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# **MATHEMATICS CURRICULUM**

**Grades K – 8**

# General Skills

## **Problem Solving**

Problem solving is an integral part of all mathematics learning. To solve problems, students must draw upon their knowledge of the concepts and skills they have learned and apply them to a novel situation; through this process, students develop new mathematical understanding. Problem solving should not be an isolated part of the program. Rather, problem solving should involve all content areas, numbers and operations, algebra, geometry, measurement, and data analysis and probability.

Instructional programs from kindergarten through grade 12 should enable students to:

- Build new mathematical knowledge through problem solving
- Solve problems that arise in mathematics and other contexts
- Apply and adapt a variety of appropriate strategies to solve problems, and
- Monitor and reflect on the process of problem solving.

To build mathematical knowledge through problem solving, teachers must first be able to choose good problems that give students the chance to solidify and extend what they know and that stimulate mathematics learning. Good problem solvers tend naturally to analyze situations carefully in mathematical terms and to properly pose problems based on particular situations. They consider simple cases before trying something more complicated, and they look for and examine patterns and relationships. Throughout the grades, teachers help build problem solving skills by asking questions that help students find the mathematics in their experiences, and by encouraging students to persist with interesting but challenging problems.

Students who can successfully solve problems are able to apply and adapt a variety of appropriate strategies. Opportunities to learn these strategies must be embedded naturally in the curriculum across the content areas. In the earliest grades, students first learn to express, categorize, and compare their strategies. In the middle grades, students should be skilled in recognizing when various strategies are appropriate to use and should be capable of deciding how to use them. By high school, students should have access to a wide range of strategies, be able to decide which one to use, and be able to adapt and invent strategies.

Effective problem solvers constantly monitor and adjust what they are doing. They make sure they understand the problem and they plan frequently, periodically taking stock of their progress to see whether they seem to be on the right track. If they are not making progress, they stop to consider alternatives and do not hesitate to take a completely different approach. Poor problem solving is often due not to lack of knowledge but to the ineffective use of what they do know. Good problem solvers become aware of what they are doing and frequently use reflective skills. Teachers must create classroom environments that support the development of reflective habits and provide opportunities where students are more likely to monitor their understanding and more likely to make productive adjustments necessary when solving problems.

## Reasoning

Reasoning is essential to understanding mathematics. By developing ideas, exploring phenomena, justifying results, and using mathematical conjectures in all content areas at all grade levels, students will learn that mathematics makes sense. Reasoning and proof cannot simply be taught in a single unit on logic or by 'doing proofs' in geometry. Reasoning and proof should be a consistent part of students' mathematical experience in kindergarten through grade 12. Reasoning mathematically is a habit of mind, and is developed through consistent use in many contexts.

Systematic reasoning is a defining feature of mathematics. It is found in all content areas and, with different degrees of rigor, at all grade levels. Effective instructional programs should enable students to:

- Recognize reasoning and proof as fundamental aspects of mathematics,
- Make and investigate mathematical conjectures,
- Develop and evaluate mathematical arguments and proofs, and
- Select and use various types of reasoning and methods of proof.

Conjecture, which is informed guessing, is a major pathway to discovery. Students can learn to make, refine, and test conjectures in very early grades, and they can develop their abilities to investigate their conjectures using concrete materials, calculators and other tools, and increasingly through the grades, mathematical representations and symbols. Beginning in the elementary grades, students can learn to disprove conjectures by finding counterexamples. At all levels, students will reason inductively from specific cases to larger patterns. Increasingly, they should learn to make effective deductive arguments. Students also need to work with other students to formulate their conjectures and to listen to and understand conjectures and explanations offered by classmates. As students move through the grades they compare their ideas with other's ideas, which may cause them to modify, consolidate, or strengthen their arguments or reasoning.

## Communication

Through communication, ideas become objects of reflection, refinement, discussion, and amendment. The communication process helps build meaning and permanence for ideas and makes them public. When students are challenged to think and reason about mathematics and to communicate the results of their thinking to others orally or in writing, they learn to be clear and convincing. Listening to others' explanations gives students opportunities to develop their own understanding. Conversations in which mathematical ideas are explored from multiple perspectives help students sharpen their thinking and make connections. Such activity also helps students to develop a language for expressing mathematical ideas and an appreciation for the need for precision in that language.

Instructional programs from kindergarten through grade 12 should enable students to:

- Organize and consolidate their thinking through communication,
- Communicate their mathematical thinking coherently and clearly to peers, teachers, and others,
- Analyze and evaluate the mathematical thinking and strategies of others, and
- Use the language of mathematics to express mathematical ideas precisely.

Reflection and communication are intertwined processes in mathematical learning. Writing in mathematics can also help students consolidate their thinking because it requires them to reflect on their work and clarify their thoughts about the ideas developed. Examining and discussing both exemplary and problematic pieces of mathematical writing can be beneficial at all levels. Students also need to test their ideas on the basis of shared knowledge and see whether they can be understood and are convincing.

Learning what is acceptable as evidence in mathematics should be an instructional goal from kindergarten through grade 12. Students benefit from analyzing and evaluating the mathematical thinking and strategies of others. Since not all methods and ideas have equal merit, students must learn to examine the methods and ideas of others to determine their own strengths and limitations.

## **Representation**

The term representation refers both to process and product, meaning the act of capturing a mathematical concept or relationship in some form or the form itself. When students have access to mathematical representations and the ideas they represent, they have a set of tools that significantly expand their capacity to think mathematically. Representations should be treated as essential elements in supporting students' understanding of mathematical concepts and relationships, in recognizing connections among related mathematical concepts, and in applying mathematics to realistic problem situations through modeling. It is important to encourage students to represent their ideas in ways that makes sense to them, first in ways that are not conventional and later, in conventional form.

Instructional programs from kindergarten through grade 12 should enable all students to:

- Create and use representations to organize, record, and communicate mathematical ideas,
- Select, apply, and translate among mathematical representations to solve problems, and
- Use representations to model and interpret physical, social, and mathematical phenomena.

It is important that students have opportunities to not only learn conventional forms of representation, but also to construct, refine, and use their own representations as tools to support learning and doing mathematics. Computers and calculators change what students can do with conventional representations and expand the set of representations with which they can work. A variety of technological tools allow students to manipulate, visualize, and simulate more complex data and therefore represent and investigate mathematical ideas and situations not otherwise possible. As students' representational repertoire expands, it is important for students to reflect on their use of representations to develop an understanding of the relative strengths and weaknesses of various representations for various purposes.

In the early grades, students model situations using physical objects and simple pictures. As middle grade students model and solve problems that arise in the real and the mathematical worlds, they learn to use variables to represent unknowns and also learn how to employ equations, graphs, and tables to represent and analyze situations. High school students create and interpret models of phenomena drawn from a wider range of contexts by identifying the essential elements of the context and by devising representations that capture mathematical relationships among those elements. With technology tools, students can explore and understand complex concepts. These tools now allow students to explore iterative models for situations that were once studied in much more advanced courses.

# Kindergarten

## Strand 1: NUMBER AND OPERATIONS

**Standard:** Students will understand numerical concepts and mathematical operations.

<u>Benchmarks</u>	<u>Skills</u>
1. Understand numbers, ways of representing numbers, relationships among numbers, and number systems.	a) Demonstrate an understanding of the place-value structure of the base-ten number system. b) Count with understanding and recognize “how many” in sets of objects up to 20. c) Read and write whole numbers up to 20. d) Compare and order whole numbers up to 20. e) Use an organized counting method to keep track of quantities while counting (e.g., touch object once and only once as counting a set). f) Order sets of objects and numbers from least to most or most to least.
2. Understands the meaning of operations and how they relate to one another.	a) Represent numbers using pictures, objects, or numerals. b) Use concrete objects to solve simple addition and subtraction story problems.
3. Compute fluently and make reasonable estimates.	a) Estimate quantities of objects up to 20.

## Strand 2: ALGEBRA

**Standard:** Students will understand algebraic concepts and applications

<u>Benchmarks</u>	<u>Skills</u>
1. Understand patterns, relations, and functions.	a) Identify the attributes of objects (e.g., the ability to identify attributes is a foundational skill for sorting and classifying). b) Sort, classify, and order objects by size, number, and other properties. c) Recognize, reproduce, describe, extend, and create repeating patterns (e.g., color, shape, size, sound, movement, simple numbers).

2. Represent and analyze mathematical situations and structures using algebraic symbols.	a) Use concrete, pictorial, and verbal representation to develop an understanding of invented and conventional symbols.
3. Use mathematical models to represent and understand quantitative relationships.	a) Model situations that involve whole numbers using objects or pictures.
4. Analyze changes in various contexts.	a) Verbally describe changes in various contexts (e.g., plants or animals growing over time).

### **Strand 3: GEOMETRY**

**Standard:** Students will understand geometric concepts and applications.

<b><u>Benchmarks</u></b>	<b><u>Skills</u></b>
1. Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.	<ul style="list-style-type: none"> <li>a) Identify common objects in their environments and describe their geometric features.</li> <li>b) Describe, identify, model, and draw common geometric objects (e.g., circle, triangle, square, rectangle, cube, sphere, cone).</li> <li>c) Compare familiar plane and solid objects by common attributes (e.g., shape, size, number of corners).</li> </ul>
2. Specify locations and describe spatial relationships using coordinate geometry and other representational systems.	<ul style="list-style-type: none"> <li>a) Follow simple directions to find a specific location in space.</li> <li>b) Use spatial vocabulary (e.g., left, right, above, below) to describe relative position.</li> </ul>
3. Apply transformations and use symmetry to analyze mathematical situations.	<ul style="list-style-type: none"> <li>a) Use manipulatives (e.g., puzzles, tangrams, blocks) to demonstrate rotation (i.e., flips), translations (i.e., slides), and reflection (i.e., turns).</li> <li>b) Investigate the symmetry of two-dimensional shapes (e.g., by folding or cutting paper, using mirrors).</li> </ul>
4. Use visualization, spatial reasoning, and geometric modeling to solve problems.	<ul style="list-style-type: none"> <li>a) Describe how to get from one location to another (e.g., how to get to the library).</li> <li>b) Find and describe geometric shapes in nature or architecture.</li> </ul>

## **Strand 4: MEASUREMENT**

**Standard:** Students will understand measurement systems and applications.

<b><u>Benchmarks</u></b>	<b><u>Skills</u></b>
1. Understand measurable attributes of objects and the units, systems, and process of measurement.	a) Describe and compare, using appropriate concepts and vocabulary, the measurable properties of length (e.g., shorter, longer, taller), volume (e.g., full, empty), weight (e.g., heavy, light), and time (e.g., before, after, morning, afternoon, days of week). b) Use tools to make predictions (e.g., a balance scale, cups). c) Measure using non-standard units of measurement (e.g., use pencils to measure desk top, use different lengths of rope to measure distance in classroom). d) Use digital and analog (face) clocks to tell time to the hour.
2. Apply appropriate techniques, tools, and formulas to determine measurements.	a) Explore measuring objects using a repeating non-standard unit of measurement (e.g., paper clips, cubes, etc.).

