

Oklahoma Academic Standards

for Mathematics

2015

To be added: Front matter, grade/course level introductions, glossary, appendix for development process, and ~~appendix of vertical progressions~~, appendix for references.

**Table of Contents**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Mathematical Actions and Processes | 3 |  | PK-1 Vertical Alignment | 40 |
| Pre-Kindergarten | 5 |  | 2-4 Vertical Alignment | 44 |
| Kindergarten | 7 |  | 5 – Pre-Algebra Vertical Alignment | 51 |
| 1st Grade | 9 |  | Algebra Vertical Alignment | 59 |
| 2nd Grade | 11 |  | Geometry Vertical Alignment | 64 |
| 3rd Grade | 14 |  |  |  |
| 4th Grade | 17 |  |  |  |
| 5th Grade | 20 |  |  |  |
| 6th Grade | 23 |  |  |  |
| 7th Grade | 26 |  |  |  |
| Pre-Algebra | 29 |  |  |  |
| Algebra 1 | 32 |  |  |  |
| Geometry | 35 |  |  |  |
| Algebra 2 | 37 |  |  |  |

**Mathematical Actions and Processes**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |

****

**Mathematical Actions and Processes**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |

The Mathematical Actions and Processes simultaneously reflect the holistic nature of mathematics as a discipline in which patterns and relationships among quantities, numbers, and space are studied (National Academies of Sciences, 2014) and as a form of literacy such that all students are supported in accessing and understanding mathematics for life, for the workplace, for the scientific and technical community, and as a part of cultural heritage (NCTM, 2000). The seven Mathematical Actions and Processes leverage both the NCTM Process Standards and the Five Mathematical Proficiencies (NRC, 2001) to capture the mathematical experience of Oklahoma students as they pursue mathematical literacy.

*Throughout their Pk-12 education experience, mathematically literate students will:*

**Develop a Deep and Flexible Conceptual Understanding**

Demonstrate a deep and flexible conceptual understanding of mathematical concepts, operations, and relations while making mathematical and real-world connections. Students will develop an understanding of how and when to apply and use the mathematics they know to solve problems.

**Develop Accurate and Appropriate Procedural Fluency**

Learn efficient procedures and algorithms for computations and repeated processes based on a strong sense of numbers. Develop fluency in addition, subtraction, multiplication, and division of numbers and expressions. Students will develop a sophisticated understanding of the development and application of algorithms and procedures.

**Develop Strategies for Problem Solving**

Analyze the parts of complex mathematical tasks and identify entry points to begin the search for a solution. Students will select from a variety of problem solving strategies and use corresponding multiple representations (verbal, physical, symbolic, pictorial, graphical, tabular) when appropriate. They will pursue solutions to various tasks from real-world situations and applications that are often interdisciplinary in nature. They will find methods to verify their answers in context and will always question the reasonableness of solutions.

**Develop Mathematical Reasoning**

Explore and communicate a variety of reasoning strategies to think through problems. Students will apply their logic to critique the thinking and strategies of others and to develop and evaluate mathematical arguments, including making arguments and counterarguments and making connections to other contexts.

**Develop a Productive Mathematical Disposition**

Hold the belief that mathematics is sensible, useful and worthwhile. Students will develop the habit of looking for and making use of patterns and mathematical structures. They will persevere and become resilient, effective problem solvers.

**Develop the Ability to Make Conjectures, Model, and Generalize**

Make predictions and conjectures and draw conclusions throughout the problem solving process based on patterns and the repeated structures

in mathematics. Students will create, identify, and extend patterns as a strategy for solving and making sense of problems.

**Develop the Ability to Communicate Mathematically**

Students will discuss, write, read, interpret and translate ideas and concepts mathematically. As they progress, students’ ability to communicate mathematically will include their increased use of mathematical language and terms and analysis of mathematical definitions.

| **Develop a Deep and Flexible Conceptual Understanding** | **Develop Accurate and Appropriate Procedural Fluency** | **Develop Strategies for Problem Solving** | **Develop Mathematical Reasoning** | **Develop a Productive Mathematical Disposition** | **Develop the Ability to Make Conjectures, Model, and Generalize** | **Develop the Ability to Communicate Mathematically** |
| --- | --- | --- | --- | --- | --- | --- |
| **Number & Operations (N)** |
| **PK.N.1** Know number names and count in sequence. | **PK.N.1.1** Count aloud forward in sequence by 1’s to 20. |
| **PK.N.1.2** Recognize and name written numerals 0-10. |
| **PK.N.1.3** Recognize that zero represents the count of no objects. |
| **PK.N.2** Count to tell the number of objects. | **PK.N.2.1** Identify the number of objects, up to 10, in a row or column. |
| **PK.N.2.2** Use one-to-one correspondence in counting objects and matching groups of objects. |
| **PK.N.2.3** Understand the last numeral spoken, when counting aloud, tells how many total objects are in a set. |
| **PK.N.2.4** Count up to 5 items in a scattered configuration; not in a row or column. |
| **PK.N.3** Compare sets using number. | **PK.N.3.1** Compare two sets of 1-5 objects using comparative language such as “same,” “more,” or “fewer”. |
| **Algebraic Reasoning & Algebra (A)** |
| **PK.A.1** Recognize, create, and extend patterns. | **PK.A.1.1** Sort and group up to 5 objects into a set and explain verbally what the objects have in common (e.g., color, size, shape). |
| **PK.A.1.2** Recognize, duplicate, create and extend repeating patterns in various formats (e.g., manipulatives, sound, movement). |
| **Geometry & Measurement (GM)** |
| **PK.GM.1 I**dentify common shapes. | **PK.GM.1.1** Identify common shapes by pointing to the shape when given the name (e.g., circle, square, rectangle and triangle). |
| **PK.GM.2** Describe and compare measureable attributes. | **PK.GM.2.1** Identify measurable attributes of objects. Describe them using age appropriate vocabulary (e.g., little, big, long, short, tall, heavy, and light). |
| **PK.GM.2.2** Directly compare two objects with a common measurable attribute using words such as longer/shorter (horizontal); heavier/lighter; or taller/shorter (vertical). |
| **PK.GM.2.3** Sort objects into sets by one or more attributes. |

| **Data & Probability (D)** |
| --- |
| **PK.D.1** Collect and organize categorical data. | **PK.D.1.1** Collect and organize information about objects and events in the environment. |
| **PK.D.1.2** Use categorical data to create real-object graphs. |

| **Develop a Deep and Flexible Conceptual Understanding** | **Develop Accurate and Appropriate Procedural Fluency** | **Develop Strategies for Problem Solving** | **Develop Mathematical Reasoning** | **Develop a Productive Mathematical Disposition** | **Develop the Ability to Make Conjectures, Model, and Generalize** | **Develop the Ability to Communicate Mathematically** |
| --- | --- | --- | --- | --- | --- | --- |
| **Number & Operations (N)** |
| **K.N.1** Understand the relationship between quantities and whole numbers. | **K.N.1.1** Count aloud forward in sequence by 1’s to 100. |
| **K.N.1.2** Recognize that a number can be used to represent how many objects are in a set up to 10.  |
| **K.N.1.3** Use ordinal numbers to represent the position of an object in a sequence up to 10.  |
| **K.N.1.4** Recognize without counting (subitizing\*) the quantity of a small group of objects in organized and random arrangements up to 10 (e.g. dot patterns).**Clarification statement**: Subitizing is defined as instantly recognizing the quantity of a set without having to count. “Subitizing” is not a vocabulary word and is not meant for student discussion at this age. |
| **K.N.1.5** Count forward, with and without objects, from any given number up to 10.  |
| **K.N.1.6** Read, write, discuss, and represent whole numbers from 0 to at least 10. Representations may include numerals, pictures, real objects and picture graphs, spoken words, and manipulatives.  |
| **K.N.1.7** Find a number that is 1 more or 1 less than a given number up to 10. |
| **K.N.1.8** Compare and order whole numbers, with and without objects, from 0 to 10 (e.g., more than, less than, equal to). |
| **K.N.2** Develop conceptual fluency with addition and subtraction (up to 10) using objects and pictures. | **K.N.2.1** Compose and decompose numbers up to 10 with objects and pictures. (e.g., making ten, number bonds). |
| **K.N.3** Understand the relationship between whole numbers and fractions through fair share. | **K.N.3.1** Distribute equally a set of objects into at least two smaller equal sets. |
| **K.N.4** Identify coins in order to recognize the need for monetary transactions. | **K.N.4.1** Identify U.S. coins by name (not value), including pennies, nickels, dimes, and quarters. |

| **Algebraic Reasoning & Algebra (A)** |
| --- |
| **K.A.1** Recognize, create, complete, and extend patterns. | **K.A.1.1** Sort and group up to 10 objects into a set and explain verbally what the objects have in common (e.g., color, size, shape). |
| **K.A.1.2** Recognize, create, complete, and extend repeating, shrinking and growing patterns using shape, color, size, quantity, sounds and movements. |
| **Geometry & Measurement (GM)** |
| **K.GM.1** Recognize and sort basic two-dimensional shapes and use them to represent real-world objects. | **K.GM.1.1** Recognize basic two-dimensional shapes such as squares, circles, triangles, and rectangles.  |
| **K.GM.1.2** Sort two-dimensional objects using characteristics such as shape, size, color, and thickness. |
| **K.GM.1.3** Identify attributes of two-dimensional shapes using informal and formal geometric language interchangeably (e.g., a square has 4 corners). |
| **K.GM.1.4** Use smaller shapes to form a larger shape when there is an outline to follow (e.g., create a larger square using 4 small squares).  |
| **K.GM.1.5** Compose free form shapes with blocks. |
| **K.GM.1.6** Use basic shapes and spatial reasoning to represent objects in the real-world. |
| **K.GM.2** Compare and order objects according to location and measurable attributes. | **PK.GM.2.1** Use words to compare objects according to length, size, weight, position, and location (e.g., below, near, far). |
| **K.GM.2.2** Order up to 6 objects using measurable attributes, such as length and weight. |
| **K.GM.2.3** Sort objects into sets by more than one attribute. |
| **K.GM.2.4** Compare two containers (e.g., fill one container using another and count the number needed to fill larger container). |
| **K.GM.3** Tell time as it relates to daily life. | **K.GM.3.1** Develop an awareness of simple time concepts within his/her daily life (e.g. yesterday, today, tomorrow, morning, afternoon, night). |
| **Data & Probability (D)** |
| **K.D.1** Collect, organize, and interpret categorical data. | **K.D.1.1** Collect and sort information about objects and events in the environment. |
| **K.D.1.2** Use categorical data to create real-object and picture graphs. |
| **K.D.1.3** Draw conclusions from real-object and picture graphs. |

| **Develop a Deep and Flexible Conceptual Understanding** | **Develop Accurate and Appropriate Procedural Fluency** | **Develop Strategies for Problem Solving** | **Develop Mathematical Reasoning** | **Develop a Productive Mathematical Disposition** | **Develop the Ability to Make Conjectures, Model, and Generalize** | **Develop the Ability to Communicate Mathematically** |
| --- | --- | --- | --- | --- | --- | --- |
| **Number & Operations (N)** |
| **1.N.1** Count, compare, and represent whole numbers up to 100, with an emphasis on groups of tens and ones. | **1.N.1.1** Recognize numbers to 20 without counting (subitize) the quantity of structured arrangements (e.g. ten frames, arrays, dot patterns).**Clarification statement**: Subitizing is defined as instantly recognizing the quantity of a set without having to count. “Subitizing” is not a vocabulary word and is not meant for student discussion at this age. |
| **1.N.1.2** Use concrete models to describe whole numbers between 10 and 100 in terms of tens and ones.  |
| **1.N.1.3** Read, write, discuss, and represent whole numbers up to 100. Representations may include numerals, addition and subtraction, pictures, tally marks, number lines and manipulatives, such as bundles of sticks and base 10 blocks. |
| **1.N.1.4** Count forward, with and without objects, from any given number up to 100 by 1s, 2s, 5s and/or 10s.   |
| **1.N.1.5** Find a number that is 10 more or 10 less than a given number up to 100. |
| **1.N.1.6** Compare and order whole numbers from 0 to 100.  |
| **1.N.1.7** Use knowledge of number relationships to locate the position of a given whole number on an open number line up to 20. |
| **1.N.1.8** Use objects to represent and use words to describe the relative size of numbers, such as more than, less than, and equal to. |
| **1.N.1.9** Demonstrate equivalence and equality (e.g., using balance scales, various manipulatives). |
| **1.N.2** Solve addition and subtraction problems up to 10 in real-world and mathematical contexts. | **1.N.2.1** Use a variety of strategies to solve addition and subtraction problems up to 10 (e.g. spoken words, objects, pictorial models, number lines, number sentences, compose and decompose numbers, making 10, doubles plus one, part-part-whole). |
| **1.N.2.2** Apply basic fact strategies to add and subtract within 10 (e.g., making ten, decomposing a number leading to a ten, doubles plus one).  |
| **1.N.2.3** Determine if equations involving addition and subtraction are true (e.g., balance scales, base ten blocks, number line, pictorial representations) |
| **1.N.2.4** Demonstrate fluency with basic addition facts and related subtraction facts up to 10. |
| **1.N.3** Develop foundational ideas for fractions. | **1.N.3.1** Partition a regular polygon into equal pieces using physical models. |
| **1.N.3.2** Partition (fair share) sets of objects into equal groupings. |
|  |

| **1.N.4** Identify coins and their values in order to understand monetary transactions. | **1.N.4.1** Identify U.S. coins, including pennies, nickels, dimes, and quarters, and their value in whole number amounts of cents. |
| --- | --- |
| **1.N.4.2** Write a number with the cent symbol to describe the value of a coin. |
| **1.N.4.3** Determine the value of a collection of pennies, nickels and/or dimes up to one dollar counting by ones, fives, and tens. |
| **Algebraic Reasoning & Algebra (A)** |
| **1.A.1** Recognize, create, complete, and extend patterns. | **1.A.1.1** Recognize, create, complete, and extend repeating, shrinking and growing patterns with objects, numbers, or geometric shapes in a variety of contexts (e.g., addition charts, skip counting, calendars, hundreds charts, number lines, real-world situations such as art and architecture). |
| **Geometry & Measurement (GM)** |
| **1.GM.1** Recognize, compose, and decompose two- and three-dimensional shapes. | **1.GM.1.1** Use smaller shapes to compose larger two-dimensional shapes such as triangles, squares, rectangles, and circles.  |
| **1.GM.1.2** Decompose larger shapes into smaller two-dimensional shapes (e.g., a hexagon can be broken into triangles and/or trapezoids).  |
| **1.GM.1.3** Compose structures with three-dimensional shapes.  |
| **1.GM.1.4** Recognize three-dimensional shapes such as cubes, cones, cylinders, and spheres. |
| **1.GM.2** Select and use units to describe length and volume/capacity. | **1.GM.2.1** Use nonstandard and standard measuring tools to measure the length of objects to reinforce the continuous nature of linear measurement. |
| **1.GM.2.2** Illustrate that the length of an object is the number of same-size units of length that, when laid end-to-end with no gaps or overlaps, reach from one end of the object to the other.  |
| **1.GM.2.3** Measure the same object/distance with units of two different lengths and describe how and why the measurements differ. |
| **1.GM.2.4** Describe a length to the nearest whole unit using a number and a unit (e.g., foot, inch, centimeter).  |
| **1.GM.2.5** Use standard and nonstandard tools to identify volume/capacity (e.g. fill and pour activities). Identify which container holds more, less, or same amount. |
| **1.GM.3.** Tell time to the half and full hour. | **1.GM.3.1** Tell time to the hour and half-hour (analog and digital). |
| **Data & Probability (D)** |
| **1.D.1** Collect, organize, and interpret categorical and numerical data. | **1.D.1.1** Collect, sort, and organize data in up to three categories using representations (e.g., tally marks, tables, Venn diagrams). |
| **1.D.1.2** Use data to create picture and bar-type graphs to demonstrate one to one correspondence. |
| **1.D.1.3** Draw conclusions from picture and bar-type graphs. |

| **Develop a Deep and Flexible Conceptual Understanding** | **Develop Accurate and Appropriate Procedural Fluency** | **Develop Strategies for Problem Solving** | **Develop Mathematical Reasoning** | **Develop a Productive Mathematical Disposition** | **Develop the Ability to Make Conjectures, Model, and Generalize** | **Develop the Ability to Communicate Mathematically** |
| --- | --- | --- | --- | --- | --- | --- |
| **Number & Operations (N)** |
| **2.N.1** Compare and represent whole numbers up to 1,000 with an emphasis on place value and equality. | **2.N.1.1** Read, write, discuss, and represent whole numbers up to 1,000. Representations may include numerals, words, pictures, tally marks, number lines and manipulatives. |
| **2.N.1.2** Use knowledge of number relationships to locate the position of a given whole number on an open number line up to 100. |
| **2.N.1.3** Use place value to describe whole numbers between 10 and 1,000 in terms of hundreds, tens and ones. Know that 100 is 10 tens, and 1,000 is 10 hundreds. |
| **2.N.1.4** Find 10 more or 10 less than a given three-digit number. Find 100 more or 100 less than a given three-digit number. |
| **2.N.1.5** Recognize when to round numbers to the nearest 10 and 100. |
| **2.N.1.6** Use place value to compare and order whole numbers up to 1,000 using comparative language, numbers, and symbols (e.g., 425 > 276, 73 < 107, page 351 comes after page 350, 753 is between 700 and 800). |
| **2.N.1.7** Recognize the difference between equivalence and equality (e.g., using balance scales to demonstrate that 2+4 is equivalent to 3+3.) |
| **2.N.1.8** Demonstrate non-equivalence (e.g., balance scales, various manipulatives). |
| **2.N.2** Add and subtract one- and two-digit numbers in real-world and mathematical problems. | **2.N.2.1** Use the relationship between addition and subtraction to generate basic facts (e.g., making tens, fact families, doubles plus or minus one, counting on, counting back, commutative and associative properties). |
| **2.N.2.2** Demonstrate fluency with basic addition facts and related subtraction facts up to 20. |
| **2.N.2.3** Use strategies to estimate sums and differences up to 100 [e.g., compose, decompose and regroup numbers, use knowledge of 10 to estimate quantities and sums (two numbers less than 10 cannot add up to more than 20)]. |
| **2.N.2.4** Use strategies and algorithms based on knowledge of place value and equality to add and subtract two-digit numbers (e.g., mental strategies, standard algorithm, decomposition, expanded notation, partial sums, differences). |
| **2.N.2.5** Solve real-world and mathematical addition and subtraction problems involving whole numbers up to 2 digits. |
| **2.N.2.6** Use concrete models and structured arrangements, such as repeated addition, arrays and ten frames to develop understanding of multiplication. |
| **2.N.3** Explore the foundational ideas of fractions. | **2.N.3.1** Identify the parts of a set and/or area that represent fractions for halves, thirds and fourths.  |
| **2.N.3.2** Construct equal sized portions through fair sharing including length and set area models for halves, thirds, and fourths. |
| **2.N.4** Determine the value of coins in order to solve monetary transactions. | **2.N.4.1** Determine the value of a collection(s) of coins up to one dollar using the cent symbol (e.g., given 2 dimes and 1 quarter, recognize you have 45¢; person 1 has a dime and a nickel and person 2 has a quarter, together they have 40¢). Limited to: whole numbers. |
| **2.N.4.2** Select a combination of coins to represent a given amount of money up to one dollar. |
| **Algebraic Reasoning & Algebra (A)** |
| **2.A.1** Represent, create, describe, complete, and extend patterns and relationships to solve real-world and mathematical problems. | **2.A.1.1** Create, describe, complete, and extend repeating, growing, and shrinking patterns involving numbers in a variety of contexts (e.g., repeated addition or subtraction, skip counting, arrays of objects). |
| **2.A.1.2** Recognize and describe repeating patterns involving geometric shapes in a variety of contexts. |
| **2.A.2** Use number sentences involving addition, subtraction and unknowns to represent and solve real-world and mathematical problems; generate real-world situations corresponding to number sentences. | **2.A.2.1** Use objects and number lines and generate real-world situations to represent number sentences. |
| **2.A.2.2** Use number sense and properties (commutative and identity) of addition and subtraction to find values for unknowns that make number sentences true. (Introduction to properties, but not mastery of vocabulary). |
| **Geometry & Measurement (GM)** |
| **2.GM.1** Analyze attributes of two-dimensional figures develop generalizations about their properties. | **2.GM.1.1** Identify and name basic two-dimensional shapes, such as squares, circles, triangles, rectangles, trapezoids, and hexagons (architecture, technology, art). |
| **2.GM.1.2** Describe, compare and classify two-dimensional figures according to their geometric attributes. |
| **2.GM.1.3** Compose 2-D shapes using triangles, squares, hexagons and rhombi. |
| **2. GM 1.4** Recognizes right angles and classify angles as smaller or larger than a right angle. |
| **2.GM.2** Understand length as a measurable attribute; use tools to measure length. | **2.GM.2.1** Explain the relationship between the size of the unit of measurement and the number of units needed to measure the length of an object. |
| **2.GM.2.2** Explain the relationship between length and the numbers on a ruler by using a ruler to measure lengths to the nearest inch and centimeter. |
| **2.GM.3.** Tell time to 5 minutes. | **2.GM.3.1** Tell time to 5 minutes. Read and write time to the quarter-hour and distinguish between a.m. and p.m. (analog and digital). |

