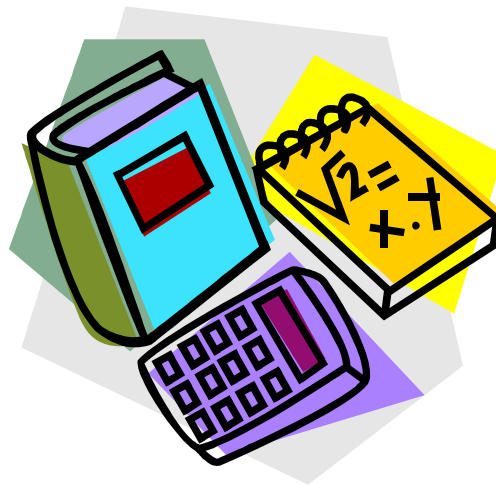


Math Grade-Level Expectations



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Mathematics Standards

Content Standards:

Standard 1 – Numeric Reasoning: Students will develop **Numeric Reasoning** and an understanding of *Number and Operations* by solving problems in which there is a need to represent and model real numbers verbally, physically, and symbolically; to explain the relationship between numbers; to determine the relative magnitude of real numbers; to use operations with understanding; and to select appropriate methods of calculations from among mental math, paper-and-pencil, calculators, or computers.

Standard 2 – Algebraic Reasoning: Students will develop **Algebraic Reasoning** and an understanding of *Patterns and Functions* by solving problems in which there is a need to recognize and extend a variety of patterns; to progress from the concrete to the abstract using physical models, equations, and graphs; to describe, represent, and analyze relationships among variable quantities; and to analyze, represent, model, and describe real-world functional relationships.

Standard 3 – Geometric Reasoning: Students will develop **Geometric Reasoning** and an understanding of *Geometry and Measurement* by solving problems in which there is a need to recognize, construct, transform, analyze properties of, and discover relationships among geometric figures; and to measure to a required degree of accuracy by selecting appropriate tools and units.

Standard 4 – Quantitative Reasoning: Students will develop **Quantitative Reasoning** and an understanding of *Data Analysis and Probability* by solving problems in which there is a need to collect, appropriately represent, and interpret data; to make inferences or predictions and to present convincing arguments; and to model mathematical situations to determine the probability.

Process Standards:

Standard 5: Problem Solving: Students will develop their Problem Solving ability by engaging in developmentally appropriate problem-solving opportunities in which there is a need to use various approaches to investigate and understand mathematical concepts; to formulate their own problems; to find solutions to problems from everyday situations; to develop and apply strategies to solve a wide variety of problems; and to integrate mathematical reasoning, communication and connections.

Standard 6: Reasoning and Proof: Students will develop their Reasoning and Proof ability by solving problems in which there is a need to investigate significant mathematical ideas in all content areas; to justify their thinking; to reinforce and extend their logical reasoning abilities; to reflect on and clarify their own thinking; to ask questions to extend their thinking; and to construct their own learning.

Standard 7: Communication: Students will develop their mathematical Communication ability by solving problems in which there is a need to obtain information from the real world through reading, listening and observing; to translate this information into mathematical language and symbols; to process this information mathematically; and to present results in written, oral, and visual formats.

Standard 8: Connections: Students will develop mathematical Connections by solving problems in which there is a need to view mathematics as an integrated whole and to integrate mathematics with other disciplines, while allowing the flexibility to approach problems, from within and outside mathematics, in a variety of ways.

**Mathematics Design Team – *Understanding by Design (UbD)*
Enduring Understandings and Essential Questions**

Enduring Understandings:

1.

Essential Questions:

1.

Standard 1 (K–5) – Numeric Reasoning: Students will develop Numeric Reasoning and an understanding of *Number and Operations* by solving problems in which there is a need to represent and model real numbers verbally, physically, and symbolically; to explain the relationship between numbers; to determine the relative magnitude of real numbers; to use operations with understanding; and to select appropriate methods of calculations from among mental math, paper-and-pencil, calculators, or computers.