## **Strand 5: DATA ANALYSIS AND PROBABILITY**

**Standard:** Students will understand how to formulate questions, analyze data, and determine probabilities.

<b><u>Benchmarks</u></b>	<b><u>Skills</u></b>
1. Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.	a) Collect data about objects and events in the environment to answer simple questions (e.g., brainstorm questions about self and surroundings, collect data, and record the results using objects, pictures, and pictographs).
2. Select and use appropriate statistical methods to analyze data.	a) Describe simple data and pose questions about the data.
3. Develop and evaluate inferences and predictions that are based on data.	a) Make simple predictions.
4. Understand and apply basic concepts of probability.	a) Answer questions that relate to the possibility of familiar events happening or not.

# Grade 1

## Strand 1: NUMBER AND OPERATIONS

**Standard:** Students will understand numerical concepts and mathematical operations.

<u>Benchmarks</u>	<u>Skills</u>
1. Understand numbers, ways of representing numbers, relationships among numbers, and number systems.	<ul style="list-style-type: none"><li>a) Demonstrate an understanding of the place-value structure of the base-ten number system.</li><li>b) Read, write, model, and sequence whole numbers up to 100.</li><li>c) Count with understanding and recognize “how many” in sets of objects up to 50.</li><li>d) Count orally by 2s to 20 and by 5s and 10s to 100 d. Count orally backward from 100.</li><li>e) Compare and order numbers up to 100.</li><li>f) Decompose and recombine numbers to create and construct equivalent representations for the same number (e.g., <math>10 = 3 + 7</math> or <math>1 + 2 + 7</math> or <math>3 + 2 + 5</math>).</li><li>g) Group objects by 10s and 1s to explore place value (e.g., 24 equals two tens and four ones).</li><li>h) Use ordinal numbers and cardinal numbers appropriately.</li><li>i) Connect number words and numbers to the quantities they represent.</li></ul>
2. Understands the meaning of operations and how they relate to one another.	<ul style="list-style-type: none"><li>a) Use a variety of models to show understanding of addition and subtraction of whole numbers.</li><li>b) Solve addition / subtraction problems with one and two-digit numbers (e.g., <math>\square + 58 = \square</math>).</li><li>c) Find the sum of three one-digit numbers to the sum of 15.</li><li>d) Understand and use the inverse relationship between addition and subtraction to solve problems and check solutions (e.g., <math>8 + 6 = 14</math> is related to <math>14 - 6 = 8</math>).</li><li>e) Use concrete materials to investigate situations that relate to multiplication and division (e.g., equal groupings of objects, sharing equally).</li><li>f) Given simple story problems, explain verbally how to select and use appropriate operations.</li></ul>
3. Compute fluently and make reasonable estimates.	<ul style="list-style-type: none"><li>a) Use strategies for whole-number computation, with a focus on addition and subtraction (e.g., counting on or counting back, doubles, sums that make 10, direct modeling with pictures or objects, numerical reasoning based on number combinations and relationships).</li><li>b) Demonstrate a variety of methods to compute (e.g., objects, mental computation, paper and pencil, and estimation).</li><li>c) Perform addition and subtraction with whole number combinations.</li><li>d) Use and explain estimation strategies to determine the reasonableness of answers involving addition and subtraction.</li></ul>

## **Strand 2: ALGEBRA**

**Standard:** Students will understand algebraic concepts and applications

<b><u>Benchmarks</u></b>	<b><u>Skills</u></b>
1. Understand patterns, relations, and functions.	<ul style="list-style-type: none"><li>a) Recognize, reproduce, describe, extend, and create repeating patterns (e.g., color, shape, size, sound, movement, simple numbers) and translate from one representation to another (e.g., red, red, blue, blue to step, step, clap, clap).</li><li>b) Skip-count on a hundreds chart (e.g., by 2s up to 20 and 5s and 10s up to 100) to identify, describe, and predict number patterns.</li><li>c) Identify number patterns on the hundreds chart.</li></ul>
2. Represent and analyze mathematical situations and structures using algebraic symbols.	<ul style="list-style-type: none"><li>a) Write number sentences that use concrete objects, pictorial, and verbal representations to express mathematical situations using invented and conventional symbols (e.g., +, -, =).</li><li>b) Demonstrate and describe the concept of equal (e.g., using objects, balance scales).</li><li>c) Solve number sentences with variables representing numbers up to 10 (e.g., <math>10 = \square + 2</math>).</li></ul>
3. Use mathematical models to represent and understand quantitative relationships.	<ul style="list-style-type: none"><li>a) Represent equivalent forms of the same number through the use of physical models, diagrams, and number expressions to 20 (e.g., <math>3 + 5 = 8</math>, <math>2 + 6 = 8</math>).</li><li>b) Describe situations that involve addition and subtraction of whole numbers including objects, pictures, and symbols (e.g., Robert has four apples, Maria has five more).</li></ul>
4. Analyze changes in various contexts.	<ul style="list-style-type: none"><li>a) Describe qualitative change (e.g., a student growing taller, trees getting bigger, ice melting).</li></ul>

## **Strand 3: GEOMETRY**

**Standard:** Students will understand geometric concepts and applications.

<b><u>Benchmarks</u></b>	<b><u>Skills</u></b>
1. Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.	<ul style="list-style-type: none"><li>a) Identify common geometric figures and classify them by common attributes.</li><li>b) Recognize, name, build, and draw both polygonal (up to six sides) and curved shapes.</li><li>c) Sort two- and three-dimensional shapes into categories based on common attributes.</li><li>d) Use the attributes of shapes to analyze and identify examples and non-examples of geometric shapes.</li></ul>

<p>2. Specify locations and describe spatial relationships using coordinate geometry and other representational systems.</p>	<p>a) Describe direction, location, space, and shape (e.g., left, right, over, under, near, far,).  b) Visualize, describe, and record directions for navigating from one location to another to develop the vocabulary needed to describe direction, distance, location, and representation.  c) Use materials to create representations of the surrounding environment (e.g., maps).  d) Develop estimates and measure distances using nonstandard measurements.</p>
<p>3. Apply transformations and use symmetry to analyze mathematical situations.</p>	<p>a) Create simple symmetrical shapes and pictures.  b) Recognize and describe the symmetric characteristics of designs (e.g., geometric designs made with pattern blocks).</p>
<p>4. Use visualization, spatial reasoning, and geometric modeling to solve problems.</p>	<p>a) Use combinations of shapes to make a new shape to demonstrate relationships between shapes (e.g., a hexagon can be made from six triangles).  b) Create three-dimensional shapes based on two-dimensional representations.  c) Describe how to get from one location to another by visualizing landmarks along the route.</p>

## **Strand 4: MEASUREMENT**

**Standard:** Students will understand measurement systems and applications.

<b><u>Benchmarks</u></b>	<b><u>Skills</u></b>
<p>1. Understand measurable attributes of objects and the units, systems, and process of measurement.</p>	<p>a) Develop an understanding of measurable properties (e.g., length, volume, weight, area, and time) using appropriate concepts and vocabulary:</p> <ul style="list-style-type: none"> <li>• Length by measuring and estimating (e.g., longer, shorter, meter, centimeter, inch,).</li> <li>• Weight by measuring, estimating, and weighing (e.g., heavy [-ier], light [-er]).</li> <li>• Volume by measuring, estimating, and weighing (e.g., full, empty).</li> <li>• Area by measuring and estimating (e.g., perimeter, rectangles, squares).</li> <li>• Time by estimating (e.g., minutes, hours, days, weeks).</li> </ul> <p>b) Use digital and analog (face) clocks to tell time to the half hour.</p>
<p>2. Apply appropriate techniques, tools, and formulas to determine measurements.</p>	<p>a) Measure with multiple copies of units the same size (e.g., paper clips).  b) Use repetition of a single unit to measure something larger than the unit (e.g., a meter stick to measure a room).</p>

## **Strand 5: DATA ANALYSIS AND PROBABILITY**

**Standard:** Students will understand how to formulate questions, analyze data, and determine probabilities

<b><u>Benchmarks</u></b>	<b><u>Skills</u></b>
1. Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.	<ul style="list-style-type: none"><li>a) Collect, organize, represent, and compare data by category on graphs and charts to answer simple questions.</li><li>b) Answer questions about “how” data can be gathered.</li><li>c) Gather data by interviewing, surveying, and making observations.</li><li>d) Organize data into appropriate categories by sorting based on shared properties.</li><li>e) Participate in discussions about selecting an appropriate way to display the data.</li><li>f) Represent data using objects, pictures, tables, and simple bar graphs.</li></ul>
2. Select and use appropriate statistical methods to analyze data.	<ul style="list-style-type: none"><li>a) Interpret what the graph or other representation shows.</li><li>b) Determine whether or not the data gathered helps answer the question that was posed.</li><li>c) Compare parts of the data (e.g., “How many students have lost none, one, two, or three teeth?”) to make statements about the data as a whole (e.g., “Most students in the class have lost only two teeth”).</li></ul>
3. Develop and evaluate inferences and predictions that are based on data.	<ul style="list-style-type: none"><li>a) Make conclusions based on data (e.g., whether or not other groups would reach similar conclusions based on the same data).</li></ul>
4. Understand and apply basic concepts of probability.	<ul style="list-style-type: none"><li>a) Discuss the likelihood of events (based on student experiences or from books) using terminology such as “more likely”, “less likely”, “possible”, or “certain”.</li><li>b) Observe, explore, and discuss whether some events occur more often than others (e.g., tossing two die and recording the sum after each toss to explore whether or not certain sums occur more frequently than others).</li></ul>