| **Data & Probability (D)** |
| --- |
| **2.D.1** Collect, organize, and interpret data. | **2.D.1.1** Explain that the length of a bar in a bar graph or the number of objects in a picture graph represent the number of data points for a given category. |
| **2.D.1.2** Organize a collection of data with up to four categories using pictographs and bar graphs with intervals of 1s, 2s, 5s or 10s. |
| **2.D.1.3** Write and solve one-step word problems involving addition or subtraction using data represented within pictographs and bar graphs with intervals of one. |
| **2.D.1.4** Draw conclusions and make predictions from information in a graph. |

| **Develop a Deep and Flexible Conceptual Understanding** | **Develop Accurate and Appropriate Procedural Fluency** | **Develop Strategies for Problem Solving** | **Develop Mathematical Reasoning** | **Develop a Productive Mathematical Disposition** | **Develop the Ability to Make Conjectures, Model, and Generalize** | **Develop the Ability to Communicate Mathematically** |
| --- | --- | --- | --- | --- | --- | --- |
| **Number & Operations (N)** |
| **3.N.1** Compare and represent whole numbers up to 10,000 with an emphasis on place value and equality. | **3.N.1.1** Read, write, discuss, and represent whole numbers up to 10,000. Representations may include numerals, expressions with operations, words, pictures, number lines, and manipulatives. |
| **3.N.1.2** Use place value to describe whole numbers between 1000 and 10,000 in terms of ten thousands, thousands, hundreds, tens and ones, including expanded form. |
| **3.N.1.3** Find 1,000 more or 1,000 less than a given four- or five-digit number. Find 100 more or 100 less than a given four- or five-digit number.  |
| **3.N.1.4** Recognize when to round numbers to the nearest 10,000, 1,000, 100 and 10 and/or use compatible numbers to estimate sums and differences.**Clarification statement**: Emphasis on understanding why and how to round vs. memorizing a rule. |
| **3.N.1.5** Recognize non-equivalence (e.g., 7+1 > 2+3, 6+3 is not equivalent to 4). |
| **3.N.1.6** Use place value to compare and order whole numbers up to 10,000, using comparative language, numbers, and symbols (e.g. 5,023 < 5,156; 2,345 is between 2,000 and 3,000). |
| **3.N.2** Add and subtract multi-digit whole numbers; represent multiplication and division in various ways; solve real-world and mathematical problems. | **3.N.2.1** Represent multiplication facts by using a variety of approaches, such as repeated addition, equal-sized groups, arrays, area models, equal jumps on a number line and skip counting.  |
| **3.N.2.2** Demonstrate fluency in addition, subtraction, and multiplication (10 x 10) facts up to 100. |
| **3.N.2.3** Use strategies and algorithms based on knowledge of place value and equality to add and subtract multi-digit numbers (e.g., mental strategies, standard algorithm, decomposition, expanded notation, partial sums and differences). |
| **3.N.2.4** Use addition and subtraction to solve real-world and mathematical problems involving whole numbers. Use various strategies, including the relationship between addition and subtraction, the use of technology, and the context of the problem to assess the reasonableness of results. |
| **3.N.2.5** Represent division facts by using a variety of approaches, such as repeated subtraction, equal sharing and forming equal groups. |
| **3.N.2.6** Recognize the relationship between multiplication and division to represent and solve real-world problems (e.g. partitioning, missing factors, arrays). |
| **3.N.2.7** Use strategies and algorithms based on knowledge of place value, equality and properties of addition and multiplication to multiply a two-digit number by a one-digit number (e.g., area model; mental strategies; partial products; standard algorithm; commutative, associative, and distributive properties). |

| **3.N.3** Understand meanings and uses of fractions in real-world and mathematical situations. | **3.N.3.1** Read and write fractions with words and symbols. |
| --- | --- |
| **3.N.3.2** Construct fractions using set, area, and length models. |
| **3.N.3.3** Order and compare fractions, including unit fractions and equivalent fractions with like denominators by using models, reasoning about their size and an understanding of the concept of numerator and denominator. |
| **3.N.4** Determine the value of coins in order to solve monetary transactions. | **3.N.4.1** Use addition to determine the value of a collection of coins up to one dollar using the cent symbol and a collection of bills up to twenty dollars. (e.g. 45¢ + 30¢= 75¢, $11 + $9=$20). |
| **3.N.4.2** Select the fewest amount of coins for a given amount of money up to one dollar. |
| **Algebraic Reasoning & Algebra (A)** |
| **3.A.1** Use single-operation input-output rules to represent patterns and relationships and to solve real-world and mathematical problems. | **3.A.1.1** Create, describe, and extend patterns involving addition, subtraction or multiplication to solve problems in a variety of contexts (e.g., skip counting, arrays of objects, function machine, hundreds chart). |
| **3.A.1.2** Describe the rule (single operation) for a pattern from an input/output table or function machine involving addition, subtraction or multiplication. |
| **3.A.1.3** Construct and explore representations of growing patterns and construct the next steps. |
| **3.A.2** Use number sentences involving multiplication and unknowns to represent and solve real-world and mathematical problems; create real-world situations corresponding to number sentences. | **3.A.2.1** Find unknowns represented by symbols in arithmetic problems by solving open sentences (equations) and other problems involving addition, subtraction, and multiplication. Generate real-world situations to represent number sentences.  |
| **3.A.2.2** Recognize, represent and apply the number properties (commutative and identity properties of addition and multiplication) using models and manipulatives. (Introduction to properties, but not mastery of vocabulary). |
| **Geometry & Measurement (GM)** |
| **3.GM.1** Use geometric attributes to describe and create shapes in various contexts. | **3GM 1.1** Sort three-dimensional shapes based on attributes. |

| **3.GM.2** Understand measurable attributes of real-world and mathematical objects using various tools. | **3.GM.2.1** Choose an appropriate measurement instrument (e.g., ruler, yard/meter, measuring tape) and measure the length of objects to the nearest whole or half unit. |
| --- | --- |
| **3.GM.2.2** Using common benchmarks, estimate the lengths (customary and metric) of a variety of objects. |
| **3.GM.2.3** Find the perimeter of rectangles and polygons (composed of rectangles on geo-boards and/or grid paper). |
| **3.GM.2.4** Use an analog thermometer to determine temperature to the nearest degree in Fahrenheit and Celsius. |
| **3.GM.2.5** Counts cubes systematically to identify number of cubes to pack the whole or half of the 3-D structure. |
| **3.GM.3** Tell time to the nearest 5-minutes and solve problems. | **3.GM.3.1** Read and write time to the nearest 5-minute (analog and digital). |
| **3.GM.3.2** Determine the solutions to problems involving addition and subtraction of time intervals of 5-minutes using pictorial models or tools up to one hour (e.g.15-minute event plus a 30-minute event equals 45 minutes). |
| **Data & Probability (D)** |
| **3.D.1** Collect, organize, and analyze data. | **3.D.1.1** Summarize and construct a data set with multiple categories using a frequency table, line plot, pictograph, and/or bar graph with scaled intervals. |
| **3.D.1.2** Solve one- and two-step problems using categorical data represented with a frequency table, pictograph, or bar graph with scaled intervals. |

| **Develop a Deep and Flexible Conceptual Understanding** | **Develop Accurate and Appropriate Procedural Fluency** | **Develop Strategies for Problem Solving** | **Develop Mathematical Reasoning** | **Develop a Productive Mathematical Disposition** | **Develop the Ability to Make Conjectures, Model, and Generalize** | **Develop the Ability to Communicate Mathematically** |
| --- | --- | --- | --- | --- | --- | --- |
| **Number & Operations (N)** |
| **4.N.1** Multiply multi-digit numbers and solve real-world and mathematical problems using arithmetic. | **4.N.1.1** Demonstrate fluency with multiplication and division facts up to 10 x 10. |
| **4.N.1.2** Use an understanding of place value to multiply or divide a number by 10, 100 and 1,000.  |
| **4.N.1.3** Multiply 3-digit by 1-digit or a 2-digit by 2-digit whole numbers, using efficient and generalizable procedures and strategies, based on knowledge of place value, including but not limited to standard algorithms. |
| **4.N.1.4** Estimate products of 3-digit by 1-digit or 2-digit by 2-digit whole numbers using rounding, benchmarks and place value to assess the reasonableness of results. Explore larger numbers using technology to investigate patterns. |
| **4.N.1.5** Solve multi-step real-world and mathematical problems requiring the use of addition, subtraction and multiplication of multi-digit whole numbers. Use various strategies, including the relationship between operations, the use of appropriate technology, and the context of the problem to assess the reasonableness of results. |
| **4.N.1.6** Use strategies and algorithms based on knowledge of place value, equality and properties of operations to divide 3-digit dividend by 1-digit whole number divisors. (e.g., mental strategies, standard algorithms, partial quotients, repeated subtraction, the commutative, associative, and distributive properties). |
| **4.N.1.7** Determine the unknown addend or factor in equivalent and non-equivalent expressions (e.g., 5 + 6 = 4 + ☐, 3 x 8 < 3 x☐). |
| **4.N.2** Represent and compare fractions and decimals in real-world and mathematical situations; use place value to understand how decimals represent quantities. | **4.N.2.1** Represent equivalent fractions using fraction models (e.g. parts of a set, area models, fraction strips, number lines). |
| **4.N.2.2** Use benchmark fractions (0, 1/4, 1/3, 1/2, 2/3, 3/4, 1) to locate additional fractions on a number line. Use models to order and compare whole numbers and fractions less than and greater than one. |
| **4.N.2.3** Decompose a fraction in more than one way into a sum of fractions with the same denominator using concrete and pictorial models and recording results with symbolic representations (e.g. 3/4 = 1/4 + 1/4 + 1/4).  |
| **4.N.2.4** Use fraction models to add and subtract fractions with like denominators in real-world and mathematical situations. |
| **4.N.2.5** Represent tenths and hundredths with concrete models, making connections between fractions and decimals. |
| **4.N.2.6** Represent, read and write decimals up to at least the hundredths place in a variety of context including money. |
| **4.N.2.7** Compare and order decimals and whole numbers using place value, a number line and models such as grids and base-10 blocks. |
| **4.N.2.8** Rename and compare benchmark fractions (1/4,1/3, 1/2, 2/3, 3/4) and decimals (0.25, 0.50, 0.75) in real-world and mathematical situations (e.g. half of a dollar is $0.50; 1/4 is the same as 0.25). |
| **4.N.3** Determine the value of coins in order to solve monetary transactions. | **4.N.3.1** Given a total cost (whole dollars and/or decimal) and amount paid (whole dollars and/or decimal), find the change required in a variety of ways. Limited to: benchmark decimals. |
| **Algebraic Reasoning & Algebra (A)** |
| **4.A.1** Use single-operation input-output rules, tables and charts to represent patterns and relationships and to solve real-world and mathematical problems. | **4.A.1.1** Create, describe, and extend a wide variety of patterns involving numbers, using tables, charts and/or rules (e.g., determine the rule from a table or function machine, extend number patterns). Record the inputs and outputs in a chart or table. |
| **4.A.1.2** Describe the rule (single operation) for a pattern from a input/output table or function machine involving addition, subtraction, multiplication, or division. |
| **4.A.1.3** Create, describe, and extend a wide variety of patterns involving geometric shapes and define the rule of the pattern. |
| **4.A.2** Use multiplication and division with unknowns to create number sentences representing a given problem situation using a number sentence. | **4.A.2.1** Use number sense, properties of multiplication (commutative, identity, and associative) and the relationship between multiplication and division to find values for the unknowns represented by letters and symbols that make number sentences true. (Introduction to properties, but not mastery of vocabulary). |
| **4.A.2.2** Solve for unknowns in one-step problems by solving open sentences (equations) and other problems involving addition, subtraction, multiplication, or division with whole numbers. Use real-world situations to represent number sentences. |
| **Geometry & Measurement (GM)** |
| **4.GM.1** Name, describe, classify and construct polygons, and three-dimensional figures. | **4.GM.1.1** Identify points, lines, line segments, rays, angles, endpoints, and parallel and perpendicular lines in various contexts. |
| **4.GM.1.2** Describe, classify, and sketch quadrilaterals, including squares, rectangles, trapezoids, rhombuses, parallelograms, and kites. Recognize quadrilaterals in various contexts. |
| **4.GM.1.3** Build a three-dimensional figure using unit cubes when picture/shape is shown. |
| **4.GM.1.4** Given two three-dimensional shapes, identify similarities and differences. |
| **4.GM.2** Understand angle, perimeter, and area as measurable attributes of real-world and mathematical objects. Use various tools to measure angles, perimeter, area, and volume. | **4.GM.2.1** Measure angles in geometric figures and real-world objects with a protractor or angle ruler. |
| **4.GM.2.2** Find the perimeter of a polygon, given the lengths of the sides. |
| **4.GM.2.3** Find the area of 2-D figures by counting total number of same-size square units that cover the shape without gaps or overlaps |
| **4.GM.2.4** Choose an appropriate instrument (e.g., ruler, yard/meter stick, tape measure) and measure the length of an object to the nearest whole centimeter or quarter-inch. |
| **4.GM.2.5** Solve problems that deal with measurements of length, when to use liquid volumes, when to use mass, temperatures above zero and money using addition, subtraction, multiplication, or division as appropriate (customary and metric). |

| **4.GM.3** Determine elapsed time and convert between units of time. | **4.GM.3.1** Determine elapsed time. |
| --- | --- |
| **4.GM.3.2** Solve problems involving the conversion of one measure of time to another. |
| **Data & Probability (D)** |
| **4.D.1** Collect, organize, and analyze data. | **4.D.1.1** Represent data on a frequency table or line plot marked with whole numbers and fractions using appropriate titles, labels, and units. |
| **4.D.1.2** Use tables, bar graphs, timelines, and Venn diagrams to display data sets. The data may include benchmark fractions or decimals (1/4, 1/3, 1/2, 2/3, 3/4, 0.25, 0.50, 0.75). |
| **4.D.1.3** Solve one- and two-step problems using data in whole number, decimal, or fraction form in a frequency table and line plot. |

| **Develop a Deep and Flexible Conceptual Understanding** | **Develop Accurate and Appropriate Procedural Fluency** | **Develop Strategies for Problem Solving** | **Develop Mathematical Reasoning** | **Develop a Productive Mathematical Disposition** | **Develop the Ability to Make Conjectures, Model, and Generalize** | **Develop the Ability to Communicate Mathematically** |
| --- | --- | --- | --- | --- | --- | --- |
| **Number & Operations (N)** |
| **5.N.1** Divide multi-digit numbers and solve real-world and mathematical problems using arithmetic. | **5.N.1.1** Estimate solutions to division problems in order to assess the reasonableness of results. |
| **5.N.1.2** Divide multi-digit numbers, by one and two digit divisors, using efficient and generalizable procedures, based on knowledge of place value, including standard algorithms. |
| **5.N.1.3** Recognize that quotients can be represented in a variety of ways, including a whole number with a remainder, a fraction or mixed number, or a decimal and consider the context in which a problem is situated to select and interpret the most useful form of the quotient for the solution. |
| **5.N.1.4** Solve real-world and mathematical problems requiring addition, subtraction, multiplication and division of multi-digit whole numbers. Use various strategies, including the inverse relationships between operations, the use of technology, and the context of the problem to assess the reasonableness of results. |
| **5.N.2** Read, write, represent and compare fractions and decimals; recognize and write equivalent fractions; convert between fractions and decimals; use fractions and decimals in real-world and mathematical situations. | **5.N.2.1** Represent decimal fractions (e.g. 1/10, 1/100) using a variety of models (e.g., 10 by 10 grids, rational number wheel, base-ten blocks, meter stick) and make connections between fractions and decimals (e.g., the visual for 1/10 is the same as for 0.1). |
| **5.N.2.2** Represent, read and write decimals using place value to describe decimal numbers including fractional numbers as small as thousandths and whole numbers as large as millions. |
| **5.N.2.3** Compare and order fractions and decimals, including mixed numbers and fractions less than one, and locate on a number line. |
| **5.N.2.4** Recognize and generate equivalent decimals, fractions, mixed numbers and fractions less than one in various contexts. |
| **5.N.3** Add and subtract fractions with like and unlike denominators, mixed numbers and decimals to solve real-world and mathematical problems. | **5.N.3.1** Estimate sums and differences of fractions with like and unlike denominators, mixed numbers, and decimals to assess the reasonableness of the results. |
| **5.N.3.2** Using the meanings of fractions, meanings of whole number addition and subtraction, and inverse relationships to illustrate addition and subtraction of fractions with like and unlike denominators, mixed numbers, and decimals using a variety of representations (e.g., fraction strips, area models, number lines, fraction rods). |
| **5.N.3.3** Add and subtract fractions with like and unlike denominators, mixed numbers, and decimals, using efficient and generalizable procedures, including but not limited to standard algorithms in order to solve real-world and mathematical problems including those involving money, measurement, geometry, and data. |
| **5.N.3.4** Find 0.1 more than a number and 0.1 less than a number. Find 0.01 more than a number and 0.01 less than a number. Find 0.001 more than a number and 0.001 less than a number. |

| **Algebraic Reasoning & Algebra (A)** |
| --- |
| **5.A.1** Create and use tables, graphs and rules with whole numbers to describe patterns to solve real-world and mathematical problems. | **5.A.1.1** Create and use rules (up to two operations) and tables to describe patterns of change and make predictions and generalizations about real-world and mathematical problems. |
| **5.A.1.2** Use a rule or table to represent ordered pairs of whole numbers and graph these ordered pairs on a coordinate system. |
| **5.A.2** Understand and interpret expressions, equations, and inequalities involving variables and whole numbers, and use them to represent and evaluate real-world and mathematical problems. | **5.A.2.1** Generate equivalent numerical expressions to evaluate problems involving whole numbers by applying the commutative, associative, and distributive properties and order of operations (no exponents). |
| **5.A.2.2** Determine whether an equation or inequality involving a variable is true or false for a given value of the variable. |
| **5.A.2.3** Evaluate expressions involving variables when values for the variables are given. |
| **Geometry & Measurement (GM)** |
| **5.GM.1** Describe, classify, and draw representations of two- and three-dimensional figures. | **5.GM.1.1** Describe, classify and construct triangles, including equilateral, right, scalene, and isosceles triangles. Recognize triangles in various contexts. |
| **5.GM.1.2** Describe and classify three-dimensional figures including cubes, rectangular prisms and pyramids by the number of edges, faces or vertices as well as the shapes of faces. |
| **5.GM.1.3** Recognize and draw a net for a three-dimensional figure (e.g., cubes, rectangular prisms, pyramids). |
| **5.GM.2** Determine the area of rectangles and polygons that can be decomposed into rectangles. | **5.GM.2.1** Develop and use formulas to determine the area of rectangles. Justify why length and width are multiplied to find the area of a rectangle by breaking the rectangle into one unit by one unit squares and viewing these as grouped into rows and columns. |
| **5.GM.2.2** Find the area of polygons that can be decomposed into rectangles. |
| **5.GM.3** Understand angle and length as measurable attributes of real-world and mathematical objects. Use various tools to measure angles and lengths. | **5.GM.3.1** Measure and compare angles according to size. Classify angles as acute, right, obtuse, and straight. |
| **5.GM.3.2** Choose an appropriate instrument (e.g., ruler, yard/meter stick, tape measure) and measure the length of an object to the nearest whole centimeter or 1/16-inch. |