Essential Questions:

Enduring Understandings:

All students in Kindergarten will be able to:	Building upon the kindergarten expectations, all students in Grade 1 will be able to:	Building upon the K–1 expectations, all students in Grade 2 will be able to:	Building upon the K–2 expectations, all students in Grade 3 will be able to:	Building upon the K–3 expectations, all students in Grade 4 will be able to:	Building upon the K–4 expectations, all students in Grade 5 will be able to:
<p>Number sense:</p> <ul style="list-style-type: none"> Count sets of objects up to 20 Connect number words and numerals (up to 10) to the quantities they represent using various physical models and representations Sequence numbers and explain what comes before, after and between other numbers Show more than one way to make numbers up to 10. <p>Operations:</p> <ul style="list-style-type: none"> Use manipulatives to model putting together and taking apart (e.g., you have one cookie and you get two more cookies) Use manipulatives to show more than one way to make a target number up to 6 	<p>Number sense:</p> <ul style="list-style-type: none"> Count sets of objects up to 50 by 1s, 2s, 5s, and 10s Connect number words and numbers (up to 50) to the quantities they represent using physical models and representations Sequence numbers and explain which is larger, which is smaller, and what is between other numbers up to 100 Compose and decompose numbers up to 20 <p>Operations:</p> <ul style="list-style-type: none"> Use manipulatives and pictures to model putting together and taking apart numbers up to 20 Write number sentences to represent addition combinations up to 10 Use manipulatives and models to demonstrate doubles Use direct models, manipulatives and pictures to demonstrate joining and separating problems 	<p>Number sense:</p> <ul style="list-style-type: none"> Develop efficient strategies for counting (e.g., skip counting by 1s, 2s, 5s and 10s) Demonstrate an understanding that our number system is based on combinations of ones and tens—place value Use combinations of one- and two-digit numbers to build larger (two-digit) numbers Use multiple strategies to compare size of two numbers (counting up, counting back) Connect number words for fractions with pictures and numerals ($\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$) <p>Operations:</p> <ul style="list-style-type: none"> Use number sentences to represent number combinations up to 20 Use number sentences with missing addends to represent number combinations up to 20 Use a variety of strategies to solve combination and separation problems up to 100 	<p>Number sense:</p> <ul style="list-style-type: none"> Demonstrate an understanding that our number system is based on combinations of 1s, 10s, and 100s—place value Connect counting up and counting back to addition and subtraction Connect skip counting to multiplication Develop understanding of fractions as parts of unit wholes Compare the size of common fractions using models <p>Operations:</p> <ul style="list-style-type: none"> Add and subtract numbers up to 100 efficiently and explain the strategies used Master addition and subtraction facts up to 20 Develop and use strategies to estimate the results of addition and subtraction operations on whole numbers 	<p>Number sense:</p> <ul style="list-style-type: none"> Decompose and recompose whole numbers up to 10,000 using a variety of one-, two- and three-digit combinations Determine factor pairs that make up a given number Develop an understanding of fractions as parts of unit wholes and division of whole numbers Demonstrate equivalent forms of common fractions using physical models, pictures, and number lines Compare and order fractions using physical models, pictures, and number lines Use decimal notation to show the value of coins Explore negative numbers by extending the number line using familiar applications (elevator, temperature, sea level, debt) 	<p>Number sense:</p> <ul style="list-style-type: none"> Describe whole numbers up to 100,000 using place value structure Develop understanding of fractions as parts of unit wholes, as part of a collection, as locations on number lines, and as division of whole numbers Describe numbers according to characteristics such as evens, odds, factors, multiples, and squares Find $\frac{1}{10}$ or 10 times a number using mental math Generate and connect equivalent forms of benchmark fractions, decimals and percents Use multiple models and methods to compare decimals Use decimal form to represent benchmark fractions ($\frac{1}{3}$s, $\frac{1}{4}$s, $\frac{1}{5}$s, $\frac{1}{10}$s)