# Grade 2

## Strand 1: NUMBER AND OPERATIONS

**Standard:** Students will understand numerical concepts and mathematical operations.

<u>Benchmarks</u>	<u>Skills</u>
1. Understand numbers, ways of representing numbers, relationships among numbers, and number systems.	<ul style="list-style-type: none"><li>a) Understand the relationship between numbers, quantities, and place value in whole numbers up to 1,000.</li><li>b) Use multiple models to explore place value and the base ten number system.</li><li>c) Identify whether a set of objects has an odd or even number of elements.</li><li>d) Compare and order numbers using a variety of terms (e.g., tens, less than, odd numbers).</li><li>e) Count and recognize “how many” in sets of objects up to 1,000.</li><li>f) Count forward and backward from given numbers.</li><li>g) Connect number words and numerals to the quantities they represent using physical models and other representations (e.g., 23 can be twenty-three 1s, one 10 and thirteen 1s, or two 10s and three 1s).</li><li>h) Model how many parts make a whole using equal fractional parts (e.g., <math>\frac{1}{2}</math>, <math>\frac{1}{3}</math>, <math>\frac{1}{4}</math>, and <math>\frac{1}{6}</math> as equal parts of a whole).</li></ul>
2. Understands the meaning of operations and how they relate to one another.	<ul style="list-style-type: none"><li>a) Find the sum of two whole numbers up to three digits long.</li><li>b) Find the difference of two whole numbers up to three digits long.</li><li>c) Understand and use the inverse relationships between addition and subtraction to check solutions (<math>28 + 31 = 59</math>; therefore, <math>59 - 31 = 28</math>).</li><li>d) Identify and describe situations that require multiplication and division and develop strategies to solve problems (e.g., repeated addition and subtraction, counting by multiples, equal sharing).</li></ul>
3. Compute fluently and make reasonable estimates.	<ul style="list-style-type: none"><li>a) Use and explain strategies for addition and subtraction of multi-digit whole numbers.</li><li>b) Model and solve problems representing adding and subtracting amounts of money using dollars and coins.</li><li>c) Use addition combinations (addends through 10) and related subtraction combinations, and develop strategies for computing based on number sense (e.g., <math>25 + 37</math>: Take 3 from the 25 and use it to turn 37 into 40; then add 40 and 22 to get 62).</li><li>d) Select and use a variety of appropriate strategies methods to compute (e.g., objects, mental computation, estimation, paper and pencil).</li><li>e) Skip-count by 2, 5, and 10 to develop multiplicative reasoning and notational representations (e.g., 5, 10, 15, 20; <math>4 \times 5 = 20</math>; four groups of 5 equals 20).</li></ul>

## **Strand 2: ALGEBRA**

**Standard:** Students will understand algebraic concepts and applications.

<b><u>Benchmarks</u></b>	<b><u>Skills</u></b>
1. Understand patterns, relations, and functions.	<ul style="list-style-type: none"><li>a) Recognize, reproduce, describe, extend, and create repeating and growing patterns, and translate from one representation to another.</li><li>b) Skip-count using calculators or a hundreds chart to identify, describe, predict, and make generalizations about number patterns to differentiate rote counting versus the meaning of the numbers.</li><li>c) Construct and solve open sentences that have variables (e.g., <math>10 = \square + 7</math>).</li><li>d) Relate everyday problem situations to number sentences involving addition and subtraction (e.g., 25 students are going to the store. Five students can ride in a car. How many cars will be needed?).</li></ul>
2. Represent and analyze mathematical situations and structures using algebraic symbols.	<ul style="list-style-type: none"><li>a) Use mathematical language to describe a variety of situations.</li><li>b) Explain the concept of equal (e.g., quantities on both sides of equation are the same) by using objects or giving examples.</li><li>c) Use objects, words, and symbols to explain the concept of addition.</li></ul>
3. Use mathematical models to represent and understand quantitative relationships.	<ul style="list-style-type: none"><li>a) Model situations of addition and subtraction of whole numbers using objects, pictures, and symbols.</li><li>b) Solve problems related to trading (e.g., coin trading).</li><li>c) Solve addition and subtraction problems by using data from simple charts, picture graphs, and number sentences.</li></ul>
4. Analyze changes in various contexts.	<ul style="list-style-type: none"><li>a) Describe quantitative change (e.g., a student growing two inches in one year, water heating up to boil).</li></ul>

### **Strand 3: GEOMETRY**

**Standard:** Students will understand geometric concepts and applications.

<b><u>Benchmarks</u></b>	<b><u>Skills</u></b>
1. Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.	<ul style="list-style-type: none"><li>a) Identify and describe the attributes of figures in a plane and objects in space.</li><li>b) Sort, describe, and analyze plane and solid geometric shapes based on various attributes (e.g., faces, edges, and corners).</li><li>c) Put shapes together and take them apart to form other shapes (e.g., two congruent right triangles can be arranged to form a rectangle).</li><li>d) Explore lines of symmetry in two-dimensional shapes.</li></ul>
2. Specify locations and describe spatial relationships using coordinate geometry and other representational systems.	<ul style="list-style-type: none"><li>a) Find and name locations with simple relationships like “near to”.</li><li>b) Describe, name, and interpret direction in navigating space and apply ideas about distance.</li><li>c) Use maps to locate points and navigate through mazes or maps.</li><li>d) Visualize, justify, and create paths using landmarks, shapes, and descriptive language.</li><li>e) Make and draw rectangular arrays of squares.</li></ul>
3. Apply transformations and use symmetry to analyze mathematical situations.	<ul style="list-style-type: none"><li>a) Use systematic thinking to solve geometric puzzles.</li><li>b) Use materials to investigate rotational and line symmetry and create shapes that have symmetry.</li></ul>
4. Use visualization, spatial reasoning, and geometric modeling to solve problems.	<ul style="list-style-type: none"><li>a) Demonstrate relationships of different attributes with concrete materials (e.g., change one characteristic of a shape while preserving others such as increasing number of sides while perimeter stays the same).</li><li>b) Select and use visualization skills to create mental images of geometric shapes.</li><li>c) Describe geometric shapes and structures from different perspectives.</li><li>d) Recognize geometric shapes and structures in the environment and specify their location.</li></ul>

## **Strand 4: MEASUREMENT**

**Standard:** Students will understand measurement systems and applications.

<b><u>Benchmarks</u></b>	<b><u>Skills</u></b>
1. Understand measurable attributes of objects and the units, systems, and process of measurement.	<ul style="list-style-type: none"><li>a) Identify a unit of measure (e.g., nearest inch) and repeat that unit comparing it to the item being measured.</li><li>b) Use direct comparison to compare and order objects according to length, mass, and area.</li><li>c) Measure and compare common objects using standard and non-standard units of length.</li><li>d) Find and represent the value of coins and dollars up to \$5.00, using appropriate notation.</li><li>e) Identify and use time intervals (e.g., hours, days, weeks, months).</li><li>f) Select and use appropriate measurement tools (e.g., ruler, meter stick).</li><li>g) Tell time to the nearest quarter hour.</li></ul>
2. Apply appropriate techniques, tools, and formulas to determine measurements.	<ul style="list-style-type: none"><li>a) Develop common referents to make comparisons and estimates of length, volume, weight, area, and time.</li><li>b) Develop an understanding that different measuring tools will yield different numerical measurements of the same object (e.g., ruler, meter stick, paper clip).</li><li>c) Estimate measurements and develop precision in measuring objects.</li></ul>

## **Strand 5: DATA ANALYSIS AND PROBABILITY**

**Standard:** Students will understand how to formulate questions, analyze data, and determine probabilities.

<b><u>Benchmarks</u></b>	<b><u>Skills</u></b>
1. Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.	<ul style="list-style-type: none"><li>a) Collect numerical data systematically.</li><li>b) Represent data by using concrete objects, pictures, tables, numbers, tallies, and graphs.</li><li>c) Pose questions about students' selves and their surroundings and gather data by interviewing, surveying, and making observations to answer the questions posed.</li><li>d) Identify patterns and explain the relationships of the units in the pattern (e.g., the number of ears on one dog, two dogs, etc., or linear numerical patterns).</li></ul>
2. Select and use appropriate statistical methods to analyze data.	<ul style="list-style-type: none"><li>a) Describe and interpret data by drawing conclusions and making conjectures based on the data collected.</li><li>b) Display data in a variety of formats.</li></ul>
3. Develop and evaluate inferences and predictions that are based on data.	<ul style="list-style-type: none"><li>a) Discuss events related to students as "likely", "unlikely", "possible" or "certain".</li><li>b) Recognize appropriate conclusions generated from the data collected.</li><li>c) Recognize inappropriate descriptions of the data set.</li></ul>
4. Understand and apply basic concepts of probability.	<ul style="list-style-type: none"><li>a) Investigate concepts of chance (e.g., outcomes of a simple experiment).</li><li>b) Investigate whether outcomes of a simple event are equally likely to occur.</li></ul>

