.

4.GM.C.9 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.

Data Reasoning (4.DR)

4.DR.A *Pose investigative questions and collect/consider data.*

4.DR.A.1 Generate questions to investigate situations within the classroom, school or community. Determine strategies for collecting or considering data involving addition and subtraction of fractions that can naturally answer questions by using information presented in line plots.

4.DR.B *Analyze, represent, and interpret data.*

4.DR.B.2 Analyze line plots to display a distribution of numerical measurement data, which include displays of data sets of fractional measurements with the same denominator. Interpret information presented to answer investigative questions.

Grade 5 Standards

Algebraic Reasoning: Operations (5.OA)

5.OA.A *Write and interpret numerical expressions.*

5.OA.A.1 Write and evaluate numerical expressions that include parentheses.

5.OA.A.2 Write expressions that record calculations with numbers, and interpret numerical expressions without evaluating them.

5.OA.B *Analyze patterns and relationships.*

5.OA.B.3 Generate two numerical patterns using two given rules. Identify and analyze relationships between corresponding terms. Form ordered pairs consisting of corresponding terms from the two patterns and graph them on a coordinate plane.

Numeric Reasoning: Base Ten Arithmetic (5.NBT)

5.NBT.A *Understand the place value system.*

5.NBT.A.1 Recognize that in a multi-digit number, a digit in one place represents 10 times as much as it represents in the place to its right and 1/10 of what it represents in the place to its left.

5.NBT.A.2 Use whole number exponents to denote powers of 10 and explain the patterns in placement of digits that occur when multiplying and/or dividing whole numbers and decimals by powers of 10.

5.NBT.A.3 Read, write, and compare decimals to thousandths.

5.NBT.A.4 Use place value understanding to round decimals to any place.

5.NBT.B *Perform operations with multi-digit whole numbers and with decimals to hundredths.*

5.NBT.B.5 Fluently multiply multi-digit whole numbers using accurate, efficient, and flexible strategies and algorithms based on place value and properties of operations.

5.NBT.B.6 Use a variety of representations and strategies to find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors.

5.NBT.B.7 Use a variety of representations and strategies to add, subtract, multiply, and divide decimals to hundredths. Relate the strategy to a written method and explain the reasoning used.

Numeric Reasoning: Fractions (5.NF)

5.NF.A *Use equivalent fractions as a strategy to add and subtract fractions.*

5.NF.A.1 Add and subtract fractions with unlike denominators, including common fractions larger than one and mixed numbers.

5.NF.A.2 Solve problems in authentic contexts involving addition and subtraction of fractions with unlike denominators, including common fractions larger than one and mixed numbers.

5.NF.B *Apply and extend previous understandings of multiplication and division.*

5.NF.B.3 Interpret a fraction as division of the numerator by the denominator (a/b = a ÷ b). Solve problems in authentic contexts involving division of whole numbers that result in answers that are common fractions or mixed numbers.

5.NF.B.4 Apply and extend previous understanding and strategies of multiplication to multiply a fraction or whole number by a fraction. Multiply fractional side lengths to find areas of rectangles, and represent fractional products as rectangular areas.

5.NF.B.5 Apply and extend previous understandings of multiplication and division to represent and calculate multiplication and division of fractions. Interpret multiplication as scaling (resizing) by comparing the size of products of two factors.

5.NF.B.6 Solve problems in authentic contexts involving multiplication of common fractions and mixed numbers.

5.NF.B.7 Apply and extend previous understandings of division to divide unit fractions by whole numbers and whole numbers by unit fractions, including solving problems in authentic contexts.

Geometric Reasoning and Measurement (5.GM)

5.GM.A Graph points on the coordinate plane to solve real-world and mathematical problems.

5.GM.A.1 Graph and name coordinate points in the first quadrant using the standard (x, y) notation. Understand the coordinate points values represent the distance traveled along the horizontal x-axis and vertical y-axis.

5.GM.A.2 Represent authentic contexts and mathematical problems by graphing points in the first quadrant of the coordinate plane. Interpret the meaning of the coordinate values based on the context of a given situation.