All students in Kindergarten will be able to:	Building upon the kindergarten expectations, all students in Grade 1 will be able to:	Building upon the K–1 expectations, all students in Grade 2 will be able to:	Building upon the K–2 expectations, all students in Grade 3 will be able to:	Building upon the K–3 expectations, all students in Grade 4 will be able to:	Building upon the K–4 expectations, all students in Grade 5 will be able to:
		<ul style="list-style-type: none"> • Show number sentences that demonstrate that addition and subtraction are inverse operations (e.g., join, separate, part-part-whole, compare) • Represent repeated addition using pictures and models • Understand that addition of whole numbers result in a larger number and subtraction of whole numbers result in a smaller number 	<ul style="list-style-type: none"> • Use pictures and number sentences to represent multiplication and division problems • Develop the concept of multiplication by using models to represent and count the number of groups and the number of elements in each group (e.g., repeated addition, arrays, skip counting) • Select and use appropriate methods and tools for computing (e.g., mental computation, estimation, calculators, paper and pencil) depending on the context and nature of the computation 	<p>Operations:</p> <ul style="list-style-type: none"> • Choose the appropriate operation to solve a word problem and explain why • Add and subtract larger numbers (e.g., three digits + two digits) and explain how the operation works • Demonstrate mastery of mental math strategies for multiplying numbers (e.g., 25×8) • Show how multiplication and division facts up to 50 are related, using arrays, skip counting, and area models • Master multiplication facts and the related division facts up to the 10s tables • Explain the meaning of the remainder in a division problem based on the context of the problem • Develop and use strategies to estimate the results of operations on whole numbers • Use physical models and pictures to add and subtract benchmark fractions • Find $\frac{1}{3}$, $\frac{1}{4}$, and $\frac{1}{5}$ of a given set or area using models • Add and subtract decimals using money models • Select and use 	<ul style="list-style-type: none"> • Use multiple methods and models to convert decimals to fractions and fractions to decimals • Develop the meaning of percent as a ratio of a number out of 100 • Use a variety of familiar applications to represent positive and negative numbers as opposites <p>Operations:</p> <ul style="list-style-type: none"> • Apply more than one operation to solve a word problem • Multiply and divide by large numbers (e.g., two digits by two digits) and show why the operation works • Use multiplication clusters to build mental math strategies (e.g., 5×2, 5×20, 50×2, 50×20) • Use partial products to prove how multiplication algorithms work • Use and apply various meanings of multiplication and division (e.g., fair share, repeated addition/ subtraction, compare, rate) • Develop and use strategies to estimate the results of operations on whole numbers • Add and subtract benchmark fractions and fractions with

All students in Kindergarten will be able to:	Building upon the kindergarten expectations, all students in Grade 1 will be able to:	Building upon the K–1 expectations, all students in Grade 2 will be able to:	Building upon the K–2 expectations, all students in Grade 3 will be able to:	Building upon the K–3 expectations, all students in Grade 4 will be able to:	Building upon the K–4 expectations, all students in Grade 5 will be able to:
				<p>appropriate methods and tools for computing (e.g., mental computation, estimation, calculators, paper and pencil) depending on the context and nature of the computation</p>	<p>common denominators using physical models</p> <ul style="list-style-type: none"> • Multiply fractions by whole numbers using models such as: clock fractions, number/ratio tables, number lines, fractions strips, skip counting or array models • Multiply numbers by 10, 1/10th, 100 and 1/100th using mental math • Connect multiplication by 1/3, 1/4, 1/5 to division by its inverse (3, 4, 5) (e.g., $12 \times 1/4 = 12 \div 4$) • Find benchmark percents of numbers using physical models • Add and subtract decimals using models • Add and subtract integers using familiar applications such as sea level, elevators, etc. • Select and use appropriate methods and tools for computing (e.g., mental computation, estimation, calculators, paper and pencil) depending on the context and nature of the computation

Standard 1 (6–11) – Numeric Reasoning: Students will develop Numeric Reasoning and an understanding of *Number and Operations* by solving problems in which there is a need to represent and model real numbers verbally, physically, and symbolically; to explain the relationship between numbers; to determine the relative magnitude of real numbers; to use operations with understanding; and to select appropriate methods of calculations from among mental math, paper-and-pencil, calculators, or computers.