# Grade 3

## Strand 1: NUMBER AND OPERATIONS

**Standard:** Students will understand numerical concepts and mathematical operations.

<u>Benchmarks</u>	<u>Skills</u>
1. Understand numbers, ways of representing numbers, relationships among numbers, and number systems.	<p>a) Exhibit an understanding of the place-value structure of the base-ten number system by:</p> <ul style="list-style-type: none"><li>• Reading, , writing, and comparing whole numbers up to 10,000</li><li>• Recognizing the position of a given number in the base-ten number system and its relationship to benchmark numbers such as 10, 50, 100, 500</li></ul> <p>b) Use whole numbers by using a variety of contexts and models (e.g., exploring the size of 1,000 by skip-counting to 1,000 using hundred charts or strips 10 or 100 centimeters long).</p> <p>c) Identify representations for numbers and generate them by decomposing and recombining them (e.g., <math>853 = 8 \times 100 + 5 \times 10 + 3</math>; <math>85 \times 10 + 3 = 853</math>; <math>853 = 900 - 50 + 3</math>).</p> <p>d) Identify the relationship among commonly encountered factors and multiples (e.g., factor pairs of 12 are <math>1 \times 12</math>, <math>2 \times 6</math>, <math>3 \times 4</math>; multiples of 12 are 12, 24, 36).</p> <p>e) Use visual models and other strategies to recognize and generate equivalents of commonly used fractions and mixed numbers (e.g., halves, thirds, fourths, sixths, eighths, and tenths).</p> <p>f) Demonstrate an understanding of fractions as parts of unit wholes, parts of a collection or set, and as locations on a number line.</p> <p>g) Use common fractions for measuring and money (e.g., using fractions and decimals as representations of the same concept, such as half of a dollar = 50 cents).</p>
2. Understands the meaning of operations and how they relate to one another.	<p>a) Use a variety of models to show an understanding of multiplication and division of whole numbers (e.g., charts, diagrams, and physical models).</p> <p>b) Find the sum or difference of two whole numbers between 0 and 10,000.</p> <p>c) Solve simple multiplication and division problems (e.g., <math>135 \div 5 = \square</math> ).</p> <p>d) Identify how the number of groups and the number of items in each group equals a product.</p> <p>e) Demonstrate the effects of multiplying and dividing on whole numbers (e.g., to find the total number of legs on 12 cats, 4 represents the number of each [cat] unit, so <math>12 \times 4 = 48</math> [leg] units).</p> <p>f) Identify and use relationship between multiplication and division (e.g., division is the inverse of multiplication) to solve problems.</p> <p>g) Select and use operations (e.g., addition, multiplication, subtraction, division) to solve problems.</p>

3. Compute fluently and make reasonable estimates.	<ul style="list-style-type: none"> <li>a) Choose computational based on properties of number relationships.</li> <li>b) Use strategies (e.g., <math>6 \times 8</math> is double <math>3 \times 8</math>) to become fluent with multiplication up to <math>10 \times 10</math>.</li> <li>c) Demonstrate reasonable estimation strategies for measurement, computation, and problem solving.</li> </ul>
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## **Strand 2: ALGEBRA**

**Standard:** Students will understand algebraic concepts and applications.

<b><u>Benchmarks</u></b>	<b><u>Skills</u></b>
1. Understand patterns, relations, and functions.	<ul style="list-style-type: none"> <li>a) Represent relationships of quantities in the form of mathematical expressions, equations, or inequalities.</li> <li>b) Solve problems involving numeric equations.</li> <li>c) Recognize the commutative property of multiplication (if <math>5 \times 7 = 35</math>, then what is <math>7 \times 5</math>?).</li> <li>d) Solve simple problems involving a functional relationship between two quantities (e.g., find the total cost of multiple items given the cost per unit).</li> <li>e) Extend and recognize a linear pattern by its rules (e.g., the number of legs on a given number of horses may be calculated by counting by 4s, by multiplying the number of horses by 4, or through the use of tables).</li> </ul>
2. Represent and analyze mathematical situations and structures using algebraic symbols.	<ul style="list-style-type: none"> <li>a) Determine the value of variables in missing part problems (e.g., <math>\square + 139 = 189</math>).</li> <li>b) Recognize and use the commutative and associative properties of addition and multiplication (If <math>5 \times 7 = 35</math>, then what is <math>7 \times 5</math>? / if <math>5 \times 7 \times 3 = 105</math>, then what is <math>7 \times 3 \times 5</math>?).</li> </ul>
3. Use mathematical models to represent and understand quantitative relationships.	<ul style="list-style-type: none"> <li>a) Model problem situations with objects and use representations such as pictures, graphs, tables, and equations to draw conclusions.</li> <li>b) Solve problems involving proportional relationships including unit pricing (e.g., four apples cost 80 cents; therefore, one apple costs 20 cents).</li> <li>c) Describe relationships of quantities in the form of mathematical expressions, equations, or inequalities.</li> </ul>
4. Analyze changes in various contexts.	<ul style="list-style-type: none"> <li>a) Demonstrate how change in one variable can relate to a change in a second variable (e.g., input-output machines, data tables).</li> </ul>

## **Strand 3: GEOMETRY**

**Standard:** Students will understand geometric concepts and applications.

<b>Benchmarks</b>	<b>Skills</b>
1. Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.	<ul style="list-style-type: none"> <li>a) Describe and compare the attributes of plane and solid geometric figures to show relationships and solve problems.</li> <li>b) Identify, describe, and classify polygons (e.g., pentagons, hexagons, and octagons).</li> <li>c) Identify lines of symmetry in two-dimensional shapes.</li> <li>d) Explore attributes of quadrilaterals (e.g., parallel and perpendicular sides for the parallelogram, right angles for the rectangle, equal sides and right angles for the square).</li> <li>e) Identify right angles.</li> <li>f) Identify, describe, and classify common three-dimensional geometric objects (e.g., cube, rectangular solid, sphere, prism, pyramid, cone, cylinder).</li> </ul>
2. Specify locations and describe spatial relationships using coordinate geometry and other representational systems.	<ul style="list-style-type: none"> <li>a) Describe location and movement using common language and geometric vocabulary (e.g., directions from classroom to gym).</li> <li>b) Use ordered pairs to graph, locate specific points, create paths, and measure distances within a coordinate grid system.</li> <li>c) Use a two-dimensional grid system (e.g., a map) to locate positions and places.</li> </ul>
3. Apply transformations and use symmetry to analyze mathematical situations.	<ul style="list-style-type: none"> <li>a) Predict and describe the results of sliding, flipping, and turning two-dimensional shapes.</li> <li>b) Identify and describe the line of symmetry in two- and three-dimensional shapes.</li> </ul>
4. Use visualization, spatial reasoning, and geometric modeling to solve problems.	<ul style="list-style-type: none"> <li>a) Visualize, build, and draw geometric objects.</li> <li>b) Create and describe mental images of objects, patterns, and paths.</li> <li>c) Recognize geometric shapes and structures (e.g., in the environment).</li> <li>d) Identify three-dimensional objects from two-dimensional representations of that object.</li> </ul>

## **Strand 4: MEASUREMENT**

**Standard:** Students will understand measurement systems and applications.

<b>Benchmarks</b>	<b>Skills</b>
1. Understand measurable attributes of objects and the units, systems, and process of measurement.	<ul style="list-style-type: none"> <li>a) Demonstrate understanding of the need for measuring with standard units and become familiar with standard units in the U.S. customary and metric system.</li> <li>b) Choose and use the appropriate units and measurement tools to quantify the properties of objects (e.g., length [ruler], width [ruler], or mass [balance scale]).</li> <li>c) Identify time to the nearest minute (elapsed time) and relate time to everyday events.</li> </ul>

	<ul style="list-style-type: none"> <li>d) Identify and use time intervals (e.g., hours, days, weeks, months, years).</li> <li>e) Identify properties (e.g., length, area, weight, volume).</li> </ul>
2. Apply appropriate techniques, tools, and formulas to determine measurements.	<ul style="list-style-type: none"> <li>a) Find the area of rectangles using appropriate tools (e.g., grid paper, tiles).</li> <li>b) Estimate measurements.</li> <li>c) Use appropriate standard units and tools to estimate, measure, and solve problems (e.g., length, area, weight).</li> <li>d) Recognize a 90-degree angle and use it as a strategy to estimate the size of other angles.</li> </ul>

## **Strand 5: DATA ANALYSIS AND PROBABILITY**

**Standard:** Students will understand how to formulate questions, analyze data, and determine probabilities.

<b><u>Benchmarks</u></b>	<b><u>Skills</u></b>
1. Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.	<ul style="list-style-type: none"> <li>a) Collect and organize data using observations, measurements, surveys, or experiments.</li> <li>b) Represent data using tables and graphs (e.g., line plots, bar graphs, and line graphs).</li> <li>c) Conduct simple experiments by determining the number of possible outcomes and make simple predictions.</li> <li>d) Identify whether events are certain, likely, unlikely, or impossible.</li> <li>e) Record the outcomes for a simple event and keep track of repetitions.</li> <li>f) Summarize and record the results in a clear and organized way and use the results to predict future events.</li> </ul>
2. Select and use appropriate statistical methods to analyze data.	<ul style="list-style-type: none"> <li>a) Apply and explain the uses of sampling techniques (e.g., observations, polls, tally marks) for gathering data.</li> </ul>
3. Develop and evaluate inferences and predictions that are based on data.	<ul style="list-style-type: none"> <li>a) Analyze data displayed in a variety of formats to make reasonable inferences and predictions, answer questions, and make decisions.</li> </ul>
4. Understand and apply basic concepts of probability.	<ul style="list-style-type: none"> <li>a) Discuss the likelihood of events and use terminology such as “certain,” “likely,” “unlikely”.</li> <li>b) Predict the outcomes of simple experiments (e.g., coin tossing) and test the predictions using concrete objects (e.g., coins, counters, number cubes, spinners).</li> <li>c) Record the probability of a specific outcome for a simple probability situation (e.g., probability is three out of seven for choosing a black ball; <math>3/7</math>).</li> </ul>