5.GM.B Classify two-dimensional figures into categories based on their properties.

5.GM.B.3 Classify two-dimensional figures within a hierarchy based on their geometrical properties, and explain the relationship across and within different categories of these figures.

5.GM.C Convert like measurement units within a given measurement system.

5.GM.C.4 Convert between different-sized standard measurement units within a given measurement system. Use these conversions in solving multi-step problems in authentic contexts.

5.GM.D Geometric measurement: understand concepts of volume.

5.GM.D.5 Recognize that volume is a measurable attribute of solid figures.

5.GM.D.6 Measure the volume of a rectangular prism by counting unit cubes using standard and nonstandard units.

5.GM.D.7 Relate volume of rectangular prisms to the operations of multiplication and addition. Solve problems in authentic contexts involving volume using a variety of strategies.

Data Reasoning (5.DR)

5.DR.A Pose investigative questions and collect/consider data.

5.DR.A.1 Generate questions to investigate situations within the classroom, school or community. Determine strategies for collecting or considering data involving operations with fractions for this grade that can naturally answer questions by using information presented in line plots.

5.DR.B Analyze, represent, and interpret data.

5.DR.B.2 Analyze graphical representations and describe the distribution of the numerical data through line plots or categorical data through bar graphs. Interpret information presented to answer investigative questions.

Grade 6 Standards

Algebraic Reasoning: Expressions and Equations (6.AEE)

6.AEE.A *Apply and extend previous understandings of arithmetic to algebraic expressions.*

6.AEE.A.1 Write and evaluate numerical expressions involving whole-number bases and exponents.

6.AEE.A.2 Write, read, and evaluate expressions in which letters stand for numbers. Apply knowledge of common mathematical terms to move between the verbal and mathematical forms of an expression including expressions that arise from authentic contexts.

6.AEE.A.3 Apply the properties of operations to generate equivalent expressions and to determine when two expressions are equivalent.

6.AEE.B *Reason about and solve one-variable equations and inequalities.*

6.AEE.B.4 Understand solving an equation or inequality as a process of answering which values from a specified set, if any, make the equation or inequality true. Use substitution to determine which number(s) in a given set make an equation or inequality true.

6.AEE.B.5 Use variables to represent numbers and write expressions when solving problems in authentic contexts.

6.AEE.B.6 Write and solve equations of the form $x + p = q$ and $px = q$ in problems that arise from authentic contexts for cases in which p, q and x are all nonnegative rational numbers.

6.AEE.B.7 Write inequalities of the form $x > c$ and $x < c$ to represent constraints or conditions to solve problems in authentic contexts. Describe and graph on a number line solutions of inequalities of the form $x > c$ and $x < c$.

6.AEE.C *Represent and analyze quantitative relationships between dependent and independent variables.*

6.AEE.C.8 Use variables to represent and analyze two quantities to solve problems in authentic contexts. Including those that change in relationship to one another; write an equation to express one quantity in terms of the other quantity.

Proportional Reasoning: Ratios and Proportions (6.RP)

6.RP.A *Understand ratio concepts and use ratio reasoning to solve problems.*

6.RP.A.1 Understand the concept of a ratio in authentic contexts, and use ratio language to describe a ratio relationship between two quantities.

6.RP.A.2 Understand the concept of a unit rate in authentic contexts and use rate language in the context of a ratio relationship.

6.RP.A.3 Use ratio and rate reasoning to solve problems in authentic contexts that use equivalent ratios, unit rates, percents, and/or measurement units.

Numeric Reasoning: Number Systems (6.NS)

6.NS.A *Apply and extend previous understandings of multiplication and division to divide fractions by fractions.*

6.NS.A.1 Represent, interpret, and compute quotients of fractions to solve problems in authentic contexts involving division of fractions by fractions.

6.NS.B *Compute fluently with multi-digit numbers and find common factors and multiples.*

6.NS.B.2 Fluently divide multi-digit numbers using accurate, efficient, and flexible strategies and algorithms based on place value and properties of operations.