| **Data & Probability (D)** |
| --- |
| **5.D.1** Display and analyze data to find the range and measures of central tendency (mean, median, and mode). | **5.D.1.1** Find the measures of central tendency (mean, median, or mode) and range of a set of data. Understand that the mean is a “leveling out” or central balance point of the data. |
| **5.D.1.2** Create and analyze line graphs and double-bar graphs using whole numbers, fractions and decimals. |

| **Develop a Deep and Flexible Conceptual Understanding** | **Develop Accurate and Appropriate Procedural Fluency** | **Develop Strategies for Problem Solving** | **Develop Mathematical Reasoning** | **Develop a Productive Mathematical Disposition** | **Develop the Ability to Make Conjectures, Model, and Generalize** | **Develop the Ability to Communicate Mathematically** |
| --- | --- | --- | --- | --- | --- | --- |
| **Number & Operations (N)** |
| **6.N.1** Read, write, represent and compare integers and positive rational numbers expressed as fractions, decimals, percents, and ratios; write positive integers as products of factors; use these representations in real-world and mathematical situations. | **6.N.1.1** Locate integers and positive rational numbers on a number line and understand the concept of opposites. |
| **6.N.1.2** Compare and order positive rational numbers, represented in various forms, or integers using the symbols <, >, and =. |
| **6.N.1.3** Explain that a percent represents parts out of 100 and ratios to 100 (e.g., 75% corresponds to the ratio 75 to 100). |
| **6.N.1.4** Determine equivalencies among fractions, decimals, and percents. Select among these representations to solve problems. |
| **6.N.1.5** Factor whole numbers and express a whole number as a product of prime factors with exponents. |
| **6.N.1.6** Determine greatest common factors and least common multiples. Use common factors and multiples to calculate with fractions and find equivalent fractions. |
| **6.N.2** Add and subtract integers in order to solve real-world and mathematical problems. | **6.N.2.1** Estimate solutions to problems involving addition and subtraction of positive and negative integers in order to assess the reasonableness of results. |
| **6.N.2.2** Illustrate addition and subtraction of positive and negative integers using a variety of representations (e.g., two-color counters, number lines). |
| **6.N.2.3** Add and subtract positive and negative integers; use efficient and generalizable procedures including but not limited to standard algorithms. |
| **6.N.3** Understand the concept of ratio and its relationship to fractions and percents and to the multiplication and division of whole numbers. Use ratios to solve real-world and mathematical problems. | **6.N.3.1** Identify and use ratios to compare quantities. Recognize that comparing quantities using ratios is not the same as comparing quantities using subtraction. |
| **6.N.3.2** Determine the unit rate for ratios of quantities with different units. |
| **6.N.3.3** Apply the relationship between ratios, equivalent fractions and percents to solve problems in various contexts, including those involving mixtures and concentrations (e.g.. which mixture has a higher concentration of peanuts?). |
| **6.N.3.4** Use reasoning about multiplication and division to solve ratio and unit rate problems. |
| **6.N.4** Multiply and divide decimals, fractions, and mixed numbers; solve real-world and mathematical problems with positive rational numbers. | **6.N.4.1** Estimate solutions to problems with whole numbers, decimals, fractions, and mixed numbers and use the estimates to assess the reasonableness of results in the context of the problem. |
| **6.N.4.2** Use the meanings of fractions, meanings of whole number multiplication and division, and inverse relationships to illustrate multiplication and division of fractions and decimals using a variety of representations (e.g., fraction strips, area models, number lines, fraction rods). |
| **6.N.4.3** Multiply and divide fractions and decimals, using efficient and generalizable procedures, including but not limited to standard algorithms. |
| **6.N.4.4** Solve real-world and mathematical problems including those involving money, measurement, geometry, and data requiring arithmetic with decimals, fractions and mixed numbers. |
| **Algebraic Reasoning & Algebra (A)** |
| **6.A.1** Recognize and represent relationships between varying quantities; translate from one representation to another; use patterns, tables, graphs and rules to solve real-world and mathematical problems. | **6.A.1.1** Plot coordinates in all four quadrants. Be able to identify each quadrant, the origin, the x-axis, and the y-axis. |
| **6.A.1.2** Represent the relationship between two varying quantities with function rules, graphs and tables; translate between any two of these representations. |
| **6.A.1.3** Use variables in various contexts including whether an equation or inequality involving a variable is true or false for a given value of the variable. |
| **6.A.2** Use properties of arithmetic to generate equivalent numerical expressions and evaluate expressions involving positive rational numbers. | **6.A.2.1** Generate equivalent expressions and evaluate problems involving positive rational numbers by applying the commutative, associative, and distributive properties and order of operations. |
| **6.A.3** Use equations and inequalities to represent real-world and mathematical problems and use the idea of maintaining equality to solve equations. Interpret solutions in the original context. | **6.A.3.1** Represent real-world or mathematical situations using equations and inequalities involving variables and positive rational numbers. |
| **6.A.3.2** Solve one-step equations (e.g., 1/3x = 9) involving positive rational numbers using number sense, properties of operations and equality. Graph the solution on a number line, interpret the solution in the original context, and assess the reasonableness. |
| **Geometry & Measurement (GM)** |
| **6.GM.1** Calculate perimeter of polygons and area of squares, parallelograms, and triangles to solve real-world and mathematical problems. | **6.GM.1.1** Develop and use formulas for the area of squares and parallelograms using a variety of methods including but not limited to the standard algorithm. |
| **6.GM.1.2** Develop and use formulas to determine the area of triangles.  |
| **6.GM.1.3** Find the area of polygons that can be decomposed into triangles. |
| **6.GM.1.4** Find the perimeter of polygons to solve real-world and mathematical problems. |
| **6.GM.2** Understand and use relationships between angles in geometric figures. | **6.GM.2.1** Solve problems using the relationships between the angles (vertical, complementary, and supplementary) formed by intersecting lines. |
| **6.GM.2.2** Develop and use the fact that the sum of the interior angles of a triangle is 180 ̊ to determine missing angle measures in a triangle. |

| **6.GM.3** Choose appropriate units of measurement and use ratios to convert within measurement systems to solve real-world and mathematical problems. | **6.GM.3.1** Estimate weights, capacities and geometric measurements (e.g. distance, area, volume) using benchmarks in measurement systems (customary and metric) with appropriate units.  |
| --- | --- |
| **6.GM.3.2** Solve problems in various real-world and mathematical contexts involving conversion of weights, capacities, geometric measurements, and time within the same measurement systems using appropriate units. |
| **6.GM.4** Use translations, reflections, and rotations to establish congruency and understand symmetries. | **6.GM.4.1** Apply translations (slides), reflections (flips), and rotations (turns) to a two-dimensional figure. |
| **6.GM.4.2** Recognize that translations, reflections, and rotations preserve congruency and use them to show that two figures are congruent. |
| **6.GM.4.3** Identify and describe the line(s) of symmetry in two-dimensional shapes. |
| **Data & Probability (D)** |
| **6.D.1** Display and analyze data. | **6.D.1.1** Calculate the mean, median and mode for a set of real-world data. |
| **6.D.1.2** Explain and justify which measure of central tendency (mean, median, or mode) would provide the most descriptive information for a given set of data. |
| **6.D.1.3** Create and analyze box and whisker plots exploring how each segment contains one quarter of the data. |
| **6.D.2** Use probability to solve real-world and mathematical problems: represent probabilities using fractions and decimals. | **6.D.2.1** Represent possible outcomes using a probability continuum from impossible to certain. |
| **6.D.2.2** Determine the sample space (set of possible outcomes) for a given experiment and determine which members of the sample space are related to certain events. Sample space may be determined by the use of tree diagrams, tables or pictorial representations. |
| **6.D.2.3** Demonstrate simple experiments in which the probabilities are known and compare the resulting relative frequencies with the known probabilities, recognizing that there may be differences between the two results (e.g., heads and tails are equally likely when flipping a fair coin, but if several different students flipped fair coins 10 times, it is likely that they will find a variety of relative frequencies of heads and tails). |

| **Develop a Deep and Flexible Conceptual Understanding** | **Develop Accurate and Appropriate Procedural Fluency** | **Develop Strategies for Problem Solving** | **Develop Mathematical Reasoning** | **Develop a Productive Mathematical Disposition** | **Develop the Ability to Make Conjectures, Model, and Generalize** | **Develop the Ability to Communicate Mathematically** |
| --- | --- | --- | --- | --- | --- | --- |
| **Number & Operations (N)** |
| **7.N.1** Read, write, represent and compare positive and negative rational numbers, expressed as integers, fractions, and decimals. | **7.N.1.1** Know that every rational number can be written as the ratio of two integers or as a terminating or repeating decimal. |
| **7.N.1.2** Compare and order positive and negative rational numbers expressed in various forms using the symbols <, >, and =. |
| **7.N.1.3** Recognize and generate equivalent representations of positive and negative rational numbers, including equivalent fractions. |
| **7.N.2** Calculate with positive and negative rational numbers, and rational numbers with positive integer exponents, to solve real-world and mathematical problems. | **7.N.2.1** Estimate solutions to multiplication and division of positive and negative integers in order to assess the reasonableness of results. |
| **7.N.2.2** Illustrate multiplication and division of positive and negative integers using a variety of representations (e.g., two-color counters, number lines). |
| **7.N.2.3** Add, subtract, multiply and divide positive and negative rational numbers including integers, fractions, and terminating decimals; use efficient and generalizable procedures including but not limited to standard algorithms. |
| **7.N.2.4** Raise integers to positive integer exponents. |
| **7.N.2.5** Solve real-world and mathematical problems involving calculations with positive and negative rational numbers and positive integer exponents. |
| **7.N.2.6** Explain the relationship between the absolute value of a rational number and the distance of that number from zero on a number line. Use the symbol for absolute value. |
| **Algebraic Reasoning & Algebra (A)** |
| **7.A.1** Understand the concept of proportionality in real-world and mathematical situations, and distinguish between proportional and other relationships. | **7.A.1.1** Describe that the relationship between two variables, *x* and *y*, is proportional if it can be expressed in the form $\frac{y}{x}=k$ or $y=kx$; distinguish proportional relationships from other relationships, including inversely proportional relationships ($ xy=k$ or $y=\frac{k}{x}$ ). |
| **7.A.1.2** Recognize that the graph of a proportional relationship is a line through the origin whose slope is the unit rate (constant of proportionality). |

| **7.A.2** Recognize proportional relationships in real-world and mathematical situations; represent these and other relationships with tables, verbal descriptions, symbols, and graphs; solve problems involving proportional relationships and interpret results in the original context. | **7.A.2.1** Represent proportional relationships with tables, verbal descriptions, symbols, and graphs; translate from one representation to another. Determine the unit rate (constant of proportionality, slope or rate of change) given any of these representations. |
| --- | --- |
| **7.A.2.2** Solve multi-step problems involving proportional relationships in a variety of contexts (e.g. distance-time, percent increase or decrease, discounts, tips, unit pricing, similar figures – but not limited to these). |
| **7.A.2.3** Use proportional reasoning to solve problems involving ratios in various contexts. |
| **7.A.2.4** Use knowledge of proportions to assess the reasonableness of solutions. |
| **7.A.3** Represent and solve linear equations and inequalities. | **7.A.3.1** Write and solve two-step linear equations with one variable. |
| **7.A.3.2** Represent, write, solve, and graph one-step linear inequalities with one variable. |
| **7.A.3.3** Represent real-world or mathematical situations using equations and inequalities involving variables and positive and negative rational numbers. |
| **7.A.4** Use order of operations and algebraic properties to generate equivalent numerical and algebraic expressions containing positive and negative rational numbers and grouping symbols; evaluate such expressions. | **7.A.4.1** Use properties of algebra (limited to associative, commutative, and distributive) to generate equivalent numerical and algebraic expressions containing positive and negative rational numbers, grouping symbols and whole number exponents. |
| **7.A.4.2** Apply understanding of order of operations and grouping symbols when using calculators and other technologies. |
| **Geometry & Measurement (GM)** |
| **7.GM.1** Develop and understand the concept of surface area and volume of rectangular prisms. | **7.GM.1.1** Using a variety of tools and strategies, develop the concept that surface area of a rectangular prism can be found by wrapping the figure with same-sized square units without gaps or overlap. Use appropriate measurements such as cm2. |
| **7.GM.1.2** Using a variety of tools and strategies, develop the concept that the volume rectangular prisms can be found by counting the total number of same-sized cubic units that fill a shape without gaps or overlaps. Use appropriate measurements such as cm3. |
| **7.GM.2** Determine the area of trapezoids and area and perimeter of composite figures. | **7.GM.2.1** Develop and use the formula to determine the area of a trapezoid. |
| **7.GM.2.2** Find the area and perimeter of composite figures to solve real-world and mathematical problems. |
| **7.GM.3** Use reasoning with proportions and ratios to determine measurements, justify formulas, and solve real-world and mathematical problems involving circles and related geometric figures. | **7.GM.3.1** Demonstrate an understanding of the proportional relationship between the diameter and circumference of a circle and that the unit rate (constant of proportionality) is π and can be approximated by rational numbers such as $\frac{22}{7}$ and 3.14. |
| **7.GM.3.2** Calculate the circumference and area of circles to solve problems in various contexts, in terms of π and using approximations for π. |

| **7.GM.4** Analyze the effect of change of scale, translations and reflections on the attributes of two-dimensional figures. | **7.GM.4.1** Describe the properties of similarity, compare geometric figures for similarity, and determine scale factors. |
| --- | --- |
| **7.GM.4.2** Apply scale factors, length ratios, and area ratios to determine side lengths and areas of similar triangles and similar rectangles. |
| **7.GM.4.3** Use proportions and ratios to solve problems involving scale drawings. |
| **7.GM.4.4** Graph and describe translations and reflections of figures on a coordinate grid and determine the coordinates of the vertices of the figure after the transformation. |
| **Data & Probability (D)** |
| **7.D.1** Display and analyze data in a variety of ways. | **7.D.1.1** Design simple experiments, collect data and calculate measures of central tendency (mean, median, and mode) and spread (range). Use these quantities to draw conclusions about the data collected and make predictions. |
| **7.D.1.2** Use reasoning with proportions to display and interpret data in circle graphs (pie charts) and histograms. Choose the appropriate data display and know how to create the display using a spreadsheet or other graphing technology. |
| **7.D.2** Calculate probabilities and reason about probabilities using proportions to solve real-world and mathematical problems. | **7.D.2.1** Determine the theoretical probability of an event using the ratio between the size of the event and the size of the sample space; represent probabilities as percents, fractions and decimals between 0 and 1. |
| **7.D.2.2** Calculate probability as a fraction of the total number of outcomes in a sample space or as a fraction of area. Express probabilities as percents, decimals and fractions. |
| **7.D.2.3** Use proportional reasoning to draw conclusions about and predict relative frequencies of outcomes based on probabilities (e.g., when rolling a number cube 600 times, one would predict that a 3 or 6 would be rolled roughly 200 times, but probably not exactly 200 times). |

| **Develop a Deep and Flexible Conceptual Understanding** | **Develop Accurate and Appropriate Procedural Fluency** | **Develop Strategies for Problem Solving** | **Develop Mathematical Reasoning** | **Develop a Productive Mathematical Disposition** | **Develop the Ability to Make Conjectures, Model, and Generalize** | **Develop the Ability to Communicate Mathematically** |
| --- | --- | --- | --- | --- | --- | --- |
| **Number & Operations (N)** |
| **PA.N.1** Read, write, compare, classify, and represent real numbers and use them to solve problems in various contexts. | **PA.N.1.1** Develop and apply the properties of integer exponents to generate equivalent numerical and algebraic expressions, including a0 = 1. |
| **PA.N.1.2** Express approximations of very large and very small numbers using scientific notation. |
| **PA.N.1.3** Multiply and divide numbers expressed in scientific notation, express the answer in scientific notation. |
| **PA.N.1.4** Classify real numbers as rational or irrational. Recognize that when a square root of a positive integer is not an integer, then it is irrational. Recognize that the sum of a rational number and an irrational number is irrational, and the product of a non-zero rational number and an irrational number is irrational. |
| **PA.N.1.5** Compare real numbers; locate real numbers on a number line. Identify the square root of a perfect square to 400 or, if it is not a perfect square root, locate it as a real number between two consecutive positive integers. |
| **Algebraic Reasoning & Algebra (A)** |
| **PA.A.1** Understand the concept of function in real-world and mathematical situations, and distinguish between linear and nonlinear functions. | **PA.A.1.1** Recognize that a function is a relationship between an independent variable and a dependent variable in which the value of the independent variable determines the value of the dependent variable. |
| **PA.A.1.2** Use linear functions to represent real-world and mathematical situations |
| **PA.A.1.3** Identify a function as linear if it can be expressed in the form$ y=mx+b$ or if its graph is a straight line. |
| **PA.A.2** Recognize linear functions in real-world and mathematical situations; represent linear functions and other function with tables, verbal descriptions, symbols, and graphs; solve problems involving linear functions and interpret results in the original context. | **PA.A.2.1** Represent linear functions with tables, verbal descriptions, symbols, and graphs; translate from one representation to another. |
| **PA.A.2.2** Identify, describe, and analyze linear relationships between two variables (e.g., as the value of *x* increases on a table, do the values of *y* increase or decrease, identify a positive rate of change on a graph and compare it to a negative rate of change). |
| **PA.A.2.3** Identify graphical properties of linear functions including slope and intercepts. Know that the slope equals the rate of change, and that the *y*-intercept is zero when the function represents a proportional relationship. |
| **PA.A.2.4** Predict the effect on the graph of a linear function when the slope or *y*-intercept changes (e.g., make predictions from graphs, identify the slope or y-intercept in the equation $y=mx+b$ and relate to a graph). Use appropriate tools to examine these effects. |
|  | **PA.A.2.5** Solve problems involving linear functions and interpret results in the original context. |