# Grade 4

## Strand 1: NUMBER AND OPERATIONS

**Standard:** Students will understand numerical concepts and mathematical operations.

<u>Benchmarks</u>	<u>Skills</u>
1. Understand numbers, ways of representing numbers, relationships among numbers, and number systems.	<ul style="list-style-type: none"><li>a) Exhibit an understanding of the place-value structure of the base-ten number up to 100,000, and compare and order the numbers.</li><li>b) Recognize representations for numbers and generate them by decomposing and combining numbers (e.g., <math>853 = 8 \times 100 + 5 \times 10 + 3</math>; <math>853 = 85 \times 10 + 3</math>; <math>853 = 900 - 50 + 3</math>).</li><li>c) Identify the numbers less than 0 by extending the number line and using negative numbers through familiar applications (e.g., temperature, money).</li><li>d) Identify fractions as parts of unit wholes and as locations on number lines.</li><li>e) Use visual models and other strategies to compare and order commonly used fractions.</li><li>f) Use models to show how whole numbers and decimals (to the hundredths place) relate to simple fractions (e.g., <math>\frac{1}{2}</math>, <math>\frac{5}{10}</math>, 0.5).</li><li>g) Identify different interpretations of fractions: division of whole numbers by whole numbers, ratio, equivalence, ordering of fractions, parts of a whole or parts of a set.</li><li>h) Add and subtract fractions with common and uncommon denominators using a variety of strategies.</li><li>i) Recognize and generate equivalent decimal forms of commonly used fractions (e.g., halves, quarters, tenths, fifths)</li><li>j) Recognize classes of numbers (e.g., odd, even, factors, multiples, square numbers) and apply these concepts in problem-solving situations.</li></ul>
2. Understand the meaning of operations and how they relate to one another.	<ul style="list-style-type: none"><li>a) Select and use appropriate operations (addition, subtraction, multiplication, and division) to solve problems.</li><li>b) Extend the uses of whole numbers to the addition and subtraction of simple decimals (positive numbers to two places).</li><li>c) Demonstrate commutative, associative, identity, and zero properties of operations on whole numbers.</li><li>d) Demonstrate the concept of distributivity of multiplication over addition and subtraction (e.g., <math>7 \times 28</math> is equivalent to <math>(7 \times 20) + (7 \times 8)</math> or <math>(7 \times 30) - (7 \times 2)</math>).</li></ul>

<p>3. Compute fluently and make reasonable estimates.</p>	<p>a) Demonstrate multiplication combinations through 12 x 12 and related division facts, and use them to solve problems mentally and compute related problems (e.g., 4 x 5 is related to 40 x 50, 400 x 5, and 40 x 500).</p> <p>b) Add, subtract, and multiply up to two double-digits accurately and efficiently.</p> <p>c) Use a variety of strategies (e.g., rounding and regrouping) to estimate the results of whole number computations and judge the reasonableness of the answers.</p> <p>d) Use strategies to estimate computations involving fractions and decimals</p>
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## **Strand 2: ALGEBRA**

**Standard:** Students will understand algebraic concepts and applications.

<b><u>Benchmarks</u></b>	<b><u>Skills</u></b>
<p>1. Understand patterns, relations, and functions.</p>	<p>a) Represent and analyze patterns and simple functions using words, tables, and graphs.</p> <p>b) Express mathematical relationships using equations.</p> <p>c) Use and interpret variables, mathematical symbols, and properties to write and simplify expressions and sentences.</p> <p>d) Use letters, boxes, or other symbols to stand for any number in simple expressions or equations (e.g., demonstrate an understanding of the concept of a variable).</p> <p>e) Interpret and evaluate mathematical expressions using parentheses.</p> <p>f) Use and interpret formulas (e.g., Area = Length x Width or <math>A = L \times W</math>) to answer questions about quantities and their relationships.</p>
<p>2. Represent and analyze mathematical situations and structures using algebraic symbols.</p>	<p>a) Identify symbols and letters that represent a variable as an unknown quantity.</p> <p>b) Explore the uses of properties (commutative, distributive, associative) in the computation of whole numbers.</p> <p>c) Determine the value of variables in simple equations (e.g., <math>80 \times 15 = 40 \times \square</math>).</p> <p>d) Develop simple formulas in exploring quantities and their relationships (e.g., <math>A = L \times W</math>).</p>
<p>3. Use mathematical models to represent and understand quantitative relationships.</p>	<p>a) Solve problems involving proportional relationships (including unit pricing and map interpretations; e.g., one inch = five miles; therefore, five inches = <math>\square</math> miles).</p> <p>b) Model problem situations and use graphs, tables, pictures, and equations to draw conclusions (e.g., different patterns of change).</p> <p>c) Use and interpret formulas (e.g., Area = Length x Width or <math>A = L \times W</math>) to answer questions about quantities and their relationships.</p>

4. Analyze changes in various contexts.	<ul style="list-style-type: none"> <li>a) Identify and describe situations with constant or varying rates of change and compare them.</li> <li>b) Explain how a change in one variable relates to a change in another variable in data tables.</li> <li>c) Find and analyze patterns using data tables.</li> <li>d) Demonstrate and describe varying rates of change in relation to real-world situations (e.g., plant growth, students' heights).</li> </ul>
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### **Strand 3: GEOMETRY**

**Standard:** Students will understand geometric concepts and applications.

<b><u>Benchmarks</u></b>	<b><u>Skills</u></b>
1. Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.	<ul style="list-style-type: none"> <li>a) Build, draw, create, and describe geometric objects.</li> <li>b) Identify lines that are parallel or perpendicular.</li> <li>c) Identify and compare congruent and similar figures</li> <li>d) Classify two- and three-dimensional shapes according to their properties and develop definitions of classes like triangles and pyramids.</li> <li>e) Visualize, describe, and make models of geometric solids in terms of the number of faces, edges, and vertices.</li> </ul>
2. Specify locations and describe spatial relationships using coordinate geometry and other representational systems.	<ul style="list-style-type: none"> <li>a) Describe location and movement using common language and geometric vocabulary.</li> <li>b) Use ordered pairs to graph, locate, identify points, and describe paths in the first quadrant of the coordinate plane.</li> <li>c) Use a variety of methods for measuring distances between locations on a grid.</li> </ul>
3. Apply transformations and use symmetry to analyze mathematical situations.	<ul style="list-style-type: none"> <li>a) Create and describe rotational designs using language of transformational symmetry.</li> <li>b) Describe a motion or set of motions that will show that two shapes are congruent.</li> </ul>
4. Use visualization, spatial reasoning, and geometric modeling to solve problems.	<ul style="list-style-type: none"> <li>a) Develop and use mental images of geometric shapes to solve problems (e.g., represent three-dimensional shapes in two dimensions).</li> <li>b) Measure area of rectangular shapes and use appropriate units.</li> <li>c) Use models and formulas to solve problems involving perimeter and area of rectangles and squares.</li> </ul>

## **Strand 4: MEASUREMENT**

**Standard:** Students will understand measurement systems and applications.

<b><u>Benchmarks</u></b>	<b><u>Skills</u></b>
1. Understand measurable attributes of objects and the units, systems, and process of measurement.	<ul style="list-style-type: none"><li>a) Select the appropriate type of unit for measuring perimeter and size of an angle.</li><li>b) Understand the need for measuring with standard units and become familiar with the standard units in customary and metric system.</li><li>c) Develop formulas to determine the surface areas of rectangular, related triangles and parallelograms.</li><li>d) Carry out simple conversions within a system of measurement (e.g., hours to minutes, meters to centimeters).</li></ul>
2. Apply appropriate techniques, tools, and formulas to determine measurements.	<ul style="list-style-type: none"><li>a) Estimate perimeters, areas of rectangles, triangles, and irregular shapes.</li><li>b) Find the area of rectangles, related triangles, and parallelograms.</li><li>c) Estimate, measure, and solve problems involving length, area, mass, time, and temperature using appropriate standard units and tools.</li><li>d) Identify common measurements of turns (e.g., 360 degrees in one turn, 90 degrees in a quarter-turn).</li><li>e) Compute elapsed time and make and interpret schedules.</li><li>f) Use tools to measure angles (e.g., protractor, compass).</li></ul>

## **Strand 5: DATA ANALYSIS AND PROBABILITY**

**Standard:** Students will understand how to formulate questions, analyze data, and determine probabilities.

<b><u>Benchmarks</u></b>	<b><u>Skills</u></b>
1. Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.	<ul style="list-style-type: none"><li>a) Organize, represent, and interpret numerical and categorical data and clearly communicate findings.</li><li>b) Choose and construct representations that are appropriate for the data set.</li><li>c) Recognize the differences in representing categorical and numerical data</li><li>d) Design investigations and represent data using tables and graphs.</li></ul>
2. Select and use appropriate statistical methods to analyze data.	<ul style="list-style-type: none"><li>a) Compare and describe related data sets.</li><li>b) Use the concepts of median, mode, maximum, minimum, and range and draw conclusions about a data set.</li><li>c) Use data analysis to make reasonable inferences/predictions and to develop convincing arguments from data described in a variety of formats (e.g. bar graphs, Venn diagrams, charts, tables, line graphs, and pictographs).</li></ul>

3. Develop and evaluate inferences and predictions that are based on data.	a) Propose and justify conclusions and predictions based on data. b) Develop convincing arguments from data displayed in a variety of formats.
4. Understand and apply basic concepts of probability.	a) Describe events as “likely,” “unlikely,” or “impossible” . b) Represent all possible outcomes for a simple probability situation in an organized way (e.g., tables, grids, tree diagrams). c) Express outcomes of experimental probability situations verbally and numerically. d) List all the possible combinations of objects from three sets (e.g., spinners, number of outfits from three different shirts, two skirts, and two hats).