6.NS.B.3 Fluently add, subtract, multiply, and divide positive rational numbers using accurate, efficient, and flexible strategies and algorithms.

6.NS.B.4 Determine greatest common factors and least common multiples using a variety of strategies. Apply the distributive property to express a sum of two whole numbers 1–100 with a common factor as a multiple of a sum of two whole numbers with no common factor.

6.NS.C Apply and extend previous understandings of numbers to the system of rational numbers.

6.NS.C.5 Understand that positive and negative numbers are used together to describe quantities having opposite directions or values. Use positive and negative numbers to represent quantities in authentic contexts, explaining the meaning of zero in each situation.

6.NS.C.6 Represent a rational number as a point on the number line. Extend number line diagrams and coordinate axes to represent points on the line and in the coordinate plane with negative number coordinates.

6.NS.C.7 Interpret statements of inequality as statements about the relative position of two numbers on a number line diagram. Write, interpret, and explain statements of order for rational numbers and absolute value in authentic applications.

6.NS.C.8 Graph points in all four quadrants of the coordinate plane to solve problems in authentic contexts. Include use of coordinates and absolute value to find distances between points with the same first coordinate or the same second coordinate.

Geometric Reasoning and Measurement (6.GM)

6.GM.A Solve real-world and mathematical problems involving area, surface area, and volume.

6.GM.A.1 Find the area of triangles, quadrilaterals, and other polygons by composing into rectangles or decomposing into triangles and other shapes. Apply these techniques to solve problems in authentic contexts.

6.GM.A.2 Find the volume of a right rectangular prism with fractional edge lengths by filling it with unit cubes of appropriate unit fraction edge lengths. Connect and apply to the formulas V = l w h and V = b h to find volumes of right rectangular prisms with fractional edge lengths to solve problems in authentic contexts.

6.GM.A.3 Draw polygons in the four quadrant coordinate plane given coordinates for the vertices and find the length of a side. Apply these techniques to solve problems in authentic contexts.

6.GM.A.4 Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures, including those from authentic contexts.

Data Reasoning (6.DR)

6.DR.A Formulate Statistical Investigative Questions.

6.DR.A.1 Formulate and recognize statistical investigative questions as those that anticipate changes in descriptive data related to the question and account for it in the answers.

6.DR.B Collect and Consider Data.

6.DR.B.2 Collect and record data with technology to identify and describe the characteristics of numerical data sets using quantitative measures of center and variability.

6.DR.C Analyze, summarize, and describe data.

6.DR.C.3 Analyze data representations and describe measures of center and variability of quantitative data using appropriate displays.

6.DR.D Interpret data and answer investigative questions.

6.DR.D.4 Interpret quantitative measures of center to describe differences between groups from data collected to answer investigative questions.

Grade 7 Standards

Algebraic Reasoning: Expressions and Equations (7.AEE)

7.AEE.A *Use properties of operations to generate equivalent expressions.*

7.AEE.A.1 Identify and write equivalent expressions with rational numbers by applying associative, commutative, and distributive properties.

7.AEE.A.2 Understand that rewriting an expression in different forms in a contextual problem can show how quantities are related.

7.AEE.B *Solve mathematical problems in authentic contexts using numerical and algebraic expressions and equations.*

7.AEE.B.3 Write and solve problems in authentic contexts using expressions and equations with positive and negative rational numbers in any form. Contexts can be limited to those that can be solved with one or two-step linear equations.

7.AEE.B.4 Use variables to represent quantities and construct one- and two-step linear inequalities with positive rational numbers to solve authentic problems by reasoning about the quantities.

Proportional Reasoning: Ratios and Proportions (7.RP)

7.RP.A *Analyze proportional relationships and use them to solve mathematical problems in authentic contexts.*

7.RP.A.1 Solve problems in authentic contexts involving unit rates associated with ratios of fractions.

7.RP.A.2 Recognize and represent proportional relationships between quantities in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships. Identify the constant of proportionality (unit rate) within various representations.

7.RP.A.3 Use proportional relationships to solve ratio and percent problems in authentic contexts.