| **PA.A.3** Generate equivalent numerical and algebraic expressions and use algebraic properties to evaluate expressions. | **PA.A.3.1** Use substitution to simplify and evaluate algebraic expressions. |
| --- | --- |
| **PA.A.3.2** Justify steps in generating equivalent expressions by identifying the properties used, including the properties of operations (associative, commutative, and distributive laws) and the order of operations, including grouping symbols. |
| **PA.A.4** Represent real-world and mathematical problems using equations and inequalities involving linear expressions. Solve and graph equations and inequalities symbolically and graphically. Interpret solutions in the original context. | **PA.A.4.1** Represent, write, and solve multi-step linear equations with one variable to solve mathematical and real-world problems. Interpret solutions in the original context. |
| **PA.A.4.2** Represent, write, and solve one- and two-step linear inequalities with one variable using the properties of inequality. Graph the solutions on a number line. |
| **PA.A.4.3** Represent real-world situations using equations and inequalities involving one variable. |
| **Geometry & Measurement (GM)** |
| **PA.GM.1** Solve problems involving right triangles using the Pythagorean Theorem. | **PA.GM.1.1** Informally justify the Pythagorean Theorem using measurements, diagrams or dynamic software and use the Pythagorean Theorem to solve problems involving right triangles. |
| **PA.GM.1.2** Determine the distance between two points on a horizontal or vertical line in a coordinate system. Use the Pythagorean Theorem to find the distance between any two points in a coordinate system. |
| **PA.GM.2** Calculate surface area and volume of three-dimensional figures. | **PA.GM.2.1** Calculate the surface area of a rectangular prism using decomposition or nets. Use appropriate measurements such as cm2. |
| **PA.GM.2.2** Calculate the surface area of a cylinder, in terms of π and using approximations for π, using decomposition or nets. Use appropriate measurements such as cm2. |
| **PA.GM.2.3** Develop and use the formulas $V=lwh$ and $V=Bh$ to determine the volume of rectangular prisms. Justify why base area (*B*) and height (*h*) are multiplied to find the volume of a rectangular prism by breaking the prism into layers of rectangles. Use appropriate measurements such as cm3. |
| **PA.GM.2.4** Develop and use the formulas $V=πr^{2}h$ and $V=Bh$ to determine the volume of right cylinders, in terms of π and using approximations for π. Justify why base area (*B*) and height (*h*) are multiplied to find the volume of a right cylinder by breaking the cylinder into layers of circles with radius (*r*). Use appropriate measurements such as cm3. |

| **Data & Probability (D)** |
| --- |
| **PA.D.1** Display and interpret data in a variety of ways, including using scatterplots and approximate lines of best fit. Use lines of best fit to draw conclusions about data. | **PA.D.1.1** Describe the impact that inserting or deleting a data point has on the mean and the median of a data set. Know how to create data displays using a spreadsheet and use a calculator to examine this impact. |
| **PA.D.1.2** Explain how outliers affect measures of central tendency. |
| **PA.D.1.3** Collect, display and interpret data using scatterplots. Use the shape of the scatterplot to informally estimate a line of best fit. Use appropriate titles, labels and units. |
| **PA.D.2** Calculate experimental probabilities and reason about probabilities to solve real-world and mathematical problems. | **PA.D.2.1** Calculate experimental probabilities and represent them as percents, fractions and decimals between 0 and 1 inclusive. Use experimental probabilities to make predictions when actual probabilities are unknown (e.g., repeatedly draw colored chips with replacement for a bag with an unknown mixture of chips, record relative frequencies, and use the results to make predictions about the contents of the bag). |
| **PA.D.2.2** Determine how samples are chosen (random, limited, biased) to draw and support conclusions about generalizing a sample to a population (e.g., Is the average height of a men’s college basketball team a good representative sample for height predictions?). |
| **PA.D.2.3** Compare and contrast dependent and independent events. |

| **Develop a Deep and Flexible Conceptual Understanding** | **Develop Accurate and Appropriate Procedural Fluency** | **Develop Strategies for Problem Solving** | **Develop Mathematical Reasoning** | **Develop a Productive Mathematical Disposition** | **Develop the Ability to Make Conjectures, Model, and Generalize** | **Develop the Ability to Communicate Mathematically** |
| --- | --- | --- | --- | --- | --- | --- |
| **Number & Operations (N)** |
| **A1.N.1** Extend the understanding of number and operations to include square roots and cube roots. | **A1.N.1.1** Write square roots and cube roots of monomial algebraic expressions in simplest radical form. |
| **A1.N.1.2** Add, subtract, multiply, and simplify square roots of monomial algebraic expressions and divide square roots of whole numbers, rationalizing the denominator when necessary. |
| **Algebraic Reasoning & Algebra (A)** |
| **A1.A.1** Represent and solve mathematical and real-world problems using linear equations, absolute value equations, and systems of equations; interpret solutions in the original context. | **A1.A.1.1** Use knowledge of solving multi-step equations to represent and solve mathematical and real-world problems (e.g., angle measures, geometric formulas, science, or statistics) and interpret the solutions in the original context.  |
| **A1.A.1.2** Solve absolute value equations and interpret the solutions in the original context.  |
| **A1.A.1.3** Solve systems of linear equations with a maximum of two variables by graphing (may include graphing calculator or other appropriate technology), substitution, and elimination, and interpret the solutions in the original context. |
| **A1.A.2** Represent and solve real-world and mathematical problems using linear inequalities, compound inequalities and systems of linear inequalities; interpret solutions in the original context. | **A1.A.2.1** Represent relationships in various contexts with linear inequalities; solve the resulting inequalities, graph on a coordinate plane, and interpret the solutions. |
| **A1.A.2.2** Represent relationships in various contexts with compound and absolute value inequalities and solve the resulting inequalities by graphing, and/or interpreting the solutions on a number line. |
| **A1.A.2.3** Solve systems of linear inequalities with a maximum of two variables; graph and interpret the solutions on a coordinate plane. |
| **A1.A.3** Generate equivalent algebraic expressions and use algebraic properties to evaluate expressions and arithmetic and geometric sequences. | **A1.A.3.1** Solve literal equations involving several variables for one variable in terms of the others. |
| **A1.A.3.2** Simplify polynomial expressions by adding, subtracting, or multiplying. |
| **A1.A.3.3** Factor common monomial factors from polynomial expressions and factor quadratic expressions with a leading coefficient of 1.  |
| **A1.A.3.4** Evaluate linear, absolute value, rational, and radical expressions. Include applying a nonstandard operation such as $a \bigodot\_{}^{}b=2a+b$. |
| **A1.A.3.5** Recognize that arithmetic sequences are linear using equations, tables, graphs, and verbal descriptions. Using the pattern, find the next term. |
| **A1.A.3.6** Recognize that geometric sequences are exponential using equations, tables, graphs and verbal descriptions. Given the formula $f\left(x\right)=a(r)^{x}$, find the next term and define the meaning of $a$ and $r$within the context of the problem. |

| **A1.A.4** Analyze mathematical change involving linear equations in real-world and mathematical problems. | **A1.A.4.1** Calculate the slope of a line using a graph, an equation, two points, or a set of data points. Interpret the slope and *x*- and *y*-intercepts in real-world and mathematical problems. |
| --- | --- |
| **A1.A.4.2** Solve mathematical and real-world problems involving lines that are parallel, perpendicular, horizontal, or vertical. |
| **A1.A.4.3** Express linear equations in slope-intercept, point-slope, and standard forms and convert between these forms. Given sufficient information (slope and y-intercept, slope and one-point on the line, two points on the line, *x*- and *y*-intercept, or a set of data points), write the equation of a line. |
| **A1.A.4.4** Relate a graph to a situation described qualitatively (e.g., faster change, slower change). |
| **Functions (F)** |
| **A1.F.1** Understand functions as descriptions of covariation (how related quantities vary together) in real-world and mathematical problems. | **A1.F.1.1** Distinguish between relations and functions using the vertical line test and the definition of a function. |
| **A1.F.1.2** Identify the dependent and independent variables as well as the domain and range given a function, equation, or graph. Identify restrictions on the domain and range in real-world contexts. |
| **A1.F.1.3** Write linear functions in terms of real-world context using function notation. |
| **A1.F.1.4** Given a graph modeling a real-world situation, read and interpret the linear piecewise function (excluding step functions). |
| **A1.F.2** Understand that families of functions are characterized by the rate of change. | **A1.F.2.1** Distinguish between linear and nonlinear data (including exponential) through tables, graphs, equations, and real-world contexts. |
| **A1.F.2.2** Recognize the graph of the functions $f\left(x\right)=x$ and $f\left(x\right)=|x|$ and predict the effects of transformations [ $f(x+c)$ and $f(x)+c$, where *c* is a positive or negative constant] algebraically and graphically using various methods and tools which may include graphing calculators. |
| **A1.F.3** Represent functions in multiple ways and use the representation to interpret real-world and mathematical problems. | **A1.F.3.1** Identify equivalent representations of linear equations, graphs, tables, and real-world situations. |
| **A1.F.3.2** Use function notation; evaluate a function, including nonlinear, at a given point in its domain algebraically and graphically. Interpret the results in terms of real-world and mathematical problems. |
| **A1.F.3.3** Add, subtract, and multiply functions with common domains using function notation. |

| **Data & Probability (D)** |
| --- |
| **A1.D.1** Display and analyze data. | **A1.D.1.1** Describe a data set using data displays, describe and compare data sets using summary statistics, including measures of central tendency, location, and spread. Measures of central tendency and location include mean, median, mode, and percentile. Measures of spread include standard deviation and range. Know how to use calculators, spreadsheets, or other appropriate technology to display data and calculate summary statistics. |
| **A1.D.1.2** Collect data and use scatterplots to analyze patterns and describe linear relationships between two variables. Using graphing technology, determine regression lines and correlation coefficients; use regression lines to make predictions and correlation coefficients to assess the reliability of those predictions. |
| **A1.D.1.3** Interpret graphs as being discrete or continuous. |
| **A1.D.2** Calculate probabilities and apply probability concepts. | **A1.D.2.1** Select and apply counting procedures, such as the multiplication and addition principles and tree diagrams, to determine the size of a sample space (the number of possible outcomes) and to calculate probabilities. |
| **A1.D.2.2** Describe the concepts of intersections, unions, and complements using Venn diagrams to evaluate probabilities. Understand the relationships between these concepts and the words AND, OR, and NOT. |
| **A1.D.2.3** Calculate experimental probabilities by performing simulations or experiments involving a probability model and using relative frequencies of outcomes. |
| **A1.D.2.4** Apply probability concepts to real-world situations to make informed decisions. |

| **Develop a Deep and Flexible Conceptual Understanding** | **Develop Accurate and Appropriate Procedural Fluency** | **Develop Strategies for Problem Solving** | **Develop Mathematical Reasoning** | **Develop a Productive Mathematical Disposition** | **Develop the Ability to Make Conjectures, Model, and Generalize** | **Develop the Ability to Communicate Mathematically** |
| --- | --- | --- | --- | --- | --- | --- |
| **Geometry: Reasoning & Logic (G.RL)** |
| **G.RL.1** Use appropriate tools and logic to evaluate mathematical arguments. | **G.RL.1.1** Understand the use of undefined terms, definitions, postulates, and theorems in logical arguments/proofs. |
| **G.RL.1.2** Analyze and draw conclusions based on a set of conditions using inductive and deductive reasoning. Recognize the logical relationships between a conditional statement and its inverse, converse, and contrapositive. |
| **G.RL.1.3** Assess the validity of a logical argument and give counterexamples to disprove a statement. |
| **Geometry: 2-Dimensional Shapes (G.2D)** |
| **G.2D.1** Discover, evaluate and analyze the relationships between lines, angles, and polygons to solve real-world and mathematical problems; express proofs in a form that clearly justifies the reasoning, such as two-column proofs, paragraph proofs, flow charts, or illustrations. | **G.2D.1.1** Apply the properties of parallel and perpendicular lines, including properties of angles formed by a transversal, to solve real-world and mathematical problems; determine if two lines are parallel using algebraic reasoning and proofs. |
| **G.2D.1.2** Apply the properties of angles, including corresponding, exterior, interior, vertical, complementary, and supplementary angles to solve real-world and mathematical problems using algebraic reasoning and proofs. |
| **G.2D.1.3** Apply theorems involving the interior and exterior angle sums of polygons and use them to solve real-world and mathematical problems using algebraic reasoning and proofs. |
| **G.2D.1.4** Apply the properties of special quadrilaterals (square, rectangle, trapezoid, isosceles trapezoid, rhombus, kite, parallelogram) and use them to solve real-world and mathematical problems involving angle measures and segment lengths using algebraic reasoning and proofs. |
| **G.2D.1.5** Use coordinate geometry to represent and analyze line segments and polygons, including determining lengths, midpoints, and slopes of line segments. |
| **G.2D.1.6** Apply the properties of polygons to solve real-world and mathematical problems involving perimeter and area (e.g., triangles, special quadrilaterals, regular polygons – up to 12 sided figures, composite figures). |
| **G.2D.1.7** Apply the properties of congruent or similar polygons to solve real-world and mathematical problems using algebraic and logical reasoning. |
| **G.2D.1.8** Construct logical arguments to prove triangle congruence (SSS, SAS, ASA, AAS and HL) and triangle similarity (AA, SSS, SAS). |
| **G.2D.1.9** Use numeric, graphic and algebraic representations of transformations in two dimensions, such as reflections, translations, dilations, and rotations about the origin by multiples of 90 ̊, to solve problems involving figures on a coordinate plane and identify types of symmetry. |

| **Geometry: 3-Dimensional Shapes (G.3D)** |
| --- |
| **G.3D.1** Solve real-world and mathematical problems involving 3-dimensional figures. | **G.3D.1.1** Solve real-world and mathematical problems using the surface area and volume of prisms, cylinders, pyramids, cones, spheres, and composites of these figures. Use nets, measuring devices, or formulas as appropriate. |
| **G.3D.1.2** Use ratios of similar 3-dimensional figures to make conjectures, generalize, and to solve for unknown values such as angle measures, side lengths, perimeter or circumference of a face, area of a face, and volume. |
| **Geometry: Circles (G.C)** |
| **G.C.1** Solve real-world and mathematical problems using the properties of circles. | **G.C.1.1** Apply the properties of circles to solve problems involving circumference and area, using approximate values and in terms of π, using algebraic and logical reasoning. |
| **G.C.1.2** Apply the properties of circles and relationships among angles, arcs, and distances in a circle among radii, chords, secants and tangents to solve problems using algebraic and logical reasoning. |
| **G.C.1.3** Recognize and write the radius $r$, center $(h,k)$, and standard form of the equation of a circle $(x-h)^{2}+(y-k)^{2}=r^{2}$ with and without graphs. |
| **G.C.1.4** Apply the distance and midpoint formulas, where appropriate, to develop the equation of a circle in standard form. |
| **Geometry: Right Triangle Trigonometry (G.RT)** |
| **G.RT.1** Develop and verify mathematical relationships of right triangles and trigonometric ratios to solve real-world and mathematical problems. | **G.RT.1.1** Apply the distance formula and the Pythagorean Theorem and its converse to solve real-world and mathematical problems, finding approximate and exact values, using algebraic and logical reasoning (include Pythagorean Triples). |
| **G.RT.1.2** Verify and apply properties of right triangles, including properties of 45-45-90 and 30-60-90 triangles, to solve problems using algebraic and logical reasoning. |
| **G.RT.1.3** Use the definition of the trigonometric functions to determine the sine, cosine and tangent ratio of an acute angle in a right triangle. Apply the inverse trigonometric functions as ratios (sine, cosine, and tangent) to find the measure of an acute angle in right triangles. |
| **G.RT.1.4** Apply the trigonometric functions as ratios (sine, cosine and tangent) to find side lengths in right triangles in real-world and mathematical problems. |

| **Develop a Deep and Flexible Conceptual Understanding** | **Develop Accurate and Appropriate Procedural Fluency** | **Develop Strategies for Problem Solving** | **Develop Mathematical Reasoning** | **Develop a Productive Mathematical Disposition** | **Develop the Ability to Make Conjectures, Model, and Generalize** | **Develop the Ability to Communicate Mathematically** |
| --- | --- | --- | --- | --- | --- | --- |
| **Number & Operations (N)** |
| **A2.N.1** Extend the understanding of number and operations to include complex numbers, matrices, radical expressions, and expressions written with rational exponents. | **A2.N.1.1** Find the value of $i^{n}$ for any whole number n. |
| **A2.N.1.2** Simplify, add, subtract, multiply, and divide complex numbers. |
| **A2.N.1.3** Identify the order (dimension) of a matrix, add and subtract matrices of appropriate dimensions, and multiply a matrix by a scalar to create a new matrix. |
| **A2.N.1.4** Add, subtract, multiply, divide and simplify radical expressions and expressions containing rational exponents. |
| **Algebraic Reasoning & Algebra (A)** |
| **A2.A.1** Represent and solve mathematical and real-world problems using nonlinear equations and systems of linear equations; interpret the solutions in the original context. | **A2.A.1.1** Represent real-world or mathematical problems using quadratic equations and solve using various methods (including graphing calculator or other appropriate technology), factoring, completing the square, and the quadratic formula. Find non-real roots when they exist. |
| **A2.A.1.2** Represent real-world or mathematical problems using exponential equations, such as compound interest, depreciation, and population growth, and solve these equations graphically (including with graphing calculators or other appropriate technology) or algebraically. |
| **A2.A.1.3** Solve one-variable rational equations with at most three distinct denominators. Check for extraneous solutions. |
| **A2.A.1.4** Solve polynomial equations with real roots using various methods and tools that may include factoring, polynomial division, synthetic division, graphing calculators or other appropriate technology. |
| **A2.A.1.5** Solve one-variable square root equations involving only one radical on either one or both sides of the equal sign. Check for extraneous solutions. |
| **A2.A.1.6** Solve common and natural logarithmic equations using the definition and properties of logarithms. |
| **A2.A.1.7** Solve real-world and mathematical problems that can be modeled using arithmetic or finite geometric sequences or series given formulas for the nth term and the sum. Graphing calculators or other appropriate technology may be used.  |
| **A2.A.1.8** Represent real-world or mathematical problems using systems of linear equations with a maximum of three variables and solve using various methods that may include substitution, elimination, and graphing (including graphing calculators or other appropriate technology).  |
| **A2.A.1.9** Solve systems of equations containing one linear equation and one quadratic equation using tools that may include graphing calculators or other appropriate technology. |
| **A2.A.1.10** Assess the reasonableness of a solution in its given context and compare the solution to appropriate graphical or numerical estimates; interpret a solution in the context of the domain of a function or expression. |
| **A2.A.2** Represent and analyze mathematical situations and structures using algebraic symbols using various strategies to write equivalent forms of expressions. | **A2.A.2.1** Factor polynomial expressions, including but not limited to trinomials, differences of squares, and sums and differences of cubes using a variety of tools and strategies, such as factoring by grouping. |
| **A2.A.2.2** Add, subtract, multiply, divide, and simplify polynomial and rational expressions. |
| **A2.A.2.3** Recognize that a quadratic function has different equivalent representations [ $f\left(x\right)=ax^{2}+bx+c, f\left(x\right)=a(x-h)^{2}+k$, or in factored form] and identify the representation that is most appropriate for the situation (solving or graphing) .  |
| **A2.A.2.4** Rewrite expressions involving radicals and rational exponents using the properties of exponents. |
| **Functions (F)** |
| **A2.F.1** Understand functions as descriptions of covariation (how related quantities vary together). | **A2.F.1.1** Use algebraic, interval, and set notations to specify the domain and range of functions of various types and evaluate a function at a given point in its domain. |
| **A2.F.1.2** Recognize the graphs of exponential, radical (square root and cube root only), quadratic, and logarithmic functions. Predict the effects of transformations [ $f(x+c)$, $f(x)+c$, $f(cx)$, and $cf(x)$, where *c* is a positive or negative constant], where c is a positive or negative constant] algebraically and graphically, using various methods and tools that may include graphing calculators or other appropriate technology.  |
| **A2.F.1.3** Graph a quadratic function. Identify the *x*- and *y*-intercepts, maximum or minimum value, axis of symmetry, and vertex using various methods and tools that may include a graphing calculator or appropriate technology. |
| **A2.F.1.4** Graph exponential and logarithmic functions. Identify asymptotes and *x*- and *y*-intercepts using various methods and tools that may include graphing calculators or other appropriate technology. Recognize exponential decay and growth graphically and algebraically.  |
| **A2.F.1.5** Analyze the graph of a polynomial function by identifying the domain, range, intercepts, zeros, relative maxima, relative minima, and intervals of increase and decrease.  |
| **A2.F.1.6** Graph a rational function and identify the *x*- and *y*-intercepts, vertical and horizontal asymptotes, using various methods and tools that may include a graphing calculator or other appropriate technology. (Excluding slant or oblique asymptotes and holes.) |
| **A2.F.1.7** Graph a radical function (square root and cube root only) and identify the *x*- and *y*-intercepts using various methods and tools that may include a graphing calculator or other appropriate technology. |
| **A2.F.1.8** Graph piecewise functions with no more than three branches. (Branches may include linear, quadratic, or exponential functions.) |
| **A2.F.1.9** Given the graph of a piecewise function, analyze the function by identifying the domain, range, intercepts, and intervals for which it is increasing, decreasing, and constant. |