Essential Questions:

Enduring Understandings:

Building upon the K–5 expectations, all students in Grade 6 will be able to:	Building upon the K–6 expectations, all students in Grade 7 will be able to:	Building upon the K–7 expectations, all students in Grade 8 will be able to:	Building upon the K–8 expectations, all students in Grade 9 will be able to:	Building upon the K–9 expectations, all students in Grade 10 will be able to:	Building upon the K–10 expectations, all students in Grade 11 will be able to:
<p>Number sense:</p> <ul style="list-style-type: none"> Expand understanding of the number system to include numbers in the millions Use factors and multiples to demonstrate part whole relationships Use factors and multiples to develop equivalent fraction families Scale up or scale down fraction and whole number measurements (e.g., recipes) Use place value structure to describe the size of decimals Demonstrate equivalence of decimals, fractions, and percents using multiple models <p>Operations:</p> <ul style="list-style-type: none"> Multiply fractions by whole numbers and explain the result Multiply fractions by other fractions using physical models, ratio/rate tables, and arrays Connect multiplication by a unit fraction (such as $\frac{1}{3}, \frac{1}{4}, \frac{1}{5}, \frac{1}{10}$, 	<p>Number sense:</p> <ul style="list-style-type: none"> Use scientific notation to represent large numbers and decimals Use powers of ten to represent place value Interpret and apply percents greater than 100.- Use proportional reasoning to express rates (e.g., speed, density, mpg) Compare fractions, decimals, and percents using multiple models Explore the effects of scaling up and scaling down on the coordinate plane Compare integers on the number line Explain the relationship of a number to its additive inverse Apply knowledge of integers to the coordinate plane <p>Operations:</p> <ul style="list-style-type: none"> Multiply and divide fractions and use models to justify your solution 	<p>Number sense:</p> <ul style="list-style-type: none"> Use exponential notation to represent whole numbers Use square numbers and square roots to reason about the relationship between the side of a square and area of the square (e.g., side of a square with an area of 9 is $\sqrt{9}$ or 3, side of a square with area of 5 is $\sqrt{5}$) Apply knowledge of factors and multiples, evens and odds, primes and composites, to generalizations Explore the meaning of irrational numbers such as π, or $\sqrt{3}$ <p>Operations:</p> <ul style="list-style-type: none"> Perform computations with exponents, powers of 10, and scientific notation Use inverse operations to "do and undo" mathematical operations with rational numbers Demonstrate the reasonableness of an exact calculation by using an estimation or mental math strategy 	<p>Number sense:</p> <ul style="list-style-type: none"> Demonstrate an understanding of numbers as rational or irrational Compare relative sizes of real numbers Estimate square roots Interpret absolute value as distance from zero Determine the appropriateness of an answer by using number sense or estimation <p>Operations:</p> <ul style="list-style-type: none"> Represent and operate with very large and very small numbers Make generalizations about the effect of operations on rational numbers Use properties of the real number system to simplify expressions (Associative, Commutative, Identity, Inverse, and Distributive) Recognize and use inverse operations to solve equations (e.g. addition and subtraction, multiplication and division, squares and square roots) 	<p>Number sense:</p> <ul style="list-style-type: none"> Compare and contrast the properties of numbers and number systems, including the rational and real number systems Determine the effect of using exact values or estimates for repeating decimals and irrational numbers (e.g. $\frac{2}{3}$ or .67, π or 3.14) in a problem solving situation Use square numbers and square roots in problem solving situations Simplify numeric expressions involving absolute value, square roots, and exponents <p>Operations:</p> <ul style="list-style-type: none"> Use technology to add, subtract, multiply, with matrices in problem solving situations and interpret the results 	<p>Number sense:</p> <ul style="list-style-type: none"> Compare and contrast the properties of numbers and number systems, including the rational and real number systems Use $i = \sqrt{-1}$ to extend the real number system to represent the complex number system Use sigma notation Simplify expressions with negative and fractional exponents <p>Operations:</p> <ul style="list-style-type: none"> Make generalizations about the effect of operations on real numbers Perform addition, subtraction, multiplication, and division on polynomial expressions Perform addition, subtraction, multiplication, and division on radical expressions Perform addition, subtraction, multiplication, and division on irrational expressions