# Grade 5

## Strand 1: NUMBER AND OPERATIONS

**Standard:** Students will understand numerical concepts and mathematical operations.

<u>Benchmarks</u>	<u>Skills</u>
1. Understand numbers, ways of representing numbers, relationships among numbers, and number systems.	<ul style="list-style-type: none"><li>a) Compare and order whole numbers (to millions), common fractions (halves, thirds, fourths, eighths), and decimals (thousandths).</li><li>b) Demonstrate understanding of the value of numbers from thousandths to millions, including fractions.</li><li>c) Represent place value up to one billion.</li><li>d) Interpret percents as part of a hundred.</li><li>e) Find decimal and percent equivalents for common fractions, explain how they represent the same value, and compute a given percent of a whole number.</li><li>f) Identify and represent on a number line decimals, fractions, and mixed numbers.</li><li>g) Identify prime and composite numbers to 50.</li></ul>
2. Understand the meaning of operations and how they relate to one another.	<ul style="list-style-type: none"><li>a) Explain and perform whole number division and express remainders as a whole number or a fractional part as appropriate to the context.</li><li>b) Add and subtract decimals, fractions and mixed numbers.</li><li>c) Find the factors / multiples of whole numbers.</li><li>d) Solve simple problems involving the addition and subtraction of fractions and mixed numbers.</li><li>e) Represent and use fractions and decimals in equivalent forms.</li></ul>
3. Compute fluently and make reasonable estimates.	<ul style="list-style-type: none"><li>a) Add, subtract, multiply, and divide whole numbers.</li><li>b) Use estimation strategies to verify the reasonableness of calculated results.</li><li>c) Simplify numerical expressions using order of operations.</li></ul>

## **Strand 2: ALGEBRA**

**Standard:** Students will understand algebraic concepts and applications.

<b><u>Benchmarks</u></b>	<b><u>Skills</u></b>
1. Understand patterns, relations, and functions.	a) Identify and graph ordered pairs in the first quadrant of the coordinate plane. b) Describe, represent, and analyze patterns and relationships(e.g., numeric, visual, oral, written, pictorial). c) Generate a pattern using a written description.
2. Represent and analyze mathematical situations and structures using algebraic symbols.	a) Compute the value of the expression for specific numerical values of the variable. b) Use a letter to represent an unknown number. c) Understand the differences between the symbols for “less than”, “less than or equal to”, “greater than”, and “greater than or equal to”.
3. Use mathematical models to represent and understand quantitative relationships.	a) Use mathematical models to represent and explain mathematical concepts and procedures. b) Understand and use mathematical models such as a number line to model the relationship between rational numbers and rational number operations. c) Understand and use of graphs, tables, and charts to describe data, and diagrams or pictures to model problem situations. d) Demonstrate how a situation can be represented in more than one way.
4. Analyze changes in various contexts.	a) Recognize and create patterns of change from everyday life using numerical or pictorial representations. b) Generalize patterns of change and recognize the same general patterns presented in different representations.

## **Strand 3: GEOMETRY**

**Standard:** Students will understand geometric concepts and applications.

<b><u>Benchmarks</u></b>	<b><u>Skills</u></b>
1. Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.	a) Identify, describe, and classify two-dimensional shapes and three-dimensional figures by their properties. b) Recognize and describe properties of regular polygons having up to ten sides. c) Identify faces, edges, and bases on three-dimensional objects.

2. Specify locations and describe spatial relationships using coordinate geometry and other representational systems.	a) Recognize perpendicular and parallel lines.
3. Apply transformations and use symmetry to analyze mathematical situations.	a) Identify line of symmetry in simple geometric figures.
4. Use visualization, spatial reasoning, and geometric modeling to solve problems.	a) Understand and compute the perimeter of regular polygons. b) Identify and explain circumference, radius, and diameter.

### **Strand 4: MEASUREMENT**

**Standard:** Students will understand measurement systems and applications.

<b><u>Benchmarks</u></b>	<b><u>Skills</u></b>
1. Understand measurable attributes of objects and the units, systems, and process of measurement.	a) Understand properties (e.g., length, area, weight, volume) and select the appropriate type of unit for measuring each using both U.S. customary and metric systems. b) Select and use appropriate units and tools to measure according to the degree of accuracy required in a particular problem-solving situation. c) Solve problems involving linear measurement, weight, and capacity (e.g., measuring to the nearest sixteenth of an inch or nearest millimeter; using ounces, milliliters, or pounds and kilograms) to the appropriate degree of accuracy. d) Perform one-step conversions within a system of measurement (e.g., inches to feet, centimeters to meters).
2. Apply appropriate techniques, tools, and formulas to determine measurements.	a) Solve measurement problems using appropriate tools involving length, perimeter, weight, capacity, time, and temperature. b) Select and use strategies to estimate measurements of length, distance, capacity, and time. c) Apply strategies and use tools for estimating and measuring the perimeter of regular and irregular shapes.

## **Strand 5: DATA ANALYSIS AND PROBABILITY**

**Standard:** Students will understand how to formulate questions, analyze data, and determine probabilities.

<b><u>Benchmarks</u></b>	<b><u>Skills</u></b>
1. Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.	a) Construct, interpret, and analyze data from graphical representations and draw simple conclusions using bar/circle/line graphs, frequency tables, and Venn diagrams. b) Display, analyze, compare, and interpret different data sets. c) Organize and display single-variable data in appropriate graphs and representations. d) Organize, read, and display numerical and non-numerical data in a clear, organized, and accurate manner including correct titles, labels, and intervals or categories, including frequency tables, stem and leaf plots, bar, line, and circle graphs, Venn diagrams, pictorial displays, charts and tables. e) Formulate questions and identify data to be collected to correctly answer a question.
2. Select and use appropriate statistical methods to analyze data.	a) Determine which types of graphs are appropriate for various data sets. b) Use fractions and percentages to compare data sets of different sizes. c) Correctly rank the values of a numerical data set containing simple fractions and decimals, identify maximum and minimum data values, and calculate the range for a data set.
3. Develop and evaluate inferences and predictions that are based on data.	a) Make and justify valid inferences, predictions, and arguments based on statistical analysis. b) Use counting strategies to determine all the possible outcomes of a particular familiar event. c) Find all possible outcome sets involving four or more sets of objects. d) Evaluate the reasonableness of inferences that are based on data. e) Identify the method used to make an inference and/or a prediction on a given data set. f) Determine the accuracy of a prediction or an inference based on a given data set. g) List all possible outcomes of simple events.
4. Understand and apply basic concepts of probability.	a) Determine probabilities through experiments and/or simulations and compare the results with mathematical expressions. b) Describe and predict the results of a probability experiment. c) Use fractions to describe the results of an experiment. d) Use probability to generalize from a simple pattern or set of examples and justify why the generalization is reasonable.

# Grade 6

## Strand 1: NUMBER AND OPERATIONS

**Standard:** Students will understand numerical concepts and mathematical operations.

<u>Benchmarks</u>	<u>Skills</u>
1. Understand numbers, ways of representing numbers, relationships among numbers, and number systems.	<ul style="list-style-type: none"><li>a) Compare and order rational numbers.</li><li>b) Use equivalent representations for rational numbers (e.g., integers, decimals, fractions, percents, ratios, and numbers with whole-number exponents).</li><li>c) Use appropriate representations of positive rational numbers in the context of real-life applications.</li><li>d) Identify greatest common factor and least common multiples for a set of whole numbers.</li><li>e) Identify and represent on a number line decimals, fractions, mixed numbers, and positive and negative integers.</li></ul>
2. Understands the meaning of operations and how they relate to one another.	<ul style="list-style-type: none"><li>a) Factor a whole number into a product of its primes.</li><li>b) Demonstrate the relationship and equivalency among ratios and percents.</li><li>c) Use proportions to solve problems.</li><li>d) Explain and perform whole number division and express remainders as decimals or appropriately in the context of the problem.</li><li>e) Explain and perform addition, subtraction, multiplication, and division with decimals.</li><li>f) Explain and perform addition and subtraction with integers, addition, subtraction, and multiplication with fractions and mixed numerals.</li><li>g) Determine the least common multiple and the greatest common divisor of whole numbers and use them to solve problems with fractions.</li></ul>
3. Compute fluently and make reasonable estimates.	<ul style="list-style-type: none"><li>a) Estimate quantities involving rational numbers using various estimations.</li><li>b) Use estimates to check reasonableness of results and make predictions in situations involving rational numbers.</li><li>c) Compare and order positive and negative fractions, decimals, and mixed numbers and place them on a number line.</li><li>d) Convert fractions to decimals and percents and use these representations in estimations, computations, and applications.</li><li>e) Interpret and use ratios in different contexts.</li><li>f) Compute and perform multiplication and division of fractions and decimals and apply these procedures to solving problems.</li></ul>

## **Strand 2: ALGEBRA**

**Standard:** Students will understand algebraic concepts and applications.

<b>Benchmarks</b>	<b>Skills</b>
1. Understand patterns, relations, and functions.	<ul style="list-style-type: none"><li>a) Solve problems involving proportional relationships.</li><li>b) Graph ordered pairs in the coordinate plane.</li><li>c) Explain and use symbols to represent unknown quantities and variable relationships.</li><li>d) Explain and use the relationships among ratios, proportions, and percents.</li></ul>
2. Represent and analyze mathematical situations and structures using algebraic symbols.	<ul style="list-style-type: none"><li>a) Use letters to represent an unknown in an equation.</li><li>b) Solve one-step linear equations and inequalities in one variable with positive whole-number solutions.</li><li>c) Demonstrate that a variable can represent a single quantity that changes.</li><li>d) Demonstrate how changes in one variable affect other variables.</li></ul>
3. Use mathematical models to represent and understand quantitative relationships.	<ul style="list-style-type: none"><li>a) Develop and use mathematical models to represent and justify mathematical relationships found in a variety of situations.</li><li>b) Create, explain, and use mathematical models such as Venn diagrams to show the relationships between the characteristics of two or more sets, equations and inequalities to model numerical relationships, three-dimensional geometric models, graphs, tables, and charts to interpret and analyze data.</li></ul>
4. Analyze changes in various contexts.	<ul style="list-style-type: none"><li>a) Represent and explain changes using one-step equations with one variable.</li><li>b) Use ratios to predict changes in proportional situations.</li><li>c) Use tables and symbols to represent and describe proportional and other relationships involving conversions, sequences, and perimeter.</li><li>d) Generate formulas to represent relationships involving changes in perimeter.</li></ul>