| **A2.F.2** Understand functions through algebraic combinations, compositions, and inverses, if they exist. | **A2.F.2.1** Add, subtract, multiply, and divide functions using function notation and recognize domain restrictions. |
| --- | --- |
| **A2.F.2.2** Combine functions by composition and recognize that $f\left(x\right)$ and $g(x)$ are inverse functions if $f\left(g\left(x\right)\right)=g\left(f\left(x\right)\right)=x$. |
| **A2.F.2.3** Find and graph the inverse of a function, if it exists, and know that the graphs of a function and its inverse are reflections of each other about the line $y=x$. |
| **A2.F.2.4** Apply the inverse relationship between exponential and logarithmic functions to convert from one form to another. |
| **Data & Probability (D)** |
| **A2.D.1** Display and analyze data. | **A2.D.1.1** Use the mean and standard deviation of a data set to fit it to a normal distribution (bell-shaped curve). |
| **A2.D.1.2** Collect data and use scatterplots to analyze patterns and describe linear, exponential or quadratic relationships between two variables. Using graphing calculators or other appropriate technology, determine regression equation and correlation coefficients; use regression equations to make predictions and correlation coefficients to assess the reliability of those predictions. |
| **A2.D.1.3** Based upon a real-world context, recognize whether a discrete or continuous graphical representation is appropriate and then create the graph. |
| **A2.D.2** Analyze statistical thinking to draw inferences, make predictions, and justify conclusions. | **A2.D.2.1** Evaluate reports based on data published in the media by identifying the source of the data, the design of the study, and the way the data are analyzed and displayed. Given spreadsheets, tables, or graphs, recognize and analyze distortions in data displays. Show how graphs and data can be distorted to support different points of view. |
| **A2.D.2.2** Identify and explain misleading uses of data. Recognize when arguments based on data confuse correlation and causation. |

| **Number & Operations (N)** |
| --- |
| **Topic** | **Pre-Kindergarten (PK)** | **Kindergarten (K)** | **First Grade (1)** |
| **Quantity** | **PK.N.1 Know number names and count in sequence.****PK.N.1.1** Count aloud forward in sequence by 1’s to 20.**PK.N.1.2** Recognize and name written numerals 0-10.**PK.N.1.3** Recognize that zero represents the count of no objects. | **K.N.1 Understand the relationship between quantities and whole numbers.****K.N.1.1** Count aloud forward in sequence by 1’s to 100.**K.N.1.2** Recognize that a number can be used to represent how many objects are in a set up to 10.**K.N.1.3** Use ordinal numbers to represent the position of an object in a sequence up to 10.**K.N.1.4** Recognize without counting (subitizing\*) the quantity of a small group of objects in organized and random arrangements up to 10 (e.g. dot patterns).**Clarification statement**: Subitizing is defined as instantly recognizing the quantity of a set without having to count. “Subitizing” is not a vocabulary word and is not meant for student discussion at this age.**K.N.1.5** Count forward, with and without objects, from any given number up to 10.**K.N.1.6** Read, write, discuss, and represent whole numbers from 0 to at least 10. Representations may include numerals, pictures, real objects and picture graphs, spoken words, and manipulatives.**K.N.1.7** Find a number that is 1 more or 1 less than a given number up to 10.**K.N.1.8** Compare and order whole numbers, with and without objects, from 0 to 10 (e.g., more than, less than, equal to). | **1.N.1 Count, compare and represent whole numbers up to 100, with an emphasis on groups of tens and ones.****1.N.1.1** Recognize numbers to 20 without counting (subitizing) the quantity of structured arrangements (e.g. ten frames, arrays, dot patterns).**Clarification statement**: Subitizing is defined as instantly recognizing the quantity of a set without having to count. “Subitizing” is not a vocabulary word and is not meant for student discussion at this age.**1.N.1.2** Use concrete models to describe whole numbers between 10 and 100 in terms of tens and ones.**1.N.1.3** Read, write, discuss, and represent whole numbers up to 100. Representations may include numerals, addition and subtraction, pictures, tally marks, number lines and manipulatives, such as bundles of sticks and base 10 blocks.**1.N.1.4** Count forward, with and without objects, from any given number up to 100 by 1s, 2s, 5s and/or 10s.**1.N.1.5** Find a number that is 10 more or 10 less than a given number up to 100.**1.N.1.6** Compare and order whole numbers from 0 to 100.**1.N.1.7** Use knowledge of number relationships to locate the position of a given whole number on an open number line up to 20.**1.N.1.8** Use objects to represent and use words to describe the relative size of numbers, such as more than, less than, and equal to.**1.N.1.9** Demonstrate equivalence and equality (e.g., using balance scales, various manipulatives). |
| **Operations** | Topic addressed at other grade levels. | **K.N.2 Develop conceptual fluency with addition and subtraction (up to 10) using objects and pictures.****K.N.2.1** Compose and decompose numbers up to 10 with objects and pictures. (e.g., making ten, number bonds). | **1.N.2 Solve addition and subtraction problems up to 10 in real-world and mathematical contexts.****1.N.2.1** Use a variety of strategies to solve addition and subtraction problems up to 10 (e.g. spoken words, objects, pictorial models, number lines, number sentences, compose and decompose numbers, making 10, doubles plus one, part-part-whole).**1.N.2.2** Apply basic fact strategies to add and subtract within 10 (e.g., making ten, decomposing a number leading to a ten, doubles plus one).**1.N.2.3** Determine if equations involving addition and subtraction are true (e.g., balance scales, base ten blocks, number line, pictorial representations)**1.N.2.4** Demonstrate fluency with basic addition facts and related subtraction facts up to 10. |
| **Fractions** | Topic addressed at other grade levels. | **K.N.3 Understand the relationship between whole numbers and fractions through fair share.****K.N.3.1** Distribute equally a set of objects into at least two smaller equal sets. | **1.N.3 Develop foundational ideas for fractions.****1.N.3.1** Partition a regular polygon using physical models into equal pieces.**1.N.3.2** Partition (fair share) sets of objects into equal groupings. |
| **Money** | Topic addressed at other grade levels. | **K.N.4 Identify coins in order to recognize the need for monetary transactions.****K.N.4.1** Identify U.S. coins by name (not value), including pennies, nickels, dimes, and quarters. | **1.N.4 Identify coins and their values in order to understand monetary transactions.****1.N.4.1** Identify U.S. coins, including pennies, nickels, dimes, and quarters, and their value.**1.N.4.2** Write a number with the cent symbol to describe the value of a coin.**1.N.4.3** Determine the value of a collection of pennies, nickels and/or dimes up to one dollar counting by ones, fives, and tens. |

| **Algebraic Reasoning & Algebra (A)** |
| --- |
| **Topic** | **Pre-Kindergarten (PK)** | **Kindergarten (K)** | **First Grade (1)** |
| **Patterns** | **PK.A.1 Recognize, create, and extend patterns**.**PK.A.1.1** Sort and group up to 5 objects into a set and explain verbally what the objects have in common (e.g., color, size, shape).**PK.A.1.2** Recognize, duplicate, create and extend repeating patterns in various formats (e.g., manipulatives, sound, movement). | **K.A.1 Recognize, create, complete, and extend patterns.****K.A.1.1** Sort and group up to 10 objects into a set and explain verbally what the objects have in common (e.g., color, size, shape).**K.A.1.2** Recognize, create, complete, and extend repeating, shrinking and growing patterns using shape, color, size, quantity, sounds and movements. | **1.A.1 Recognize, create, complete, and extend patterns.****1.A.1.1** Recognize, create, complete, and extend repeating, shrinking and growing patterns with objects, numbers, or geometric shapes in a variety of contexts (e.g., addition charts, skip counting, calendars, hundreds charts, number lines, real-world situations such as art and architecture). |
| **Number Sentences** | Topic addressed at other grade levels. | Topic addressed at other grade levels. | Topic addressed at other grade levels. |

| **Geometry & Measurement (GM)** |
| --- |
| **Topic** | **Pre-Kindergarten (PK)** | **Kindergarten (K)** | **First Grade (1)** |
| **Geometry** | **PK.GM.1 Identify common shapes.****PK.GM.1.1** Identify common shapes by pointing to the shape when given the name (e.g., circle, square, rectangle and triangle). | **K.GM.1 Recognize and sort basic two-dimensional shapes and use them to represent real-world objects.****K.GM.1.1** Recognize basic two-dimensional shapes such as squares, circles, triangles, and rectangles.**K.GM.1.2** Sort two-dimensional objects using characteristics such as shape, size, color, and thickness.**K.GM.1.3** Identify attributes of two-dimensional shapes using informal and formal geometric language interchangeably (e.g., a square has 4 corners).**K.GM.1.4** Use smaller shapes to form a larger shape when there is an outline to follow (e.g., create a larger square using 4 small squares).**K.GM.1.5** Compose free form shapes with blocks.**K.GM.1.6** Use basic shapes and spatial reasoning to represent objects in the real-world. | **1.GM.1 Recognize, compose, and decompose two- and three–dimensional shapes.****1.GM.1.1** Use smaller shapes to form larger two-dimensional shapes (compose) such as triangles, squares, rectangles, and circles.**1.GM.1.2** Decompose larger shapes into smaller two-dimensional shapes (e.g., a hexagon can be broken into triangles and/or trapezoids).**1.GM.1.3** Compose structures with three-dimensional shapes.**1.GM.1.4** Recognize three-dimensional shapes such as cubes, cones, cylinders, and spheres. |
| **Measurement** | **PK.GM.2 Describe and compare measureable attributes.****PK.GM.2.1** Identify measurable attributes of objects. Describe them using age appropriate vocabulary (e.g., little, big, long, short, tall, heavy, and light).**PK.GM.2.2** Directly compare two objects with a common measurable attribute using words such as longer/shorter (horizontal); heavier/lighter; or taller/shorter (vertical).**PK.GM.2.3** Sort objects into sets by one or more attributes. | **K.GM.2 Compare and order objects according to location and measurable attributes.****PK.GM.2.1** Use words to compare objects according to length, size, weight, position, and location (e.g., below, near, far).**K.GM.2.2** Order up to 6 objects using measurable attributes, such as length and weight.**K.GM.2.3** Sort objects into sets by more than one attribute.**K.GM.2.4** Compares two containers (e.g., fills one container using another and counts the number needed to fill larger container). | **1.GM.2 Select and use units to describe length and volume/capacity.****1.GM.2.1** Use nonstandard and standard measuring tools to measure the length of objects to reinforce the continuous nature of linear measurement.**1.GM.2.2** Illustrate that the length of an object is the number of same-size units of length that, when laid end-to-end with no gaps or overlaps, reach from one end of the object to the other.**1.GM.2.3** Measure the same object/distance with units of two different lengths and describe how and why the measurements differ.**1.GM.2.4** Describe a length to the nearest whole unit using a number and a unit (e.g., foot, inch, centimeter).**1.GM.2.5** Use standard and nonstandard tools to identify volume/capacity (e.g. fill and pour activities). Identify which container holds more, less, or same amount. |
| **Time** | Topic addressed at other grade levels. | **K.GM.3 Tell time as it relates to daily life.****K.GM.3.1** Develop an awareness of simple time concepts within his/her daily life (e.g. yesterday, today, tomorrow, morning, afternoon, night). | **1.GM.3. Tell time to the half and full hour.****1.GM.3.1** Tell time to the hour and half-hour (analog and digital). |
| **Data & Probability (D)** |
| **Topic** | **Pre-Kindergarten (PK)** | **Kindergarten (K)** | **First Grade (1)** |
| **Data Analysis** | **PK.D.1 Collect and organize categorical data.****PK.D.1.1** Collect and organize information about objects and events in the environment.**PK.D.1.2** Use categorical data to create real-object graphs. | **K.D.1 Collect, organize, and interpret categorical data.****K.D.1.1** Collect and sort information about objects and events in the environment.**K.D.1.2** Use categorical data to create real-object and picture graphs.**K.D.1.3** Draw conclusions from real-object and picture graphs. | **1.D.1 Collect, organize, and interpret categorical and numerical data.****1.D.1.1** Collect, sort, and organize data in up to three categories using representations (e.g., tally marks, tables, Venn diagrams).**1.D.1.2** Use data to create picture and bar-type graphs to demonstrate one to one correspondence.**1.D.1.3** Draw conclusions from picture and bar-type graphs. |

| **Number & Operations (N)** |
| --- |
| **Topic** | **Second Grade (2)** | **Third Grade (3)** | **Fourth Grade (4)** |
| **Quantity** | **2.N.1 Compare and represent whole numbers up to 1,000 with an emphasis on place value and equality.****2.N.1.1** Read, write, discuss, and represent whole numbers up to 1,000. Representations may include numerals, words, pictures, tally marks, number lines and manipulatives.**2.N.1.2** Use knowledge of number relationships to locate the position of a given whole number on an open number line up to 100.**2.N.1.3** Use place value to describe whole numbers between 10 and 1,000 in terms of hundreds, tens and ones. Know that 100 is 10 tens, and 1,000 is 10 hundreds.**2.N.1.4** Find 10 more or 10 less than a given three-digit number. Find 100 more or 100 less than a given three-digit number.**2.N.1.5** Recognize when to round numbers to the nearest 10 and 100.**2.N.1.6** Use place value to compare and order whole numbers up to 1,000 using comparative language, numbers, and symbols (e.g., 425 > 276, 73 <107, page 351 comes after page 350, 753 is between 700 and 800).**2.N.1.7** Recognize the difference between equivalence and equality (e.g., using balance scales to demonstrate that 2+4 is equivalent to 3+3.)**2.N.1.8** Demonstrate non-equivalence (e.g., balance scales, various manipulatives). | **3.N.1 Compare and represent whole numbers up to 10,000 with an emphasis on place value and equality.****3.N.1.1** Read, write, discuss, and represent whole numbers up to 10,000. Representations may include numerals, expressions with operations, words, pictures, number lines, and manipulatives.**3.N.1.2** Use place value to describe whole numbers between 1000 and 10,000 in terms of ten thousands, thousands, hundreds, tens and ones, including expanded form.**3.N.1.3** Find 1,000 more or 1,000 less than a given four- or five-digit number. Find 100 more or 100 less than a given four- or five-digit number.**3.N.1.4** Recognize when to round numbers to the nearest 10,000, 1,000, 100 and 10 and/or use compatible numbers to estimate sums and differences.**Clarification statement**: Emphasis on understanding why and how to round vs. memorizing a rule.**3.N.1.5** Recognize non-equivalence (e.g., 7+1 > 2+3, 6+3 is not equivalent to 4).**3.N.1.6** Use place value to compare and order whole numbers up to 10,000, using comparative language, numbers, and symbols (e.g. 5,023 < 5,156; 2,345 is between 2,000 and 3,000). | Topic addressed at other grade levels. |
| **Operations** | **2.N.2 Add and subtract one- and two-digit numbers in real-world and mathematical problems.****2.N.2.1** Use the relationship between addition and subtraction to generate basic facts (e.g., making tens, fact families, doubles plus or minus one, counting on, counting back, commutative and associative properties).**2.N.2.2** Demonstrate fluency with basic addition facts and related subtraction facts up to 20.**2.N.2.3** Use strategies to estimate sums and differences up to 100 [e.g., compose, decompose and regroup numbers, use knowledge of 10 to estimate quantities and sums (two numbers less than 10 cannot add up to more than 20)].**2.N.2.4** Use strategies and algorithms based on knowledge of place value and equality to add and subtract two-digit numbers (e.g., mental strategies, standard algorithm, decomposition, expanded notation, partial sums, differences).**2.N.2.5** Solve real-world and mathematical addition and subtraction problems involving whole numbers up to 2 digits.**2.N.2.6** Use concrete models and structured arrangements, such as repeated addition, arrays and ten frames to develop understanding of multiplication. | **3.N.2 Add and subtract multi-digit whole numbers; represent multiplication and division in various ways; solve real-world and mathematical problems**.**3.N.2.1** Represent multiplication facts by using a variety of approaches, such as repeated addition, equal-sized groups, arrays, area models, equal jumps on a number line and skip counting.**3.N.2.2** Demonstrate fluency in addition, subtraction, and multiplication (10 x 10) facts up to 100.**3.N.2.3** Use strategies and algorithms based on knowledge of place value and equality to add and subtract multi-digit numbers (e.g., mental strategies, standard algorithm, decomposition, expanded notation, partial sums and differences).**3.N.2.4** Use addition and subtraction to solve real-world and mathematical problems involving whole numbers. Use various strategies, including the relationship between addition and subtraction, the use of technology, and the context of the problem to assess the reasonableness of results.**3.N.2.5** Represent division facts by using a variety of approaches, such as repeated subtraction, equal sharing and forming equal groups.**3.N.2.6** Recognize the relationship between multiplication and division to represent and solve real-world problems (e.g. partitioning, missing factors, arrays).**3.N.2.7** Use strategies and algorithms based on knowledge of place value, equality and properties of addition and multiplication to multiply a two-digit number by a one-digit number (e.g., area model; mental strategies; partial products; standard algorithm; commutative, associative, and distributive properties). | **4.N.1 Multiply multi-digit numbers and solve real-world and mathematical problems using arithmetic.****4.N.1.1** Demonstrate fluency with multiplication and division facts up to 10 x 10.**4.N.1.2** Use an understanding of place value to multiply or divide a number by 10, 100 and 1,000.**4.N.1.3** Multiply 3-digit by 1-digit or a 2-digit by 2-digit whole numbers, using efficient and generalizable procedures and strategies, based on knowledge of place value, including but not limited to standard algorithms.**4.N.1.4** Estimate products of 3-digit by 1-digit or 2-digit by 2-digit whole numbers using rounding, benchmarks and place value to assess the reasonableness of results. Explore larger numbers using technology to investigate patterns.**4.N.1.5** Solve multi-step real-world and mathematical problems requiring the use of addition, subtraction and multiplication of multi-digit whole numbers. Use various strategies, including the relationship between operations, the use of appropriate technology, and the context of the problem to assess the reasonableness of results.**4.N.1.6** Use strategies and algorithms based on knowledge of place value, equality and properties of operations to divide 3-digit dividend by 1-digit whole number divisors. (e.g., mental strategies, standard algorithms, partial quotients, repeated subtraction, the commutative, associative, and distributive properties).**4.N.1.7** Determine the unknown addend or factor in equivalent and non-equivalent expressions (e.g., 5 + 6 = 4 + ☐ , 3 x 8 < 3 x ☐). |
| **Fractions** | **2.N.3 Explore the foundational ideas of fractions.****2.N.3.1** Identify the parts of a set and/or area that represent fractions for halves, thirds and fourths.**2.N.3.2** Construct equal sized portions through fair sharing including length and set area models for halves, thirds, and fourths. | **3.N.3 Understand meanings and uses of fractions in real-world and mathematical situations**.**3.N.3.1** Read and write fractions with words and symbols.**3.N.3.2** Construct fractions using set, area and length models.**3.N.3.3** Order and compare, including unit fractions and equivalent fractions with like denominators by using models, reasoning about their size and an understanding of the concept of numerator and denominator. | **4.N.2 Represent and compare fractions and decimals in real-world and mathematical situations; use place value to understand how decimals represent quantities**.**4.N.2.1** Represent equivalent fractions using fraction models (e.g. parts of a set, area models, fraction strips, number lines).**4.N.2.2** Use benchmark fractions (0, 1/4, 1/3, 1/2, 2/3, 3/4, 1) to locate additional fractions on a number line. Use models to order and compare whole numbers and fractions less than and greater than one.**4.N.2.3** Decompose a fraction in more than one way into a sum of fractions with the same denominator using concrete and pictorial models and recording results with symbolic representations (e.g. 3/4 = 1/4 + 1/4 + 1/4).**4.N.2.4** Use fraction models to add and subtract fractions with like denominators in real-world and mathematical situations.**4.N.2.5** Represent tenths and hundredths with concrete models, making connections between fractions and decimals.**4.N.2.6** Represent, read and write decimals up to at least the hundredths place in a variety of context including money.**4.N.2.7** Compare and order decimals and whole numbers using place value, a number line and models such as grids and base 10 blocks.**4.N.2.8** Rename and compare benchmark fractions (1/4,1/3, 1/2, 2/3, 3/4) and decimals (0.25, 0.50, 0.75) in real-world and mathematical situations (e.g. half of a dollar is $0.50; 1/4 is the same as 0.25). |
| **Money** | **2.N.4 Determine the value of coins in order to solve monetary transactions**.**2.N.4.1** Determine the value of a collection(s) of coins up to one dollar using the cent symbol (e.g., given 2 dimes and 1 quarter, recognize you have 45¢; person 1 has a dime and a nickel and person 2 has a quarter, together they have 40¢). Limited to: whole numbers.**2.N.4.2** Select a combination of coins to represent a given amount of money up to one dollar. | **3.N.4 Determine the value of coins in order to solve monetary transactions.****3.N.4.1** Use addition to determine the value of a collection of coins up to one dollar using the cent symbol and a collection of bills up to twenty dollars.(e.g. 45¢ + 30¢= 75¢, $11 + $9=$20).**3.N.4.**2 Select the fewest amount of coins for a given amount of money up to one dollar. | **4.N.3 Determine the value of coins in order to solve monetary transactions.****4.N.3.1** Given a total cost (whole dollars and/or decimal) and amount paid (whole dollars and/or decimal), find the change required in a variety of ways.**Clarification statement**: Limit to benchmark decimals. |