7.RP.B *Investigate chance processes and develop, use, and evaluate probability models.*

7.RP.B.4 Understand that the probability of a chance event is a number between 0 and 1 that expresses the likelihood of the event occurring. Represent probabilities as fractions, decimals, and percents.

7.RP.B.5 Use experimental data and theoretical probability to make predictions. Understand the probability predictions may not be exact.

7.RP.B.6 Develop a probability model and use it to find probabilities of events. Compare theoretical and experimental probabilities and explain possible sources of discrepancy if any exists.

7.RP.B.7 Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.

Numeric Reasoning: Number Systems (7.NS)

7.NS.A *Apply and extend previous understandings of operations with fractions.*

7.NS.A.1 Apply and extend previous understandings of addition, subtraction and absolute value to add and subtract rational numbers in authentic contexts. Understand subtraction as adding the additive inverse, $p - q = p + (-q)$.

7.NS.A.2 Apply and extend previous understandings of multiplication and division and of fractions to multiply and divide rational numbers. Interpret operations of rational numbers solving problems in authentic contexts.

7.NS.A.3 Understand that equivalent rational numbers can be written as fractions, decimals and percents.

Geometric Reasoning and Measurement (7.GM)

7.GM.A *Draw, construct, and describe geometrical figures and describe the relationships between them.*

7.GM.A.1 Solve problems involving scale drawings of geometric figures. Reproduce a scale drawing at a different scale and compute actual lengths and areas from a scale drawing.

7.GM.A.2 Draw triangles from three measures of angles or sides. Understand the possible side lengths and angle measures that determine a unique triangle, more than one triangle, or no triangle.

7.GM.B *Solve mathematical problems in authentic contexts involving angle measure, area, surface area, and volume.*

7.GM.B.3 Understand the relationship between area and circumference of circles. Choose and use the appropriate formula to solve problems with radius, diameter, circumference and area of circles.

7.GM.B.4 Apply facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to determine an unknown angle in a figure.

7.GM.B.5 Solve problems in authentic contexts involving two- and three-dimensional figures. Given formulas, calculate area, volume and surface area.

Data Reasoning (7.DR)

7.DR.A *Formulate Statistical Investigative Questions.*

7.DR.A.1 Formulate summary, comparative investigative questions to gain information about a population and that a sample is valid only if the sample is representative of that population.

7.DR.B *Collect and Consider Data.*

7.DR.B.1 Collect or consider data from a random sample to compare and draw inferences about a population with an unknown characteristic of interest.

7.DR.C *Analyze, summarize, and describe data.*

7.DR.C.2 Analyze two data distributions visually to compare multiple measures of center and variability.

7.DR.D *Interpret data and answer investigative questions.*

7.DR.D.4 Interpret measures of center and measures of variability for numerical data from random samples to compare between two populations, and to answer investigative questions.

Grade 8 Standards

Algebraic Reasoning: Expressions and Equations (8.AEE)

8.AEE.A *Expressions and Equations Work with radicals and integer exponents.*

8.AEE.A.1 Apply the properties of integer exponents using powers of 10 to generate equivalent numerical expressions.

8.AEE.A.2 Represent solutions to equations using square root and cube root symbols.

8.AEE.A.3 Estimate very large or very small quantities using scientific notation with a single digit times an integer power of ten.

8.AEE.A.4 Perform operations with numbers expressed in scientific notation.

8.AEE.B *Understand the connections between proportional relationships, lines, and linear equations.*

8.AEE.B.5 Graph proportional relationships in authentic contexts. Interpret the unit rate as the slope of the graph, and compare two different proportional relationships represented in different ways.

8.AEE.B.6 Write the equation for a line in slope intercept form y = mx + b, where m and b are rational numbers, and explain in context why the slope m is the same between any two distinct points.

8.AEE.C *Analyze and solve linear equations and pairs of simultaneous linear equations.*

8.AEE.C.7 Solve linear equations with one variable including equations with rational number coefficients, with the variable on both sides, or whose solutions require using the distributive property and/or combining like terms.

8.AEE.C.8 Find, analyze, and interpret solutions to pairs of simultaneous linear equations using graphs or tables.