### **Strand 3: GEOMETRY**

**Standard:** Students will understand geometric concepts and applications.

<b>Benchmarks</b>	<b>Skills</b>
1. Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.	<ul style="list-style-type: none"><li>a) Identify, describe, and classify the properties of, and the relationships between, plane and solid geometric figures.</li><li>b) Measure, identify, and draw angles, perpendicular and parallel lines, rectangles, and triangles by using appropriate tools (e.g., ruler, compass, protractor).</li><li>c) Understand that the sum of angles of any triangle is 180 degrees and the sum of the angles of any quadrilateral is 360 degrees and use this information to solve problems.</li><li>d) Visualize and draw two-dimensional views of three-dimensional objects made from rectangular solids.</li><li>e) Classify angles as right, obtuse, or straight.</li><li>f) Describe the properties of geometric figures that include regular polygons, circles, ellipses, cylinders, cones, spheres, and cubes.</li><li>g) Classify polygons as regular or irregular.</li><li>h) Classify triangles as scalene, isosceles, or equilateral and by angles (right, acute, obtuse).</li><li>i) Identify angle, line, segment, and ray and use the symbols for each.</li></ul>
2. Specify locations and describe spatial relationships using coordinate geometry and other representational systems.	<ul style="list-style-type: none"><li>a) Use coordinate geometry to describe location on a plane.</li><li>b) Recognize skewed lines in space.</li></ul>
3. Apply transformations and use symmetry to analyze mathematical situations.	<ul style="list-style-type: none"><li>a) Identify line of symmetry with rotation and scaling.</li></ul>
4. Use visualization, spatial reasoning, and geometric modeling to solve problems.	<ul style="list-style-type: none"><li>a) Use appropriate technology, constructions, or drawings to recognize or compare geometric figures.</li></ul>

## **Strand 4: MEASUREMENT**

**Standard:** Students will understand measurement systems and applications.

<b><u>Benchmarks</u></b>	<b><u>Skills</u></b>
1. Understand measurable attributes of objects and the units, systems, and process of measurement.	a) Perform multi-step conversions of measurement units to equivalent units within a given system. b) Estimate measurement in both U.S. customary and metric units. c) Select and use units of appropriate size and type to measure angles, perimeter, area, and capacity in both U.S. customary and metric systems.
2. Apply appropriate techniques, tools, and formulas to determine measurements.	a) Apply various measurement techniques and tools, units of measure, and degrees of accuracy to find accurate rational number representations for length, liquid, weight, perimeter, temperature, and time. b) Select and use formulas for perimeters of squares and rectangles. c) Select and use strategies to estimate measurements including angle measure and capacity. d) Select and justify the selection of measurement tools, units of measure, and degrees of accuracy appropriate to the given situation.

## **Strand 5: DATA ANALYSIS AND PROBABILITY**

**Standard:** Students will understand how to formulate questions, analyze data, and determine probabilities.

<b><u>Benchmarks</u></b>	<b><u>Skills</u></b>
1. Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.	a) Use statistical representations to analyze data. b) Draw and compare different graphical representations of the same data. c) Use mean, median, mode, and range to describe data. d) Sketch circle graphs to display data. e) Solve problems by collecting, organizing, displaying and interpreting data. f) Compare different samples of a population with the entire population and determine the appropriateness of using a sample. g) Explain advantages / disadvantages of using various display formats for a specific data set. h) Formulate and solve problems by collecting, organizing, displaying, and interpreting data.

<p>2. Select and use appropriate statistical methods to analyze data.</p>	<ul style="list-style-type: none"> <li>a) Compute and analyze statistical measurements for data sets.</li> <li>b) Explain how extra data added to data sets may affect the computations of central tendency.</li> <li>c) Know why a specific measure of central tendency provides information in a given context.</li> <li>d) Use data samples of a population and describe the characteristics of the sample.</li> <li>e) Identify different ways of selecting a sample and which method makes a sample more representative for a population.</li> <li>f) Identify data that represent sampling errors and explain why the sample and the display might be biased.</li> <li>g) Identify claims based on statistical data and evaluate the validity of the claims.</li> </ul>
<p>3. Develop and evaluate inferences and predictions that are based on data.</p>	<ul style="list-style-type: none"> <li>a) Conduct observations, surveys, experiments and/or simulations, record the results in charts, tables, or graphs, and use the results to draw conclusions and make predictions.</li> <li>b) Find all possible combinations in a given set (e.g., the number of ways a set of books can be arranged on a shelf).</li> <li>c) Compare expected results with actual results in a simple experiment.</li> </ul>
<p>4. Understand and apply basic concepts of probability.</p>	<ul style="list-style-type: none"> <li>a) Determine theoretical and experimental probabilities and use them to make predictions about events.</li> <li>b) Represent all possible outcomes for compound events in an organized way (e.g., tables, grids, diagrams) and express whether an outcome is certain, impossible, likely, or unlikely.</li> <li>c) Use data to estimate the probability of future events.</li> <li>d) Represent probabilities as ratios, proportions, decimals between 0 and 1, and percentages between 0 and 100 and verify that the probabilities computed are reasonable; know that if P is the probability of an event, 1- P is the probability of the event not occurring.</li> <li>e) Describe the difference between independent and dependent events and identify situations involving independent or dependent events.</li> </ul>

# Grade 7

## Strand 1: NUMBER AND OPERATIONS

**Standard:** Students will understand numerical concepts and mathematical operations.

<u>Benchmarks</u>	<u>Skills</u>
1. Understand numbers, ways of representing numbers, relationships among numbers, and number systems.	<ul style="list-style-type: none"><li>a) Determine the absolute value of rational numbers.</li><li>b) Illustrate the relationships among natural and whole numbers, integers, rational and irrational numbers.</li><li>c) Use properties of the real-number system to solve real-world problems.</li><li>d) Read, write, and compare rational numbers in scientific notation.</li><li>e) Simplify numerical expressions using order of operations.</li></ul>
2. Understands the meaning of operations and how they relate to one another.	<ul style="list-style-type: none"><li>a) Add, subtract, multiply, and divide rational numbers.</li><li>b) Convert terminating decimals into reduced fractions.</li><li>c) Calculate given percentages of quantities and use them to solve problems.</li><li>d) Add and subtract fractions with unlike denominators.</li><li>e) Multiply, divide, and simplify rational numbers by using exponent rules.</li><li>f) Understand the meaning of the absolute value of a number.</li><li>g) Find square roots of perfect whole-number squares.</li><li>h) Simplify and evaluate positive rational numbers raised to positive whole number powers.</li><li>i) Solve addition, subtraction, multiplication, and division problems that use positive and negative integers and combinations of these operations.</li></ul>
3. Compute fluently and make reasonable estimates.	<ul style="list-style-type: none"><li>a) Use estimation to check reasonableness of results.</li><li>b) Convert fractions to decimals and percents and use these representations in estimations, computations, and applications.</li><li>c) Read, write, and compare rational numbers in scientific notation with approximate numbers using scientific notation.</li><li>d) Calculate the percentage of increases and decreases of a quantity.</li><li>e) Use the inverse relationship between raising to a power and extracting the root of a perfect square integer.</li></ul>

## **Strand 2: ALGEBRA**

**Standard:** Students will understand algebraic concepts and applications.

<b><u>Benchmarks</u></b>	<b><u>Skills</u></b>
1. Understand patterns, relations, and functions	<ul style="list-style-type: none"><li>a) Represent a variety of relationships using tables, graphs, verbal rules, and possible symbolic notation, and recognize the same general pattern presented in different representations.</li><li>b) Simplify numerical expressions by applying properties of rational numbers, and justify the process used.</li><li>c) Interpret and evaluate expressions involving integer powers and simple roots.</li><li>d) Graph and interpret linear functions.</li><li>e) Solve problems involving rate, average speed, distance, and time.</li></ul>
2. Represent and analyze mathematical situations and structures using algebraic symbols.	<ul style="list-style-type: none"><li>a) Write verbal expressions and sentences as algebraic expressions and equations.</li><li>b) Use variables and appropriate operations to write an expression, an equation, or an inequality that represents a verbal description.</li><li>c) Use the order of operations to evaluate algebraic expressions.</li><li>d) Simplify numerical expressions by applying properties of rational numbers.</li><li>e) Graph linear functions and identify slope as positive or negative.</li><li>f) Use letters as variables in mathematical expressions to describe how one quantity changes when a related quantity changes.</li></ul>
3. Use mathematical models to represent and understand quantitative relationships.	<ul style="list-style-type: none"><li>a) Create scale models and use them for dimensional drawings.</li><li>b) Understand and use the coordinate plane to graph ordered pairs and linear equations.</li><li>c) Select and use an appropriate model for a particular situation.</li></ul>
4. Analyze changes in various contexts.	<ul style="list-style-type: none"><li>a) Interpret and evaluate expressions involving integer powers and simple roots as they relate to change.</li><li>b) Solve two-step equations and inequalities with one variable over the rational numbers, interpret the solution or solutions in the context from which they arose, and verify the reasonableness of the results.</li></ul>

### **Strand 3: GEOMETRY**

**Standard:** Students will understand geometric concepts and applications.

<b><u>Benchmarks</u></b>	<b><u>Skills</u></b>
1. Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.	<ul style="list-style-type: none"><li>a) Classify geometric figures as similar or congruent.</li><li>b) Understand the concept of a constant (e.g., pi) and use the formulas for the circumference and area of a circle.</li><li>c) Explain and use the Pythagorean theorem.</li><li>d) Determine the radius, diameter, and circumference of a circle and explain their relationship.</li><li>e) Use properties to classify solids including pyramids, cones, prisms, and cylinders.</li></ul>
2. Specify locations and describe spatial relationships using coordinate geometry and other representational systems	<ul style="list-style-type: none"><li>a) Construct and use coordinate graphs to plot simple figures, determine lengths and areas related to them, and determine the image under translations and reflections.</li></ul>
3. Apply transformations and use symmetry to analyze mathematical situations.	<ul style="list-style-type: none"><li>a) Determine how perimeter and area are affected by changes of scale.</li></ul>
4. Use visualization, spatial reasoning, and geometric modeling to solve problems.	<ul style="list-style-type: none"><li>b) Compute the perimeter and area of common geometric shapes and use the results to find measures of less common objects.</li><li>c) Identify and describe the properties of two-dimensional figures.</li><li>d) Identify angles as vertical, adjacent, complementary, or supplementary and provide descriptions of these terms.</li><li>e) Use the properties of complementary and supplementary angles and the sum of the angles of a triangle to solve problems involving an unknown angle.</li><li>f) Draw quadrilaterals and triangles from given information.</li></ul>