| **Algebraic Reasoning & Algebra (A)** |
| --- |
| **Topic** | **Second Grade (2)** | **Third Grade (3)** | **Fourth Grade (4)** |
| **Patterns** | **2.A.1 Represent, create, describe, complete, and extend patterns and relationships to solve real-world and mathematical problems.****2.A.1.1** Create, describe, complete, and extend repeating, growing, and shrinking patterns involving numbers in a variety of contexts (e.g., repeated addition or subtraction, skip counting, arrays of objects).**2.A.1.2** Recognize and describe repeating patterns involving geometric shapes in a variety of contexts. | **3.A.1 Use single-operation input-output rules to represent patterns and relationships and to solve real-world and mathematical problems.****3.A.1.1** Create, describe, and extend patterns involving addition, subtraction or multiplication to solve problems in a variety of contexts (e.g., skip counting, arrays of objects, function machine, hundreds chart).**3.A.1.2** Describe the rule (single operation) for a pattern from an input/output table or function machine involving addition, subtraction or multiplication.**3.A.1.3** Construct and explore representations of growing patterns and construct the next steps. | **4.A.1 Use single-operation input-output rules, tables and charts to represent patterns and relationships and to solve real-world and mathematical problems.****4.A.1.1** Create, describe, and extend a wide variety of patterns involving numbers, using tables, charts and/or rules (e.g., determine the rule from a tableor function machine, extend number patterns). Record the inputs and outputs in a chart or table.**4.A.1.2** Describe the rule (single operation) for a pattern from a input/output table or function machine involving addition, subtraction, multiplication, or division.**4.A.1.3** Create, describe, and extend a wide variety of patterns involving geometric shapes and define the rule of the pattern. |
| **Number Sentences** | **2.A.2 Use number sentences involving addition, subtraction and unknowns to represent and solve real-world and mathematical problems; generate real-world situations corresponding to number sentences**.**2.A.2.1** Use objects and number lines and generate real-world situations to represent number sentences.**2.A.2.2** Use number sense and properties (commutative and identity) of addition and subtraction to find values for the unknowns that make the number sentences true. (Introduction to properties, but not mastery of vocabulary). | **3.A.2 Use number sentences involving multiplication and unknowns to represent and solve real-world and mathematical problems; create real-world situations corresponding to number sentences.****3.A.2.1** Find unknowns represented by symbols in arithmetic problems by solving open sentences (equations) and other problems involving addition, subtraction, and multiplication. Generate real-world situations to represent number sentences.**3.A.2.2** Recognize, represent and apply the number properties (commutative and identity properties of addition and multiplication) using models and manipulatives. (Introduction to properties, but not mastery of vocabulary). | **4.A.2 Use multiplication and division with unknowns to create number sentences representing a given problem situation using a number sentence.****4.A.2.1** Use number sense, properties of multiplication (commutative, identity, and associative) and the relationship between multiplication and division to find values for the unknowns represented by letters and symbols that make number sentences true. (Introduction to properties, but not mastery of vocabulary).**4.A.2.2** Solve for unknowns in one-step problems by solving open sentences (equations) and other problems involving addition, subtraction, multiplication, or division with whole numbers. Use real-world situations to represent number sentences. |

| **Geometry & Measurement (GM)** |
| --- |
| **Topic** | **Second Grade (2)** | **Third Grade (3)** | **Fourth Grade (4)** |
| **Geometry** | **2.GM.1 Analyze attributes of two-dimensional figures develop generalizations about their properties.****2.GM.1.1** Identify and name basic two-dimensional shapes, such as squares, circles, triangles, rectangles, trapezoids, and hexagons (architecture, technology, art).**2.GM.1.2** Describe, compare and classify two-dimensional figures according to their geometric attributes.**2.GM.1.3** Compose 2-D shapes using triangles squares, hexagons and rhombi.**2. GM 1.4** Recognizes right angles and classify angles as smaller or larger than a right angle. | **3.GM.1 Use geometric attributes to describe and create shapes in various contexts.****3GM 1.1** Sort three-dimensional shapes based on attributes | **4.GM.1 Name, describe, classify and construct polygons, and three-dimensional figures.****4.GM.1.1** Identify points, lines, line segments, rays, angles, endpoints, and parallel and perpendicular lines in various contexts.**4.GM.1.2** Describe, classify, and sketch quadrilaterals, including squares, rectangles, trapezoids, rhombuses, parallelograms, and kites. Recognize quadrilaterals in various contexts.**4.GM.1.3** Build a three-dimensional figure using unit cubes when picture/shape is shown.**4.GM.1.4** Given two three-dimensional shapes, identify similarities, and differences. |
| **Measurement** | **2.GM.2 Understand length as a measurable attribute; use tools to measure length.****2.GM.2.1** Explain the relationship between the size of the unit of measurement and the number of units needed to measure the length of an object.**2.GM.2.2** Explain the relationship between length and the numbers on a ruler by using a ruler to measure lengths to the nearest inch and centimeter. | **3.GM.2 Understand measurable attributes of real-world and mathematical objects using various tools.****3.GM.2.1** Choose an appropriate measurement instrument (e.g., ruler, yard/meter, measuring tape) and measure the length of objects to the nearest whole or half unit.**3.GM.2.2** Using common benchmarks, estimate the lengths (customary and metric) of a variety of objects.**3.GM.2.3** Find the perimeter of rectangles and polygons (composed of rectangles on geo-boards and/or grid paper).**3.GM.2.4** Use an analog thermometer to determine temperature to the nearest degree in Fahrenheit and Celsius.**3.GM.2.5** Counts cubes systematically to identify number of cubes to pack the whole or half of the 3-D structure. | **4.GM.2 Understand angle, perimeter, and area as measurable attributes of real-world and mathematical objects. Use various tools to measure angles, perimeter, area, and volume.****4.GM.2.1** Measure angles in geometric figures and real-world objects with a protractor or angle ruler.**4.GM.2.2** Find perimeter of polygon, given the lengths of the sides.**4.GM.2.3** Find the area of 2-D figures by counting total number of same size square unit that cover the shape without gaps or overlaps**4.GM.2.4** Choose an appropriate instrument (e.g., ruler, yard/meter stick, tape measure) and measure the length of an object to the nearest whole centimeter or quarter-inch.**4.GM.2.5** Solve problems that deal with measurements of length, when to use liquid volumes, when to use mass, temperatures above zero and money using addition, subtraction, multiplication, or division as appropriate (customary and metric). |
| **Time** | **2.GM.3 Tell time to 5 minutes.****2.GM.3.1** Tell time to 5 minutes. Read and write time to the quarter-hour and distinguish between a.m. and p.m. (analog and digital). | **3.GM.3 Tell time to the nearest 5-minutes and solve problems.****3.GM.3.1** Read and write time to the nearest 5-minute (analog and digital).**3.GM.3.2** Determine the solutions to problems involving addition and subtraction of time intervals of 5-minutes using pictorial models or tools up to one hour (e.g.15-minute event plus a 30-minute event equals 45 minutes).**Data and Probability (D)** | **4.GM.3 Determine elapsed time and convert between units of time.****4.GM.3.1** Determine elapsed time.**4.GM.3.2** Solve problems involving the conversion of one measure of time to another. |

| **Data & Probability (D)** |
| --- |
| **Topic** | **Second Grade (2)** | **Third Grade (3)** | **Fourth Grade (4)** |
| **Data Analysis** | **2.D.1 Collect, organize, and interpret data.****2.D.1.1** Explain that the length of a bar in a bar graph or the number of objects in a picture graph represents the number of data points for a given category.**2.D.1.2** Organize a collection of data with up to four categories using pictographs and bar graphs with intervals of 1s, 2s, 5s or 10s.**2.D.1.3** Write and solve one-step word problems involving addition or subtraction using data represented within pictographs and bar graphs with intervals of one.**2.D.1.4** Draw conclusions and make predictions from information in a graph. | **3.D.1 Collect, organize, and analyze data.****3.D.1.1** Summarize and construct a data set with multiple categories using a frequency table, line plot, pictograph, and/or bar graph with scaled intervals.**3.D.1.2** Solve one- and two-step problems using categorical data represented with a frequency table, pictograph, or bar graph with scaled intervals. | **4.D.1 Collect, organize, and analyze data.****4.D.1.1** Represent data on a frequency table or line plot marked with whole numbers and fractions using appropriate titles, labels, and units.**4.D.1.2** Use tables, bar graphs, timelines, and Venn diagrams to display data sets. The data may include benchmark fractions or decimals (1/4, 1/3, 1/2,2/3, 3/4, 0.25, 0.50, 0.75).**4.D.1.3** Solve one- and two-step problems using data in whole number, decimal, or fraction form in a frequency table and line plot. |

| **Number & Operations (N)** |
| --- |
| **Fifth Grade (5)** | **Sixth Grade (6)** | **Seventh Grade (7)** | **Pre-Algebra (PA)** |
| **5.N.1 Divide multi-digit numbers and solve real-world and mathematical problems using arithmetic.****5.N.1.1** Estimate solutions to division problems in order to assess the reasonableness of results.**5.N.1.2** Divide multi-digit numbers, by one and two digit divisors, using efficient and generalizable procedures, based on knowledge of place value, including standard algorithms.**5.N.1.3** Recognize that quotients can be represented in a variety of ways, including a whole number with a remainder, a fraction or mixed number, or a decimal and consider the context in which a problem is situated to select and interpret the most useful form of the quotient for the solution.**5.N.1.4** Solve real-world and mathematical problems requiring addition, subtraction, multiplication and division of multi-digit whole numbers. Use various strategies, including the inverse relationships between operations, the use of technology, and the context of the problem to assess the reasonableness of results.**5.N.2 Read, write, represent and compare fractions and decimals; recognize and write equivalent fractions; convert between fractions and decimals; use fractions and decimals in real-world and mathematical situations.****5.N.2.1** Represent decimal fractions (e.g. 1/10, 1/100) using a variety of models (e.g., 10 by 10 grids, rational number wheel, base-ten blocks, meter stick) and make connections between fractions and decimals (e.g., the visual for 1/10 is the same as for 0.1).**5.N.2.2** Represent, read and write decimals using place value to describe decimal numbers including fractional numbers as small as thousandths and whole numbers as large as millions.**5.N.2.3** Compare and order fractions and decimals, including mixed numbers and fractions less than one, and locate on a number line.**5.N.2.4** Recognize and generate equivalent decimals, fractions, mixed numbers and fractions less than one in various contexts.**5.N.3 Add and subtract fractions with like and unlike denominators, mixed numbers and decimals to solve real-world and mathematical problems.****5.N.3.1** Estimate sums and differences of fractions with like and unlike denominators, mixed numbers, and decimals to assess the reasonableness of the results.**5.N.3.2** Using the meanings of fractions, meanings of whole number addition and subtraction, and inverse relationships to illustrate addition and subtraction of fractions with like and unlike denominators, mixed numbers, and decimals using a variety of representations (e.g., fraction strips, area models, number lines, fraction rods).**5.N.3.3** Add and subtract fractions with like and unlike denominators, mixed numbers, and decimals, using efficient and generalizable procedures, including but not limited to standard algorithms in order to solve real-world and mathematical problems including those involving money, measurement, geometry, and data.**5.N.3.4** Find 0.1 more than a number and 0.1 less than a number. Find 0.01 more than a number and 0.01 less than a number. Find 0.001 more than a number and 0.001 less than a number. | **6.N.1 Read, write, represent and compare integers and positive rational numbers expressed as fractions, decimals, percents, and ratios; write positive integers as products of factors; use these representations in real-world and mathematical situations**.**6.N.1.1** Locate integers and positive rational numbers on a number line and understand the concept of opposites.**6.N.1.2** Compare and order positive rational numbers, represented in various forms, or integers using the symbols <, >, and =.**6.N.1.3** Explain that a percent represents parts out of 100 and ratios to 100 (e.g., 75% corresponds to the ratio 75 to 100).**6.N.1.4** Determine equivalencies among fractions, decimals, and percents. Select among these representations to solve problems.**6.N.1.5** Factor whole numbers and express a whole number as a product of prime factors with exponents.**6.N.1.6** Determine the greatest common factors and least common multiples. Use common factors and multiples to calculate with fractions and find equivalent fractions.**6.N.2 Add and subtract integers in order to solve real-world and mathematical problems.****6.N.2.1** Estimate solutions to addition and subtraction of positive and negative integers problems in order to assess the reasonableness of results.**6.N.2.2** Illustrate addition and subtraction of positive and negative integers using a variety of representations (e.g., two-color counters, number lines).**6.N.2.3** Add and subtract positive and negative integers; use efficient and generalizable procedures including but not limited to standard algorithms.**6.N.3 Understand the concept of ratio and its relationship to fractions and percents and to the multiplication and division of whole numbers. Use ratios to solve real-world and mathematical problems.****6.N.3.1** Identify and use ratios to compare quantities. Recognize that comparing quantities using ratios is not the same as comparing quantities using subtraction.**6.N.3.2** Determine the unit rate for ratios of quantities with different units.**6.N.3.3** Apply the relationship between ratios, equivalent fractions and percents to solve problems in various contexts, including those involving mixture and concentrations (e.g., which mixture has a higher concentration of peanuts).**6.N.3.4** Use reasoning about multiplication and division to solve ratio and unit rate problems.**6.N.4 Multiply and divide decimals, fractions, and mixed numbers; solve real-world and mathematical problems with positive rational numbers.****6.N.4.1** Estimate solutions to problems with whole numbers, decimals, fractions, and mixed numbers and use the estimates to assess the reasonableness of results in the context of the problem.**6.N.4.2** Use the meanings of fractions, meanings of whole number multiplication and division, and inverse relationships to illustrate multiplication and division of fractions and decimals using a variety of representations (e.g., fraction strips, area models, number lines, fraction rods).**6.N.4.3** Multiply and divide fractions and decimals, using efficient and generalizable procedures, including but not limited to standard algorithms. | **7.N.1 Read, write, represent and compare positive and negative rational numbers, expressed as integers, fractions, and decimals.****7.N.1.1** Know that every rational number can be written as the ratio of two integers or as a terminating or repeating decimal.**7.N.1.2** Compare and order positive and negative rational numbers expressed in various forms using the symbols <, >, and =.**7.N.1.3** Recognize and generate equivalent representations of positive and negative rational numbers, including equivalent fractions.**7.N.2 Calculate with positive and negative rational numbers, and rational numbers with positive integer exponents, to solve real-world and mathematical problems.****7.N.2.1** Estimate solutions to multiplication and division of positive and negative integers in order to assess the reasonableness of results.**7.N.2.2** Illustrate multiplication and division of positive and negative integers using a variety of representations (e.g., two-color counters, number lines).**7.N.2.3** Add, subtract, multiply and divide positive and negative rational numbers including integers, fractions, and terminating decimals; use efficient and generalizable procedures including but not limited to standard algorithms.**7.N.2.4** Raise integers to positive integer exponents.**7.N.2.5** Solve real-world and mathematical problems involving calculations with positive and negative rational numbers and positive integer exponents.**7.N.2.6** Explain the relationship between the absolute value of a rational number and the distance of that number from zero a number line. Use the symbol for absolute value. | **PA.N.1 Read, write, compare, classify, and represent real numbers and use them to solve problems in various contexts.****PA.N.1.1** Develop and apply the properties of integer exponents to generate equivalent numerical and algebraic expressions, including a0 = 1.**PA.N.1.2** Express approximations of very large and very small numbers using scientific notation.**PA.N.1.3** Multiply and divide numbers expressed in scientific notation, express the answer in scientific notation.**PA.N.1.4** Classify real numbers as rational or irrational. Recognize that when a square root of a positive integer is not an integer, then it is irrational.Recognize that the sum of a rational number and an irrational number is irrational, and the product of a non-zero rational number and an irrational number is irrational.**PA.N.1.5** Compare real numbers; locate real numbers on a number line. Identify the square root of a perfect square to 400 or, if it is not a perfect square root, locate it as a real number between two consecutive positive integers. |