Algebraic Reasoning: Functions (8.AFN)

8.AFN.A *Define, evaluate, and compare functions.*

8.AFN.A.1 Understand in authentic contexts, that the graph of a function is the set of ordered pairs consisting of an input and a corresponding output.

8.AFN.A.2 Compare the properties of two functions represented algebraically, graphically, numerically in tables, or verbally by description.

8.AFN.A.3 Understand and identify linear functions, whose graph is a straight line, and identify examples of functions that are not linear.

8.AFN.B *Use functions to model relationships between quantities.*

8.AFN.B.4 Construct a function to model a linear relationship in authentic contexts between two quantities.

8.AFN.B.5 Describe qualitatively the functional relationship between two quantities in authentic contexts by analyzing a graph.

Numeric Reasoning: Number Systems (8.NS)

8.NS.A *Know that there are numbers that are not rational, and approximate them by rational numbers.*

8.NS.A.1 Know that real numbers that are not rational are called irrational.

8.NS.A.2 Use rational approximations of irrational numbers to compare size and locate on a number line.

Geometric Reasoning and Measurement (8.GM)

8.GM.A *Understand congruence and similarity using physical models, transparencies, or geometry software.*

8.GM.A.1 Verify experimentally the properties of rotations, reflections, and translations.

8.GM.A.2 Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections, and translations.

8.GM.A.3 Describe the effect of dilations, translations, rotations and reflections on two-dimensional figures using coordinates.

8.GM.A.4 Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and/or dilations.

8.GM.A.5 Use informal arguments to establish facts about interior and exterior angles of triangles and angles formed by parallel lines cut with a transversal.

8.GM.B *Understand and apply the Pythagorean Theorem.*

8.GM.B.6 Distinguish between applications of the Pythagorean Theorem and its Converse in authentic contexts.

8.GM.B.7 Apply the Pythagorean Theorem in authentic contexts to determine unknown side lengths in right triangles.

8.GM.B.8 Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

8.GM.C *Solve mathematical problems in authentic contexts involving volume of cylinders, cones, and spheres.*

8.GM.C.9 Choose and use the appropriate formula for the volume of cones, cylinders, and spheres to solve problems in authentic contexts.

Data Reasoning (8.DR)

8.DR.A *Formulate Statistical Investigative Questions.*

8.DR.A.1 Formulate statistical investigative questions to articulate research topics and uncover patterns of association seen in bivariate categorical data.

8.DR.B *Collect and Consider Data.*

8.DR.B.2 Collect or consider data using surveys and measurements to capture patterns of association, and critically analyze data collection methods.

8.DR.C *Analyze, summarize, and describe data.*

8.DR.C.3 Analyze patterns of association between two quantitative or categorical variables and reason about distributions to compare groups.

8.DR.D *Interpret data and answer investigative questions.*

8.DR.D.4 Interpret scatter plots for bivariate quantitative data to investigate patterns of association between two quantities to answer investigative questions.

High School Standards

Algebraic Reasoning: Expressions and Equations (HS.AEE)

HS.AEE.A *Use algebraic reasoning to rewrite expressions in equivalent forms.*

HS.AEE.A.1 Interpret an expression which models a quantity by viewing one or more of its parts as a single entity. Reason about how changes in parts of the expression impact the whole, and vice versa.

HS.AEE.A.2 Create and recognize an equivalent form of an expression to understand the quantity represented in an authentic context.

HS.AEE.A.3 Rearrange formulas and equations to highlight a specific quantity.

HS.AEE.B *Use algebraic reasoning to find solutions to an equation, inequality, and systems of equations or inequalities.*

HS.AEE.B.4 Define variables and create equations with two or more variables to represent relationships between quantities in order to solve problems in authentic contexts.

HS.AEE.B.5 Define variables and create inequalities with one or more variables and use them to solve problems in authentic contexts.

HS.AEE.B.6 Solve systems of linear equations and systems of linear inequalities in authentic contexts through reasoning,algebraic means, or strategically using technology.