## **Strand 4: MEASUREMENT**

**Standard:** Students will understand measurement systems and applications.

<b><u>Benchmarks</u></b>	<b><u>Skills</u></b>
1. Students will understand measurement systems and applications.	<ul style="list-style-type: none"><li>a) Choose appropriate units of measure and ratios to recognize new equivalences to solve problems.</li><li>b) Select and use the appropriate size and type of unit for a given measurement situation.</li><li>c) Compare masses, weights, capacities, geometric measures, times, and temperatures within measurement systems.</li><li>d) Approximate the relationship between standard and metric measurement systems.</li><li>e) Use measures expressed as rates and measures expressed as products to solve problems, check the units of the solutions, and analyze the reasonableness of the answer.</li></ul>
2. Apply appropriate techniques, tools, and formulas to determine measurements.	<ul style="list-style-type: none"><li>a) Apply strategies and formulas to find missing angle measurements in triangles and quadrilaterals.</li><li>b) Select and use formulas to determine the circumference of circles and the area of triangles, parallelograms, trapezoids, and circles.</li><li>c) Solve problems involving scale factors, ratios, and proportions.</li></ul>

## **Strand 5: DATA ANALYSIS AND PROBABILITY**

**Standard:** Students will understand how to formulate questions, analyze data, and determine probabilities.

<b><u>Benchmarks</u></b>	<b><u>Skills</u></b>
1. Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.	<ul style="list-style-type: none"><li>a) Describe how data representations influence interpretation.</li><li>b) Select, use and justify appropriate representation for presenting collected data.</li><li>c) Use measures of central tendency and spread to describe a set of data.</li><li>d) Choose and justify the choice between median and mode to describe a set of data.</li><li>e) Determine the quartiles of a data set.</li><li>f) Identify ordered pairs of data from a graph and interpret the data in terms of the situation depicted by the graph.</li><li>g) Collect, organize, and represent data sets that have one or more variables and identify relationships among variables within a data set.</li><li>h) Identify and explain the effects of scale and/or interval changes on graphs of data sets.</li></ul>

<p>2. Select and use appropriate statistical methods to analyze data.</p>	<ul style="list-style-type: none"> <li>a) Choose and justify appropriate measures of central tendencies (e.g., mean, median, mode, range) to describe given or derived data.</li> <li>b) Know various ways to display data sets (e.g., stem and leaf plot, scatter plots) and use these forms to display a single set of data or to compare two sets of data.</li> <li>c) Use appropriate technology to gather and display data sets and identify the relationships that exist among variables within the data set.</li> <li>d) Use data samples of a population and describe the characteristics of the sample.</li> <li>e) Identify data that represent sampling errors and explain why it might be biased.</li> <li>f) Identify claims based on statistical data and evaluate the validity of the claims.</li> </ul>
<p>3. Develop and evaluate inferences and predictions that are based on data.</p>	<ul style="list-style-type: none"> <li>a) Formulate and justify mathematical conjectures based on data or problem posed.</li> <li>b) Analyze data to make accurate inferences, predictions, and to develop convincing arguments from data displayed in a variety of forms.</li> <li>c) Approximate a line of best fit for a data set in a scatter plot form and make predictions using the simple equation of that line.</li> </ul>
<p>4. Understand and apply basic concepts of probability.</p>	<ul style="list-style-type: none"> <li>a) Determine the probability of a compound event composed of two independent events.</li> <li>b) Identify examples of events having the probability of one or zero.</li> <li>c) Describe the probability of events using fractions, decimals, and percents.</li> <li>d) Use probability to generate convincing arguments, draw conclusions, and make decisions in a variety of situations.</li> <li>e) Make predictions based on theoretical probabilities of compound events.</li> <li>f) Determine the probability of a simple event or a compound event composed of simple, independent events.</li> </ul>

# Grade 8

## **Strand 1: NUMBER AND OPERATIONS**

**Standard:** Students will understand numerical concepts and mathematical operations.

<b><u>Benchmarks</u></b>	<b><u>Skills</u></b>
1) Understand numbers, ways of representing numbers, relationships among numbers, and number systems.	a) Sort numbers by their properties (e.g., prime, composite, square, square root). b) Demonstrate the magnitude of rational numbers (e.g., trillions to millions).
2) Understand the meaning of operations and how they relate to one another.	a) Use real number properties (e.g., commutative, associative, distributive) to perform various computational procedures. b) Perform arithmetic operations and their inverses (e.g., addition/subtraction, multiplication/division, square roots of perfect squares, cube roots of perfect cubes) on real numbers.
3) Compute fluently and make reasonable estimates.	a) Formulate algebraic expressions that include real numbers to describe and solve real-world problems. b) Differentiate between rational and irrational numbers. c) Perform and explain computations with rational numbers, $\pi$ , and first-degree algebraic expressions in one variable in a variety of situations. d) Select and use appropriate forms of rational numbers to solve real-world problems including those involving proportional relationships. e) Approximate, mentally and with calculators, the value of irrational numbers as they arise from problem situations. f) Express numbers in scientific notation (including negative exponents) in appropriate problem situations using a calculator. g) Estimate answers and use formulas to solve application problems involving surface area and volume.

## **Strand 2: ALGEBRA**

**Standard:** Students will understand algebraic concepts and applications.

<b><u>Benchmarks</u></b>	<b><u>Skills</u></b>
1) Understand patterns, relations, and functions.	<ul style="list-style-type: none"><li>a) Move between numerical, tabular, and graphical representations of linear relationships.</li><li>b) Use variables to generalize patterns and information presented in tables, charts, and graphs.</li><li>c) Graph linear functions noting that the vertical change per unit of horizontal change (the slope of the graph) is always the same.</li><li>d) Plot the values of quantities whose ratios are always the same, fit a line to the plot, and understand that the slope of the line equals the quantities.</li></ul>
2) Represent and analyze mathematical situations and structures using algebraic symbols.	<ul style="list-style-type: none"><li>a) Demonstrate the difference between an equation and an expression.</li><li>b) Solve two-step linear equations and inequalities in one variable with rational solutions.</li><li>c) Evaluate formulas using substitution.</li><li>d) Demonstrate understanding of the relationships between ratios, proportions, and percents and solve for a missing term in a proportion.</li><li>e) Graph solution sets of linear equations in two variables on the coordinate plane.</li><li>f) Formulate and solve problems involving simple linear relationships, find percents of a given number, variable situations, and unknown quantities.</li><li>g) Use symbols, variables, expressions, inequalities, equations, and simple systems of equations to represent problem situations that involve variables or unknown quantities.</li></ul>
3) Use mathematical models to represent and understand quantitative relationships.	<ul style="list-style-type: none"><li>a) Generate different representations to model a specific numerical relationship given one representation of data (e.g., a table, a graph, an equation, a verbal description).</li></ul>
4) Analyze changes in various contexts.	<ul style="list-style-type: none"><li>a) Use graphs, tables, and algebraic representations to make predictions and solve problems that involve change.</li><li>b) Estimate, find, and justify solutions to problems that involve change using tables, graphs, and algebraic expressions.</li><li>c) Use appropriate problem-solving strategies (e.g., drawing a picture, looking for a pattern, making a table or writing an algebraic expression) to solve problems that involve change.</li><li>d) Solve multi-step problems that involve changes in rate, average speed, distance, and time.</li><li>e) Analyze problems that involve change by identifying relationships, distinguishing relevant from irrelevant information, identifying missing information, and observing patterns.</li><li>f) Generalize a pattern of change using algebra and show the relationship among the equation, graph, and table of values.</li><li>g) Recognize the same general pattern of change presented in different representations.</li></ul>

### **Strand 3: GEOMETRY**

**Standard:** Students will understand geometric concepts and applications.

<b>Benchmarks</b>	<b>Skills</b>
1) Analyze characteristics and properties of two- and three-dimensional geometric shapes and develop mathematical arguments about geometric relationships.	a) Recognize, classify, and discuss properties of all geometric figures including point, line, and plane. b) Identify arc, chord, and semicircle and explain their attributes. c) Use the Pythagorean theorem and its converse to find the missing side of a right triangle and the lengths of the other line segments.
2) Specify locations and describe spatial relationships using coordinate geometry and other representational systems.	a) Represent, formulate, and solve distance and geometry problems using the language and symbols of algebra and the coordinate plane and space (e.g., ordered triplets).
3) Apply transformations and use symmetry to analyze mathematical situations.	a) Describe the symmetry of three-dimensional figures. b) Describe and perform single and multiple transformations that include rotation, translation, and dilation to two-dimensional figures.
4) Use visualization, spatial reasoning, and geometric modeling to solve problems.	a) Understand angle relationships formed by parallel lines cut by a transversal. b) Recognize and apply properties of corresponding parts of similar and congruent triangles and quadrilaterals. c) Represent and solve problems relating to size, shape, area, and volume using geometric models. d) Develop and use formulas for area, perimeter, circumference, and volume.

## **Strand 4: MEASUREMENT**

**Standard:** Students will understand measurement systems and applications.

<b><u>Benchmarks</u></b>	<b><u>Skills</u></b>
1) Understand measurable attributes of objects and the units, systems, and processes of measurement.	<ul style="list-style-type: none"><li>a) Understand the concept of volume and use the appropriate units in common measuring systems (e.g., cubic centimeter, cubic inch, cubic yard) to compute the volume of rectangular solids.</li><li>b) Use changes in measurement units (e.g., square inches, cubic feet) to perform conversions from one-, two-, and three-dimensional shapes.</li></ul>
2) Apply appropriate techniques, tools, and formulas to determine measurements.	<ul style="list-style-type: none"><li>a) Use ratios and proportions to measure hard-to-measure objects.</li><li>b) Use proportional relationships in similar shapes to find missing measurements.</li><li>c) Apply strategies to determine the surface area and volume of prisms, pyramids, and cylinders.</li><li>d) Perform conversions with multiple terms between metric and U.S. standard measurement systems.</li></ul>