| **Algebraic Reasoning & Algebra (A)** |
| --- |
| **Fifth Grade (5)** | **Sixth Grade (6)** | **Seventh Grade (7)** | **Pre-Algebra (PA)** |
| **5.A.1 Create and use tables, graphs and rules with whole numbers to describe patterns to solve real-world and mathematical problems.****5.A.1.1** Create and use rules (up to two operations) and tables to describe patterns of change and make predictions and generalizations about real-world and mathematical problems.**5.A.1.2** Use a rule or table to represent ordered pairs of whole numbers and graph these ordered pairs on a coordinate system.**5.A.2 Understand and interpret expressions, equations, and inequalities involving variables and whole numbers, and use them to represent and evaluate real-world and mathematical problems.****5.A.2.1** Generate equivalent numerical expressions to evaluate problems involving whole numbers by applying the commutative, associative, and distributive properties and order of operations (no exponents).**5.A.2.2** Determine whether an equation or inequality involving a variable is true or false for a given value of the variable.**5.A.2.3** Evaluate expressions involving variables when values for the variables are given. | **6.A.1 Recognize and represent relationships between varying quantities; translate from one representation to another; use patterns, tables, graphs and rules to solve real-world and mathematical problems.****6.A.1.1** Plot coordinates in all four quadrants. Be able to identify each quadrant, the origin, the x-axis, and the y-axis.**6.A.1.2** Represent the relationship between two varying quantities with function rules, graphs and tables; translate between any two of these representations.**6.A.1.3** Use variables in various contexts including whether an equation or inequality involving a variable is true or false for a given value of the variable.**6.A.2 Use properties of arithmetic to generate equivalent numerical expressions and evaluate expressions involving positive rational numbers.****6.A.2.1** Generate equivalent expressions and evaluate problems involving positive rational numbers by applying the commutative, associative, and distributive properties and order of operations.**6.A.3 Use equations and inequalities to represent real-world and mathematical problems and use the idea of maintaining equality to solve equations. Interpret solutions in the original context.****6.A.3.1** Represent real-world or mathematical situations using equations and inequalities involving variables and positive rational numbers.**6.A.3.2** Solve one-step equations (e.g., 1/3x = 9) involving positive rational numbers using number sense, properties of operations and equality. Graph the solution on a number line, interpret the solution in the original context, and assess the reasonableness. | **7.A.1 Understand the concept of proportionality in real-world and mathematical situations, and distinguish between proportional and other relationships.****7.A.1.1** Describe that the relationship between two variables, *x* and *y*, is proportional if it can be expressed in the form $\frac{y}{x}=k$ or $y=kx$; distinguish proportional relationships from other relationships, including inversely proportional relationships ($ xy=k$ or $y=\frac{k}{x}$ ).**7.A.1.2** Recognize that the graph of a proportional relationship is a line through the origin whose slope is the unit rate (constant of proportionality).**7.A.2 Recognize proportional relationships in real-world and mathematical situations; represent these and other relationships with tables, verbal descriptions, symbols, and graphs; solve problems involving proportional relationships and interpret results in the original context.****7.A.2.1** Represent proportional relationships with tables, verbal descriptions, symbols, and graphs; translate from one representation to another. Determine the unit rate (constant of proportionality, slope or rate of change) given any of these representations.**7.A.2.2** Solve multi-step problems involving proportional relationships in a variety of contexts (e.g. distance-time, percent increase or decrease, discounts, tips, unit pricing, similar figures – but not limited to these).**7.A.2.3** Use proportional reasoning to solve problems involving ratios in various contexts.**7.A.2.4** Use knowledge of proportions to assess the reasonableness of solutions.**7.A.3 Represent and solve linear equations and inequalities.****7.A.3.1** Write and solve two-step linear equations with one variable.**7.A.3.2** Represent, write, solve, and graph one-step linear inequalities with one variable.**7.A.3.3** Represent real-world or mathematical situations using equations and inequalities involving variables and positive and negative rational numbers.**7.A.4 Use order of operations and algebraic properties to generate equivalent numerical and algebraic expressions containing positive and negative rational numbers and grouping symbols; evaluate such expressions.****7.A.4.1** Use properties of algebra (limited to associative, commutative, and distributive) to generate equivalent numerical and algebraic expressions containing positive and negative rational numbers, grouping symbols and whole number exponents.**7.A.4.2** Apply understanding of order of operations and grouping symbols when using calculators and other technologies. | **PA.A.1 Understand the concept of function in real-world and mathematical situations, and distinguish between linear and nonlinear functions.****PA.A.1.1** Recognize that a function is a relationship between an independent variable and a dependent variable in which the value of the independent variable determines the value of the dependent variable.**PA.A.1.2** Use linear functions to represent real-world and mathematical situations**PA.A.1.3** Identify a function as linear if it can be expressed in the form 𝑦 = 𝑚𝑥 + 𝑏 or if its graph is a straight line.**PA.A.2 Recognize linear functions in real-world and mathematical situations; represent linear functions and other function with tables, verbal descriptions, symbols, and graphs; solve problems involving linear functions and interpret results in the original context.****PA.A.2.1** Represent linear functions with tables, verbal descriptions, symbols, and graphs; translate from one representation to another.**PA.A.2.2** Identify, describe, and analyze linear relationships between two variables (e.g., as the value of *x* increases on a table, do the values of *y* increase or decrease, identify a positive rate of change on a graph and compare it to a negative rate of change).**PA.A.2.3** Identify graphical properties of linear functions including slope and intercepts. Know that the slope equals the rate of change, and that the *y-*interceptis zero when the function represents a proportional relationship.**PA.A.2.4** Predict the effect on the graph of a linear function when the slope or *y*-intercept changes (e.g., make predictions from graphs, identify the slope or y-intercept in the equation 𝑦 = 𝑚𝑥 + 𝑏 and relate to a graph). Use appropriate tools to examine these effects.**PA.A.2.5** Solve problems involving linear functions and interpret results in the original context.**PA.A.3 Generate equivalent numerical and algebraic expressions and use algebraic properties to evaluate expressions**.**PA.A.3.1** Use substitution to simplify and evaluate algebraic expressions.**PA.A.3.2** Justify steps in generating equivalent expressions by identifying the properties used, including the properties of operations (associative, commutative, and distributive laws) and the order of operations, including grouping symbols.**PA.A.4 Represent real-world and mathematical problems using equations and inequalities involving linear expressions. Solve and graph equations and inequalities symbolically and graphically. Interpret solutions in the original context.****PA.A.4.1** Represent, write, and solve multi-step linear equations with one variable to solve mathematical and real-world problems. Interpret solutions in the original context.**PA.A.4.2** Represent, write, and solve one- and two-step linear inequalities with one variable using the properties of inequality. Graph the solutions on a number line.**PA.A.4.3** Represent real-world situations using equations and inequalities involving one variable. |

| **Geometry & Measurement (GM)** |
| --- |
| **Fifth Grade (5)** | **Sixth Grade (6)** | **Seventh Grade (7)** | **Pre-Algebra (PA)** |
| **5.GM.1 Describe, classify, and draw representations of two- and three-dimensional figures.****5.GM.1.1** Describe, classify and construct triangles, including equilateral, right, scalene, and isosceles triangles. Recognize triangles in various contexts.**5.GM.1.2** Describe and classify three-dimensional figures including cubes, rectangular prisms and pyramids by the number of edges, faces or vertices as well as the shapes of faces.**5.GM.1.3** Recognize and draw a net for a three-dimensional figure (e.g., cubes, rectangular prisms, pyramids).**5.GM.2 Determine the area of rectangles and polygons that can be decomposed into rectangles**.**5.GM.2.1** Develop and use formulas to determine the area of rectangles. Justify why length and width are multiplied to find the area of a rectangle by breaking the rectangle into one unit by one unit squares and viewing these as grouped into rows and columns.**5.GM.2.2** Find the area of polygons that can be decomposed into rectangles.**5.GM.3 Understand angle and length as measurable attributes of real-world and mathematical objects. Use various tools to measure angles and lengths.****5.GM.3.1** Measure and compare angles according to size. Classify angles as acute, right, obtuse, and straight.**5.GM.3.2** Choose an appropriate instrument (e.g., ruler, yard/meter stick, tape measure) and measure the length of an object to the nearest whole centimeter or 1/16-inch. | **6.GM.1 Calculate perimeter of polygons and area of squares, parallelograms, and triangles to solve real-world and mathematical problems.****6.GM.1.1** Develop and use formulas for the area of squares and parallelograms using a variety of methods including but not limited to the standard algorithm.**6.GM.1.2** Develop and use formulas to determine the area of triangles.**6.GM.1.3** Find the area of polygons that can be decomposed into triangles.**6.GM.1.4** Find the perimeter of polygons to solve real-world and mathematical problems.**6.GM.2 Understand and use relationships between angles in geometric figures**.**6.GM.2.1** Solve problems using the relationships between the angles (vertical, complementary, and supplementary) formed by intersecting lines.**6.GM.2.2** Develop and use the fact that the sum of the interior angles of a triangle is 180$°$ to determine missing angle measures in a triangle.**6.GM.3 Choose appropriate units of measurement and use ratios to convert within measurement systems to solve real-world and mathematical problems.****6.GM.3.1** Estimate weights, capacities and geometric measurements (e.g. distance, area, volume) using benchmarks in measurement systems (customary and metric) with appropriate units.**6.GM.3.2** Solve problems in various real-world and mathematical contexts involving conversion of weights, capacities, geometric measurements, and time within the same measurement systems using appropriate units.**6.GM.4 Use translations, reflections, and rotations to establish congruency and understand symmetries.****6.GM.4.1** Apply translations (slides), reflections (flips), and rotations (turns) to a two-dimensional figure.**6.GM.4.2** Recognize that translations, reflections, and rotations preserve congruency and use them to show that two figures are congruent.**6.GM.4.3** Identify and describe the line(s) of symmetry in two-dimensional shapes. | **7.GM.1 Develop and understand the concept of surface area and volume of rectangular prisms.****7.GM.1.1** Using a variety of tools and strategies, develop the concept that surface area of a rectangular prism can be found by wrapping the figure with same-sized square units without gaps or overlap. Use appropriate measurements such as cm2.**7.GM.1.2** Using a variety of tools and strategies, develop the concept that the volume rectangular prisms can be found by counting the total number of same-sized cubic units that fill a shape without gaps or overlaps. Use appropriate measurements such as cm3.**7.GM.2 Determine the area of trapezoids and area and perimeter of composite figures.****7.GM.2.1** Develop and use the formula to determine the area of a trapezoid.**7.GM.2.2** Find the area and perimeter of composite figures to solve real-world and mathematical problems.**7.GM.3 Use reasoning with proportions and ratios to determine measurements, justify formulas, and solve real-world and mathematical problems involving circles and related geometric figures.****7.GM.3.1** Demonstrate an understanding of the proportional relationship between the diameter and circumference of a circle and that the unit rate (constant of proportionality) is π and can be approximated by rational numbers such as $\frac{22}{7}$ and 3.14.**7.GM.3.2** Calculate the circumference and area of circles to solve problems in various contexts, in terms of π and using approximations for π. | **PA.GM.1 Solve problems involving right triangles using the****Pythagorean Theorem**.**PA.GM.1.1** Informally justify the Pythagorean Theorem using measurements, diagrams or dynamic software and use the Pythagorean Theorem to solve problems involving right triangles.**PA.GM.1.2** Determine the distance between two points on a horizontal or vertical line in a coordinate system. Use the Pythagorean Theorem to find the distance between any two points in a coordinate system.**PA.GM.2 Calculate surface area and volume of three-dimensional figures.****PA.GM.2.1** Calculate the surface area of a rectangular prism using decomposition or nets. Use appropriate measurements such as cm2.**PA.GM.2.2** Calculate the surface area of a cylinder, in terms of π and using approximations for π, using decomposition or nets. Use appropriate measurements such as cm2.**PA.GM.2.3** Develop and use the formulas $V=lwh$ and $V=Bh$ to determine the volume of rectangular prisms. Justify why base area (*B*) and height (*h*) are multiplied to find the volume of a rectangular prism by breaking the prism into layers of rectangles. Use appropriate measurements such as cm3.**PA.GM.2.4** Develop and use the formulas $V=πr^{2}h$ and $V=Bh$ to determine the volume of right cylinders, in terms of π and using approximations for π. Justify why base area (*B*) and height (*h*) are multiplied to find the volume of a right cylinder by breaking the cylinder into layers of circles with radius (*r*). Use appropriate measurements such as cm3. |

| **Data & Probability (D)** |
| --- |
| **Fifth Grade (5)** | **Sixth Grade (6)** | **Seventh Grade (7)** | **Pre-Algebra (PA)** |
| **5.D.1 Display and analyze data to find the range and measures of central tendency (mean, median, and mode).****5.D.1.1** Find the measures of central tendency (mean, median, or mode) and range of a set of data. Understand that the mean is a “leveling out” or central balance point of the data.**5.D.1.2** Create and analyze line graphs and double-bar using whole numbers, fractions and decimals. | **6.D.1 Display and analyze data.****6.D.1.1** Calculate the mean, median and mode for a set of real-world data.**6.D.1.2** Explain and justify which measure of central tendency (mean, median, or mode) would provide the most descriptive information for a given set of data.**6.D.1.3** Create and analyze box and whisker plots exploring how each segment contains one quarter of the data.**6.D.2 Use probability to solve real-world and mathematical problems: represent probabilities using fractions and decimals.****6.D.2.1** Represent possible outcomes using a probability continuum from impossible to certain.**6.D.2.2** Determine the sample space (set of possible outcomes) for a given experiment and determine which members of the sample space are related to certain events. Sample space may be determined by the use of tree diagrams, tables or pictorial representations.**6.D.2.3** Demonstrate simple experiments in which the probabilities are known and compare the resulting relative frequencies with the known probabilities, recognizing that there may be differences between the two results (e.g., heads and tails are equally likely when flipping a fair coin, but if several different students flipped fair coins 10 times, it is likely that they will find a variety of relative frequencies of heads and tails). | **7.D.1 Display and analyze data in a variety of ways.****7.D.1.1** Design simple experiments, collect data and calculate measures of central tendency (mean, median, and mode) and spread (range). Use these quantities to draw conclusions about the data collected and make predictions.**7.D.1.2** Use reasoning with proportions to display and interpret data in circle graphs (pie charts) and histograms. Choose the appropriate data display and know how to create the display using a spreadsheet or other graphing technology.**7.D.2 Calculate probabilities and reason about probabilities using proportions to solve real-world and mathematical problems.****7.D.2.1** Determine the theoretical probability of an event using the ratio between the size of the event and the size of the sample space; represent probabilities as percents, fractions and decimals between 0 and 1.**7.D.2.2** Calculate probability as a fraction of sample space or as a fraction of area. Express probabilities as percents, decimals and fractions.**7.D.2.3** Use proportional reasoning to draw conclusions about and predict relative frequencies of outcomes based on probabilities (e.g., when rolling a number cube 600 times, one would predict that a 3 or 6 would be rolled roughly 200 times, but probably not exactly 200 times). | **PA.D.1 Display and interpret data in a variety of ways, including using scatterplots and approximate lines of best fit. Use lines of best fit to draw conclusions about data.****PA.D.1.1** Describe the impact that inserting or deleting a data point has on the mean and the median of a data set. Know how to create data displays using a spreadsheet and use a calculator to examine this impact.**PA.D.1.2** Explain how outliers affect measures of central tendency.**PA.D.1.3** Collect, display and interpret data using scatterplots. Use the shape of the scatterplot to informally estimate a line of best fit. Use appropriate titles, labels and units.**PA.D.2 Calculate experimental probabilities and reason about probabilities to solve real-world and mathematical problems.****PA.D.2.1** Calculate experimental probabilities and represent them as percents, fractions and decimals between 0 and 1 inclusive. Use experimental probabilities to make predictions when actual probabilities are unknown (e.g., repeatedly draw colored chips with replacement for a bag with an unknown mixture of chips, record relative frequencies, and use the results to make predictions about the contents of the bag).**PA.D.2.2** Determine how samples are chosen (random, limited, biased) to draw and support conclusions about generalizing a sample to a population(e.g., Is the average height of a men’s college basketball team a good representative sample for height predictions?).**PA.D.2.3** Compare and contrast dependent and independent events. |

| **Number & Operations (N)** |
| --- |
| **Pre-Algebra (PA)** | **Algebra 1 (A1)** | **Algebra 2 (A2)** |
| **PA.N.1 Read, write, compare, classify, and represent real numbers and use them to solve problems in various contexts.****PA.N.1.1** Develop and apply the properties of integer exponents to generate equivalent numerical and algebraic expressions, including a0 = 1.**PA.N.1.2** Express approximations of very large and very small numbers using scientific notation.**PA.N.1.3** Multiply and divide numbers expressed in scientific notation, express the answer in scientific notation.**PA.N.1.4** Classify real numbers as rational or irrational. Recognize that when a square root of a positive integer is not an integer, then it is irrational.Recognize that the sum of a rational number and an irrational number is irrational, and the product of a non-zero rational number and an irrational number is irrational.**PA.N.1.5** Compare real numbers; locate real numbers on a number line. Identify the square root of a perfect square to 400 or, if it is not a perfect square root, locate it as a real number between two consecutive positive integers. | **A1.N.1 Extend the understanding of number and operations to include square roots and cube roots.****A1.N.1.1** Write square roots and cube roots of monomial algebraic expressions in simplest radical form.**A1.N.1.2** Add, subtract, multiply, and simplify square roots of monomial algebraic expressions and divide square roots of whole numbers, rationalizing the denominator when necessary. | **A2.N.1 Extend the understanding of number and operations to include complex numbers, matrices, radical expressions, and expressions written with rational exponents.****A2.N.1.1** Find the value of $i^{n}$ for any whole number n.**A2.N.1.2** Simplify, add, subtract, multiply, and divide complex numbers.**A2.N.1.3** Identify the order (dimension) of a matrix, add and subtract matrices of appropriate dimensions, and multiply a matrix by a scalar to create a new matrix.**A2.N.1.4** Add, subtract, multiply, divide and simplify radical expressions and expressions containing rational exponents. |

| **Algebraic Reasoning & Algebra (A)** |
| --- |
| **Pre-Algebra (PA)** | **Algebra 1 (A1)** | **Algebra 2 (A2)** |
| **PA.A.1 Understand the concept of function in real-world and mathematical situations, and distinguish between linear and nonlinear functions.****PA.A.1.1** Recognize that a function is a relationship between an independent variable and a dependent variable in which the value of the independent variable determines the value of the dependent variable.**PA.A.1.2** Use linear functions to represent real-world and mathematical situations**PA.A.1.3** Identify a function as linear if it can be expressed in the form 𝑦 = 𝑚𝑥 + 𝑏 or if its graph is a straight line.**PA.A.2 Recognize linear functions in real-world and mathematical situations; represent linear functions and other function with tables, verbal descriptions, symbols, and graphs; solve problems involving linear functions and interpret results in the original context.****PA.A.2.1** Represent linear functions with tables, verbal descriptions, symbols, and graphs; translate from one representation to another.**PA.A.2.2** Identify, describe, and analyze linear relationships between two variables (e.g., as the value of *x* increases on a table, do the values of *y* increase or decrease, identify a positive rate of change on a graph and compare it to a negative rate of change).**PA.A.2.3** Identify graphical properties of linear functions including slope and intercepts. Know that the slope equals the rate of change, and that the *y-*intercept is zero when the function represents a proportional relationship.**PA.A.2.4** Predict the effect on the graph of a linear function when the slope or *y*-intercept changes (e.g., make predictions from graphs, identify the slope or y-intercept in the equation 𝑦 = 𝑚𝑥 + 𝑏 and relate to a graph). Use appropriate tools to examine these effects.**PA.A.2.5** Solve problems involving linear functions and interpret results in the original context.**PA.A.3 Generate equivalent numerical and algebraic expressions and use algebraic properties to evaluate expressions.****PA.A.3.2** Justify steps in generating equivalent expressions by identifying the properties used, including the properties of operations (associative, commutative, and distributive laws) and the order of operations, including grouping symbols.**PA.A.4 Represent real-world and mathematical problems using equations and inequalities involving linear expressions. Solve and graph equations and inequalities symbolically and graphically. Interpret solutions in the original context.****PA.A.4.1** Represent, write, and solve multi-step linear equations with one variable to solve mathematical and real-world problems. Interpret solutions in the original context.**PA.A.4.2** Represent, write, and solve one- and two-step linear inequalities with one variable using the properties of inequality. Graph the solutions on a number line.**PA.A.4.3** Represent real-world situations using equations and inequalities involving one variable. | **A1.A.1 Represent and solve mathematical and real-world problems using linear equations, absolute value equations, and systems of equations; interpret solutions in the original context.****A1.A.1.1** Use knowledge of solving multi-step equations to represent and solve mathematical and real-world problems (e.g., angle measures, geometric formulas, science, or statistics) and interpret the solutions in the original context.**A1.A.1.2** Solve absolute value equations and interpret the solutions in the original context.**A1.A.1.3** Solve systems of linear equations with a maximum of two variables by graphing (may include graphing calculator or other appropriate technology), substitution, and elimination and interpret the solutions in the original context.**A1.A.2 Represent and solve real-world and mathematical problems using linear inequalities, compound inequalities and systems of linear inequalities; interpret solutions in the original context.****A1.A.2.1** Represent relationships in various contexts with linear inequalities; solve the resulting inequalities, graph on a coordinate plane, and interpret the solutions.**A1.A.2.2** Represent relationships in various contexts with compound and absolute value inequalities and solve the resulting inequalities by graphing, and/or interpreting the solutions on a number line.**A1.A.2.3** Solve systems of linear inequalities with a maximum of two variables; graph and interpret the solutions on a coordinate plane.**A1.A.3 Generate equivalent algebraic expressions and use algebraic properties to evaluate expressions and arithmetic and geometric sequences.****A1.A.3.1** Solve literal equations involving several variables for one variable in terms of the others.**A1.A.3.2** Simplify polynomial expressions by adding, subtracting, or multiplying.**A1.A.3.3** Factor common monomial factors from polynomial expressions and factor quadratic expressions with a leading coefficient of 1.**A1.A.3.4** Evaluate linear, absolute value, rational, and radical expressions. Include applying a nonstandard operation such as $a \bigodot\_{}^{}b=2a+b$.**A1.A.3.5** Recognize that arithmetic sequences are linear using equations, tables, graphs, and verbal descriptions. Using the pattern, find the next term.**A1.A.3.6** Recognize that geometric sequences are exponential using equations, tables, graphs and verbal descriptions. Given the formula $f\left(x\right)=a(r)^{x}$, find the next term and define the meaning of $a$ and $r$within the context of the problem.  |  **A2.A.1 Represent and solve mathematical and real-world problems using nonlinear equations and systems of linear equations; interpret the solutions in the original context.****A2.A.1.1** Represent real-world or mathematical problems using quadratic equations and solve using various methods (including graphing calculator or other appropriate technology), factoring, completing the square, and the quadratic formula. Find non-real roots when they exist.**A2.A.1.2** Represent real-world or mathematical problems using exponential equations, such as compound interest, depreciation, and population growth, and solve these equations graphically (including graphing calculator or other appropriate technology) or algebraically.**A2.A.1.3** Solve one-variable rational equations with at most three distinct denominators. Check for extraneous solutions.**A2.A.1.4** Solve polynomial equations with real roots using various methods and tools that may include factoring, polynomial division, synthetic division, graphing calculators or other appropriate technology.**A2.A.1.5** Solve square root equations with one variable and only one radical on either one or both sides of the equal sign. Check for extraneous solutions.**A2.A.1.6** Solve common and natural logarithmic equations using the properties of logs.**A2.A.1.7** Solve real-world and mathematical problems that can be modeled using arithmetic or finite geometric sequences or series given the nth terms and sum formulas. Graphing calculators or other appropriate technology may be used. **A2.A.1.8** Represent real-world or mathematical problems using systems of linear equations with a maximum of three variables and solve using various methods that may include substitution, elimination, and graphing (may include graphing calculators or other appropriate technology).**A2.A.1.9** Solve systems of equations containing one linear equation and one quadratic equation using tools that may include graphing calculators or other appropriate technology.**A2.A.1.10** Assess the reasonableness of a solution in its given context and compare the solution to appropriate graphical or numerical estimates; interpret a solution in the context of the domain.**A2.A.2 Represent and analyze mathematical situations and structures using algebraic symbols using various strategies to write equivalent forms of expressions.****A2.A.2.1** Factor polynomial expressions including but not limited to trinomials, differences of squares, sum and difference of cubes, and factoring by grouping using a variety of tools and strategies.**A2.A.2.2** Add, subtract, multiply, divide, and simplify polynomial and rational expressions.**A2.A.2.3** Recognize that a quadratic function has different equivalent representations [ $f\left(x\right)=ax^{2}+bx+c, f\left(x\right)=a(x-h)^{2}+k$, or in factored form] and identify the representation that is most appropriate for the situation (solving or graphing) . **A2.A.2.4** Rewrite expressions involving radicals and rational exponents using the properties of exponents. |