HS.AEE.C *Analyze the structure of an equation or inequality to determine an efficient strategy to find and justify a solution.*

HS.AEE.C.7 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities; interpret solutions as viable or nonviable options in authentic contexts.

HS.AEE.C.8 Construct a viable argument to justify a method for solving equations or inequalities.

HS.AEE.D *Make predictions in different applications using expressions, equations, and inequalities to analyze authentic contexts.*

HS.AEE.D.9 Understand that the solution to an equation in two variables is a set of points in the coordinate plane that form a curve, which could be a line.

HS.AEE.D.10 Recognize and explain why the point(s) of intersection of the graphs of f(x) and g(x) are solutions to the equation f(x)=g(x). Interpret the meaning of the coordinates of these points in authentic contexts.

HS.AEE.D.11 Graph and explain why the points in a half plane are solutions to a linear inequality and the solutions to a system of inequalities are the points in the intersection of corresponding half planes. Interpret the meaning of the coordinates of these points in authentic contexts.

Algebraic Reasoning: Functions (HS.AFN)

HS.AFN.A *Describe functions by using both symbolic and graphical representations.*

HS.AFN.A.1 Understand a function as a rule that assigns a unique output for every input and that functions model situations where one quantity determines another.

HS.AFN.A.2 Use function notation and interpret statements that use function notation in terms of the context and the relationship it describes.

HS.AFN.A.3 Calculate and interpret the average rate of change of a function over a specified interval.

HS.AFN.B *Compare and relate functions using common attributes.*

HS.AFN.B.4 Compare properties of two functions using multiple representations. Distinguish functions as members of the same family using common attributes.

HS.AFN.B.5 Relate the domain of a function to its graph and to its context.

HS.AFN.C *Represent functions graphically and interpret key features in terms of the equivalent symbolic representation.*

HS.AFN.C.6 Interpret key features of functions, from multiple representations, and conversely predict features of functions from knowledge of context.

HS.AFN.C.7 Graph functions using technology to show key features.

HS.AFN.D *Model a wide variety of authentic situations using functions through the process of making and changing assumptions, assigning variables, and finding solutions to contextual problems.*

HS.AFN.D.8 Model situations involving arithmetic patterns. Use a variety of representations such as pictures, graphs, or an explicit formula to describe the pattern.

HS.AFN.D.9 Identify and interpret the effect on the graph of a function when the equation has been transformed.

HS.AFN.D.10 Explain why a situation can be modeled with a linear function, an exponential function, or neither. In a given model, explain the meaning of coefficients and features of functions used, such as slope for a linear model.

Numeric Reasoning: Number and Quantity (HS.NQ)

HS.NQ.A *Understand and apply the real number system.*

HS.NQ.A.1 Use reasoning to establish properties of positive integer exponents. Extend the definition of exponentiation to include negative and rational exponents so as to be consistent with these properties. Utilize exponentiation to model authentic contexts.

HS.NQ.A.2 Compare real numbers presented through different representations, including both rational and irrational numbers. Apply comparisons in authentic contexts.

HS.NQ.B *Attend to units of measurement needed to solve problems through quantitative reasoning and mathematical modeling.*

HS.NQ.B.3 Use reasoning to choose and interpret measurement units consistently in formulas, graphs, and data displays, as a way to understand problems and to guide the solution of multi-step problems.

HS.NQ.B.4 Define, manipulate, and interpret appropriate quantities using rational and irrational numbers to authentically model situations and use reasoning to justify these choices.

HS.NQ.B.5 Use reasoning to choose a level of accuracy appropriate to limitations on measurement when reporting quantities in modeling situations.

Geometric Reasoning and Measurement (HS.GM)

HS.GM.A *Apply geometric transformations to figures through analysis of graphs and understanding of functions.*

HS.GM.A.1 Apply definitions of rotations, reflections, and translations to transform a figure and map between two congruent figures in authentic contexts.

HS.GM.A.2 Verify experimentally the properties of a dilation given a center and a scale factor. Solve problems in authentic contexts involving similar triangles or dilations.