| **Functions (F)** |
| --- |
| **Pre-Algebra (PA)** | **Algebra 1 (A1)** | **Algebra 2 (A2)** |
| Strand addressed at other grade levels. |  **A1.F.1 Understand functions as descriptions of covariation (how related quantities vary together) in real-world and mathematical problems.****A1.F.1.1** Distinguish between relations and functions using the vertical line test and the definition of a function.**A1.F.1.2** Identify the dependent and independent variables as well as the domain and range given a function, equation, or graph. Identify restrictions on the domain and range in real-world contexts.**A1.F.1.3** Write linear functions in terms of real-world context using function notation.**A1.F.1.4** Given a graph modeling a real-world situation read and interpret the linear piecewise function (excluding step functions).**A1.F.2 Understand that families of functions are characterized by the rate of change.****A1.F.2.1** Distinguish between linear and nonlinear data (including exponential) through tables, graphs, equations, and real-world contexts.**A1.F.2.2** Recognize the graph of the functions 𝑓 𝑥 = 𝑥 and 𝑓 𝑥 = |𝑥| and predict the effects of transformations [ 𝑓(𝑥 + 𝑐) and 𝑓(𝑥) + 𝑐, where *c* is a positive or negative constant] algebraically and graphically using various methods and tools that may include graphing calculators.**A1.F.3 Represent functions in multiple ways and use the representation to interpret real-world and mathematical problems.****A1.F.3.1** Identify equivalent representations of linear equations, graphs, tables, and real-world situations.**A1.F.3.2** Use function notation; evaluate a function, including nonlinear, at a given point in its domain algebraically and graphically. Interpret the results in terms of real-world and mathematical problems.**A1.F.3.3** Add, subtract, and multiply functions using function notation. | **A2.F.1 Understand functions as descriptions of covariation (how related quantities vary together).****A2.F.1.1** Use algebraic, interval, and set notations to specify the domain and range of functions of various types and evaluate a function at a given pointin its domain.**A2.F.1.2** Recognize the graphs of exponential, radical (square root and cube root only), quadratic, and logarithmic functions. Predict the effects of transformations [ 𝑓(𝑥 + 𝑐), 𝑓(𝑥) + 𝑐, 𝑓(𝑐𝑥), and 𝑐𝑓(𝑥), where *c* is a positive or negative constant], where c is a positive or negative constant] algebraically and graphically, using various methods and tools that may include graphing calculators or other appropriate technology.**A2.F.1.3** Graph a quadratic function. Identify the *x*- and *y*-intercepts, maximum or minimum value, axis of symmetry, and vertex using various methods and tools that may include a graphing calculator o appropriate technology.**A2.F.1.4** Graph exponential and logarithmic functions. Identify asymptotes and *x*- and *y*-intercepts using various methods and tools that may include graphing calculators or other appropriate technology. Recognize exponential decay and growth graphically and algebraically.**A2.F.1.5** Analyze the graph of a polynomial function by identifying the domain, range, intercepts, zeros, relative maxima, relative minima, and intervals of increase and decrease.**A2.F.1.6** Graph a rational function and identify the *x*- and *y*-intercepts, vertical and horizontal asymptotes, using various methods and tools that may include a graphing calculator or other appropriate technology. (Excluding slant or oblique asymptotes and holes.)**A2.F.1.7** Graph a radical function (square root and cube root only) and identify the *x*- and *y*-intercepts using various methods and tools that may include a graphing calculator or other appropriate technology.**A2.F.1.8** Graph piecewise functions with no more than three branches. (Branches may include linear, quadratic, or exponential functions.)**A2.F.1.9** Given the graph of a piecewise function, analyze the function by identifying the domain, range, intercepts, and intervals for which it is increasing, decreasing, and constant.**A2.F.2 Understand functions through algebraic combinations, compositions, and inverses, if they exist.****A2.F.2.1** Add, subtract, multiply, and divide functions using function notation and recognize domain restrictions.**A2.F.2.2** Combine functions by composition and recognize that $f\left(x\right)$ and $g(x)$ are inverse functions if $f\left(g\left(x\right)\right)=g\left(f\left(x\right)\right)=x$.**A2.F.2.3** Find and graph the inverse of a function, if it exists, and know the graphs are reflected about the line $y=x$.**A2.F.2.4** Apply the inverse relationship between exponential and logarithmic functions to convert from one form to another. |

| **Data & Probability (D)** |
| --- |
| **Pre-Algebra (PA)** | **Algebra 1 (A1)** | **Algebra 2 (A2)** |
| **PA.D.1 Display and interpret data in a variety of ways, including using scatterplots and approximate lines of best fit. Use lines of best fit to draw conclusions about data.****PA.D.1.1** Describe the impact that inserting or deleting a data point has on the mean and the median of a data set. Know how to create data displays using a spreadsheet and use a calculator to examine this impact.**PA.D.1.2** Explain how outliers affect measures of central tendency.**PA.D.1.3** Collect, display and interpret data using scatterplots. Use the shape of the scatterplot to informally estimate a line of best fit. Use appropriate titles, labels and units.**PA.D.2 Calculate experimental probabilities and reason about probabilities to solve real-world and mathematical problems.****PA.D.2.1** Calculate experimental probabilities and represent them as percents, fractions and decimals between 0 and 1 inclusive. Use experimental probabilities to make predictions when actual probabilities are unknown (e.g., repeatedly draw colored chips with replacement for a bag with an unknown mixture of chips, record relative frequencies, and use the results to make predictions about the contents of the bag).**PA.D.2.2** Determine how samples are chosen (random, limited, biased) to draw and support conclusions about generalizing a sample to a population (e.g., Is the average height of a men’s college basketball team a good representative sample for height predictions?).**PA.D.2.3** Compare and contrast dependent and independent events. | **A1.D.1 Display and analyze data.****A1.D.1.1** Describe a data set using data displays, describe and compare data sets using summary statistics, including measures of central tendency, location, and spread. Measures of central tendency and location include mean, median, mode, and percentile. Measures of spread include standard deviation and range. Know how to use calculators, spreadsheets, or other appropriate technology to display data and calculate summary statistics.**A1.D.1.2** Collect data and use scatterplots to analyze patterns and describe linear relationships between two variables. Using graphing technology, determine regression lines and correlation coefficients; use regression lines to make predictions and correlation coefficients to assess the reliability of those predictions.**A1.D.1.3** Interpret graphs as being discrete or continuous.**A1.D.2 Calculate probabilities and apply probability concepts.****A1.D.2.1** Select and apply counting procedures, such as the multiplication and addition principles and tree diagrams, to determine the size of a sample space (the number of possible outcomes) and to calculate probabilities.**A1.D.2.2** Describe the concepts of intersections, unions, and complements using Venn diagrams to evaluate probabilities. Understand the relationships between these concepts and the words AND, OR, and NOT.**A1.D.2.3** Calculate experimental probabilities by performing simulations or experiments involving a probability model and using relative frequencies of outcomes.**A1.D.2.4** Apply probability concepts to real-world situations to make informed decisions. | **A2.D.1 Display and analyze data.****A2.D.1.1** Use the mean and standard deviation of a data set to fit it to a normal distribution (bell-shaped curve).**A2.D.1.2** Collect data and use scatterplots to analyze patterns and describe linear, exponential or quadratic relationships between two variables. Using graphing calculators or other appropriate technology, determine regression equation and correlation coefficients; use regression equations to make predictions and correlation coefficients to assess the reliability of those predictions.**A2.D.1.3** Based upon a real-world context, recognize whether a discrete or continuous graphical representation is appropriate and then create the graph.**A2.D.2 Analyze statistical thinking to draw inferences, make predictions, and justify conclusions.****A2.D.2.1** Evaluate reports based on data published in the media by identifying the source of the data, the design of the study, and the way the data are analyzed and displayed. Given spreadsheets, tables, or graphs, recognize and analyze distortions in data displays. Show how graphs and data can be distorted to support different points of view.**A2.D.2.2** Identify and explain misleading uses of data. Recognize when arguments based on data confuse correlation and causation. |

| **Reasoning & Logic (G.RL)** |
| --- |
| **Seventh Grade (7)** | **Pre-Algebra (PA)** | **Geometry (G)** |
| Topic addressed at other grade levels. | Topic addressed at other grade levels. | **G.RL.1 Use appropriate tools and logic to evaluate mathematical arguments.****G.RL.1.1** Understand the use of undefined terms, definitions, postulates, and theorems in logical arguments/proofs.**G.RL.1.2** Analyze and draw conclusions based on a set of conditions using inductive and deductive reasoning. Recognize the logical relationships between a conditional statement and its inverse, converse, and contrapositive.**G.RL.1.3** Assess the validity of a logical argument and give counterexamples to disprove a statement. |

| **2-Dimensional Shapes (G.2D)** |
| --- |
| **Seventh Grade (7)** | **Pre-Algebra (PA)** | **Geometry (G)** |
| **7.GM.2 Determine the area of trapezoids and area and perimeter of composite figures.****7.GM.2.1** Develop and use the formula to determine the area of a trapezoid.**7.GM.2.2** Find the area and perimeter of composite figures to solve real-world and mathematical problems.**7.GM.4 Analyze the effect of change of scale, translations and reflections on the attributes of two-dimensional figures.****7.GM.4.1** Describe the properties of similarity, compare geometric figures for similarity, and determine scale factors.**7.GM.4.2** Apply scale factors, length ratios and area ratios to determine side lengths and areas of similar geometric figures limited to triangles and rectangles.**7.GM.4.3** Use proportions and ratios to solve problems involving scale drawings.**7.GM.4.4** Graph and describe translations and reflections of figures on a coordinate grid and determine the coordinates of the vertices of the figure after the transformation. | Topic addressed at other grade levels. | **G.2D.1 Discover, evaluate and analyze the relationships between lines, angles, and polygons to solve real-world and mathematical problems; express proofs in a form that clearly justifies the reasoning, such as two-column proofs, paragraph proofs, flow charts, or illustrations.****G.2D.1.1** Apply the properties of parallel and perpendicular lines, including properties of angles formed by a transversal, to solve real-world and mathematical problems and determine if two lines are parallel, using algebraic reasoning and proofs.**G.2D.1.2** Apply the properties of angles, including corresponding, exterior, interior, vertical, complementary, and supplementary angles to solve real-world and mathematical problems using algebraic reasoning and proofs.**G.2D.1.3** Apply theorems involving the interior and exterior angle sums of polygons and use them to solve real-world and mathematical problems using algebraic reasoning and proofs.**G.2D.1.4** Apply the properties of special quadrilaterals (square, rectangle, trapezoid, isosceles trapezoid, rhombus, kite, parallelogram) and use them to solve real-world and mathematical problems involving angle measures and segment lengths using algebraic reasoning and proofs.**G.2D.1.5** Use coordinate geometry to represent and analyze line segments and polygons, including determining lengths, midpoints, and slopes of line segments.**G.2D.1.6** Apply the properties of polygons to solve real-world and mathematical problems involving perimeter and area (e.g., triangles, special quadrilaterals, regular polygons – up to 12 sided figures, composite figures).**G.2D.1.7** Apply the properties of congruent or similar polygons to solve real-world and mathematical problems using algebraic and logical reasoning.**G.2D.1.8** Construct logical arguments to prove triangle congruence (SSS, SAS, ASA, AAS and HL) and triangle similarity (AA, SSS, SAS).**G.2D.1.9** Use numeric, graphic and algebraic representations of transformations in two dimensions, such as reflections, translations, dilations, and rotations about the origin by multiples of 90 ̊, to solve problems involving figures on a coordinate plane and identify types of symmetry. |
| **3-Dimensional Shapes (G.3D)** |
| **Seventh Grade (7)** | **Pre-Algebra (PA)** | **Geometry (G)** |
| **7.GM.1 Develop and understand the concept of surface area and volume of rectangular prisms.****7.GM.1.1** Using a variety of tools and strategies, develop the concept that surface area of a rectangular prism can be found by wrapping the figure with same-sized square units without gaps or overlap. Use appropriate measurements such as cm2.**7.GM.1.2** Using a variety of tools and strategies, develop the concept that the volume rectangular prisms can be found by counting the total number of same-sized cubic units that fill a shape without gaps or overlaps. Use appropriate measurements such as cm3. | **PA.GM.2 Calculate surface area and volume of three-dimensional figures.****PA.GM.2.1** Calculate the surface area of a rectangular prism using decomposition or nets. Use appropriate measurements such as cm2.**PA.GM.2.2** Calculate the surface area of a cylinder, in terms of π and using approximations for π, using decomposition or nets. Use appropriate measurements such as cm2.**PA.GM.2.3** Develop and use the formulas $V=lwh$ and $V=Bh$ to determine the volume of rectangular prisms. Justify why base area (B) and height (h) are multiplied to find the volume of a rectangular prism by breaking the prism into layers of rectangles. Use appropriate measurements such as cm3.**PA.GM.2.4** Develop and use the formulas $V=πr^{2}h$ and $V=Bh$ to determine the volume of right cylinders, in terms of π and using approximations for π. Justify why base area (*B*) and height (*h*) are multiplied to find the volume of a right cylinder by breaking the cylinder into layers of circles with radius (*r*). Use appropriate measurements such as cm3 | **G.3D.1 Solve real-world and mathematical problems involving 3-dimensional figures.****G.3D.1.1** Solve real-world and mathematical problems using the surface area and volume of prisms, cylinders, pyramids, cones, spheres, and composites of these figures. Use nets, measuring devices, or formulas as appropriate.**G.3D.1.2** Use ratios of similar 3-dimensional figures to make conjectures, generalize, and to solve for unknown values such as angles, side lengths, perimeter or circumference of a face, area of a face, and volume. |

| **Circles (G.C)** |
| --- |
| **Seventh Grade (7)** | **Pre-Algebra (PA)** | **Geometry (G)** |
| **7.GM.3 Use reasoning with proportions and ratios to determine measurements, justify formulas, and solve real-world and mathematical problems involving circles and related geometric figures.****7.GM.3.1** Demonstrate an understanding of the proportional relationship between the diameter and circumference of a circle and that the unit rate (constant of proportionality) is π and can be approximated by rational numbers such as $\frac{22}{7}$ and 3.14.**7.GM.3.2** Calculate the circumference and area of circles to solve problems in various contexts, in terms of π and using approximations for π. | Topic addressed at other grade levels. | **G.C.1 Solve real-world and mathematical problems using the properties of circles.****G.C.1.1** Apply the properties of circles to solve problems involving circumference and area, approximate values and in terms of π, using algebraic and logical reasoning.**G.C.1.2** Apply the properties of circles and relationships among angles, arcs, and distances in a circle among radii, chords, secants and tangents to solve problems using algebraic and logical reasoning.**G.C.1.3** Recognize and write the radius $r$, center $(h,k)$, and standard form of the equation of a circle $(x-h)^{2}+(y-k)^{2}=r^{2}$ with and without graphs.**G.C.1.4** Apply the distance and midpoint formula, where appropriate, to develop the equation of a circle in standard form. |

| **Right Triangle Trigonometry (G.RT)** |
| --- |
| **Seventh Grade (7)** | **Pre-Algebra (PA)** | **Geometry (G)** |
| Topic addressed at other grade levels. | **PA.GM.1 Solve problems involving right triangles using the Pythagorean Theorem.****PA.GM.1.1** Informally justify the Pythagorean Theorem using measurements, diagrams or dynamic software and use the Pythagorean Theorem to solve problems involving right triangles.**PA.GM.1.2** Determine the distance between two points on a horizontal or vertical line in a coordinate system. Use the Pythagorean Theorem to find the distance between any two points in a coordinate system. | **G.RT.1 Develop and verify mathematical relationships of right triangles and trigonometric ratios to solve real-world and mathematical problems.****G.RT.1.1** Apply the distance formula and the Pythagorean Theorem and its converse to solve real-world and mathematical problems, as approximate and exact values, using algebraic and logical reasoning (include Pythagorean Triples).**G.RT.1.2** Verify and apply properties of right triangles, including properties of 45-45-90 and 30-60-90 triangles, to solve problems using algebraic and logical reasoning.**G.RT.1.3** Use the definition of the trigonometric functions to determine the sine, cosine and tangent ratio of an acute angle in a right triangle. Apply the inverse trigonometric functions as ratios (sine, cosine, and tangent) to find the measure of an acute angle in right triangles.**G.RT.1.4** Apply the trigonometric functions as ratios (sine, cosine and tangent) to find side lengths in right triangles in real-world and mathematical problems. |