HS.GM.A.3 Use the slopes of segments and the coordinates of the vertices of triangles, parallelograms, and trapezoids to solve problems in authentic contexts.

HS.GM.A.4 Use definitions of transformations and symmetry relationships to justify the solutions of problems in authentic contexts.

HS.GM.B *Construct and communicate geometric arguments through use of proofs, logical reasoning, and geometric technology.*

HS.GM.B.5 Apply and justify triangle congruence and similarity theorems in authentic contexts.

HS.GM.B.6 Justify theorems of line relationships, angles, triangles, and parallelograms; and use them to solve problems in authentic contexts.

HS.GM.B.7 Perform geometric constructions with a variety of tools and methods.

HS.GM.C *Solve problems and interpret solutions of area and volume of shapes by applying concepts of congruence, similarity, symmetry in authentic contexts.*

HS.GM.C.8 Solve authentic modeling problems using area formulas for triangles, parallelograms, trapezoids, regular polygons, and circles.

HS.GM.C.9 Use volume and surface area formulas for prisms, cylinders, pyramids, cones, and spheres to solve problems and apply to authentic contexts.

HS.GM.C.10 Use geometric shapes, their measures, and their properties to describe real world objects, and solve related authentic modeling and design problems.

HS.GM.C.11 Apply concepts of density based on area and volume in authentic modeling situations.

HS.GM.D *Apply concepts of right triangle trigonometry in authentic contexts to solve problems and interpret solutions.*

HS.GM.D.12 Apply sine, cosine, and tangent ratios, and the Pythagorean Theorem, to solve problems in authentic contexts.

HS.GM.D.13 Apply the Pythagorean Theorem in authentic contexts, and develop the standard form for the equation of a circle.

HS.GM.D.14 Use the coordinate plane to determine parallel and perpendicular relationships, and the distance between points.

Data Reasoning and Probability (HS.DR)

HS.DR.A *Formulate Statistical Investigative Questions.*

HS.DR.A.1 Formulate multivariable statistical investigative questions and determine how data from samples can be collected and analyzed to provide an answer.

HS.DR.A.2 Formulate summative, comparative, and associative statistical investigative questions for surveys, observational studies, and experiments using primary or secondary data.

HS.DR.A.3 Formulate inferential statistical investigative questions regarding causality and prediction from correlation.

HS.DR.A.4 Use mathematical and statistical reasoning to formulate questions about data to evaluate conclusions and assess risks.

HS.DR.B *Collect and Consider Data.*

HS.DR.B.5 Articulate what constitutes good practice in designing a sample survey, an experiment, and an observational study. Understand issues of bias and confounding variables in a study and their implications for interpretation.

HS.DR.B.6 Distinguish and choose between surveys, observational studies, and experiments to design an appropriate data collection that answers an investigative question of interest.

HS.DR.B.7 Apply an appropriate data collection plan when collecting primary data or selecting secondary data for the statistical investigative question of interest.

HS.DR.C *Analyze, summarize, and describe data.*

HS.DR.C.8 Identify appropriate ways to summarize and then represent the distribution of univariate and bivariate data multiple ways with graphs and/or tables. Use technology to present data that supports interpretation of tabular and graphical representations.

HS.DR.C.9 Use statistics appropriate to the shape of the data distribution to compare the center and spread of two or more different data sets.

HS.DR.C.10 Use data to compare two groups, describe sample variability, and decide if differences between parameters are significant based on the statistics.

HS.DR.D *Interpret data and answer investigative questions.*

HS.DR.D.11 Use statistical evidence from analyses to answer statistical investigative questions, and communicate the findings in a variety of formats (verbal, written, visual) to support informed data-based decisions.

HS.DR.D.12 Articulate what it means for an outcome or an estimate of a population characteristic to be plausible or not plausible compared to chance variation.

HS.DR.D.13 Use multivariate thinking to articulate how variables impact one another, and measure the strength of association using correlation coefficients for regression curves.

HS.DR.E *Understand independence and conditional probability and use them to interpret data.*

HS.DR.E.14 Describe the possible outcomes for a situation as subsets of a sample space.

HS.DR.E.15 Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.