Building upon the K–5 expectations, all students in Grade 6 will be able to:	Building upon the K–6 expectations, all students in Grade 7 will be able to:	Building upon the K–7 expectations, all students in Grade 8 will be able to:	Building upon the K–8 expectations, all students in Grade 9 will be able to:	Building upon the K–9 expectations, all students in Grade 10 will be able to:	Building upon the K–10 expectations, all students in Grade 11 will be able to:
<p>1/100) to division by its multiplicative inverse (3, 4, 5, 10, 100) using models</p> <ul style="list-style-type: none"> • Add and subtract fractions with unlike denominators and use physical models to justify your answer • Calculate the decimal equivalent of fractions • Use benchmark percents to solve problems • Explain the role of place value in adding and subtracting decimals • Multiply decimals to solve real-world problems (e.g., find the cost of 3 1/2 pounds of grapes at \$1.95 per pound) • Describe in which situations an estimate is preferable and in which situations the exact answer is required • Select and use appropriate methods and tools for computing (e.g., mental computation, estimation, calculators, paper, and pencil) depending on the context and nature of the computation 	<ul style="list-style-type: none"> • Use a variety of strategies to add, subtract, multiply, and divide fractions • Calculate unit rate to solve real-world problems (e.g., speed of a car, unit price of food, etc.) • Justify the placement of the decimal point in the solution to a multiplication or division problem • Use ratios, proportions and percents to solve contextualized problems • Connect addition and subtraction of integers using models or concrete examples • Add, subtract, multiply, and divide integers • Use an estimation or mental math strategy to demonstrate the reasonableness on an exact answer • Select and use appropriate methods and tools for computing (e.g., mental computation, estimation, calculators, paper and pencil) depending on the context and nature of the computation 	<ul style="list-style-type: none"> • Explain how the distributive property is used to multiply (e.g., partial products, mixed numbers) • Use meaningful relationships between addition, subtraction, multiplication, and division of integers to justify the rules of operations • Apply proportional reasoning strategies to solve real-world problems • Select and use appropriate methods and tools for computing (e.g., mental computation, estimation, calculators, paper and pencil) depending on the context and nature of the computation 	<ul style="list-style-type: none"> • Select and use appropriate methods and tools for computing from among mental computation, estimation, calculators, paper and pencil, and computers according to the context and nature of the computation 		<ul style="list-style-type: none"> • Simplify powers of i and expressions involving operations with complex numbers

Standard 2 (K–5) – Algebraic Reasoning: Students will develop Algebraic Reasoning and an understanding of Patterns and Functions by solving problems in which there is a need to recognize and extend a variety of patterns; to progress from the concrete to the abstract using physical models, equations, and graphs; to describe, represent, and analyze relationships among variable quantities; and to analyze, represent, model, and describe real-world functional relationships.

Essential Questions:

Enduring Understandings:

All students in Kindergarten will be able to:	Building upon the kindergarten expectations, all students in Grade 1 will be able to:	Building upon the K–1 expectations, all students in Grade 2 will be able to:	Building upon the K–2 expectations, all students in Grade 3 will be able to:	Building upon the K–3 expectations, all students in Grade 4 will be able to:	Building upon the K–4 expectations, all students in Grade 5 will be able to:
<p>Patterns and change:</p> <ul style="list-style-type: none"> Sort objects by a given attribute (e.g., size, color, shape) Repeat and extend a simple repeating pattern given the core Find visual patterns in the world around us (e.g., patterns in the rug, in the wallpaper) Discuss things that repeat in cyclic patterns, (e.g., day and night, days of week) <p>Representations:</p> <ul style="list-style-type: none"> Model join and separate situations with objects and pictures <p>Symbols:</p> <ul style="list-style-type: none"> Record mathematical thinking symbolically with teacher assistance 	<p>Patterns and change:</p> <ul style="list-style-type: none"> Sort objects by one attribute and then re-sort by another Describe the rule used to sort a given a set of pre-sorted objects Determine the core of the pattern given a set of objects with multiple repetitions (of a simple pattern) Describe what changes in a repeating pattern <p>Representations:</p> <ul style="list-style-type: none"> Model situations in which there is a need to join, separate, compare and use part-part-whole: using objects, pictures, geometric models and symbols <p>Symbols:</p> <ul style="list-style-type: none"> Record mathematical thinking (i.e., invented notation) 	<p>Patterns and change:</p> <ul style="list-style-type: none"> Sort objects by more than one attribute (e.g., boys with glasses, blue squares) Develop a system for sorting a given set of objects Create and extend patterns and then translate them into a rule or drawing Describe the rule for a pattern <p>Representations:</p> <ul style="list-style-type: none"> Model situations that involve the addition and subtraction of whole numbers, using objects, pictures, geometric models and symbols (e.g., multiplicative thinking may be represented by repeated addition and fair shares by repeated subtraction) <p>Symbols:</p> <ul style="list-style-type: none"> Record mathematical thinking using conventional notation Use the = sign to connect equivalent parts in a number sentence 	<p>Patterns and change:</p> <ul style="list-style-type: none"> Find numeric patterns in a hundreds table Describe the patterns that result when skip-counting <p>Representations:</p> <ul style="list-style-type: none"> Model situations that involve the addition, subtraction, and multiplication of whole numbers using objects, pictures, symbols, and geometric models <p>Symbols:</p> <ul style="list-style-type: none"> Represent the idea of an unknown quantity using a letter or a symbol Develop an understanding of the Commutative and Associative properties of whole number addition as a tool to solve problems (e.g., is $3 + (7 + 2)$ always the same as $(3 + 7) + 2$?) 	<p>Patterns and change:</p> <ul style="list-style-type: none"> Classify observed patterns of growth according to whether the growth is constant or varied (e.g., plant lab, geometric patterns) Record patterns of growth in tables and graphs Interpret tables, graphs and real-world events based on how they change over time <p>Representations:</p> <ul style="list-style-type: none"> Model situations that involve the addition, subtraction, multiplication and division of whole numbers using objects, pictures, geometric model, and symbols <p>Symbols:</p> <ul style="list-style-type: none"> Represent the idea of a variable as an unknown quantity using a letter or symbol Develop an understanding of the Commutative and Associative Properties of whole number multiplication as a tool to solve problems (e.g., 	<p>Patterns and change:</p> <ul style="list-style-type: none"> Find a given term in an arithmetic sequence Translate visual patterns into rules Describe trends in patterns and graphs <p>Representations:</p> <ul style="list-style-type: none"> Model problem situations with objects and use representations such as graphs, tables or equations to draw conclusion <p>Symbols:</p> <ul style="list-style-type: none"> Use equations to express mathematical relationships Develop an understanding of the Distributive Properties of whole number operations as a tool to solve problems (e.g., is 24×32 ever the same as $20 \times 30 + 4 \times 2$?)

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				is 4×5 always the same as 5×4 ?)	

Standard 2 (6–11) – Algebraic Reasoning: Students will develop Algebraic Reasoning and an understanding of Patterns and Functions by solving problems in which there is a need to recognize and extend a variety of patterns; to progress from the concrete to the abstract using physical models, equations, and graphs; to describe, represent, and analyze relationships among variable quantities; and to analyze, represent, model, and describe real-world functional relationships.

Essential Questions:

Enduring Understandings:

Building upon the K–5 expectations, all students in Grade 6 will be able to:	Building upon the K–6 expectations, all students in Grade 7 will be able to:	Building upon the K–7 expectations, all students in Grade 8 will be able to:	Building upon the K–8 expectations, all students in Grade 9 will be able to:	Building upon the K–9 expectations, all students in Grade 10 will be able to:	Building upon the K–10 expectations, all students in Grade 11 will be able to:
<p>Patterns and change:</p> <ul style="list-style-type: none"> Use an expression or rule to describe patterns of change in numeric and geometric patterns <p>Representations:</p> <ul style="list-style-type: none"> Demonstrate that a given situation may be represented by a table, graph or equation Explore informal methods to model and solve real-world situations that involve equivalent fractions (e.g., use a table of equivalent ratios to solve proportional reasoning problems) Create a table and scatter plot to represent the relationship between two variables <p>Symbols:</p> <ul style="list-style-type: none"> Use inverse operations to "do and undo" number sentences 	<p>Patterns and change:</p> <ul style="list-style-type: none"> Describe rate of change in tables, rules or graphs Interpret rate of change in tables and graphs based on the context of the problem <p>Representations:</p> <ul style="list-style-type: none"> Connect different representations of the same situation to one another using tables, graphs, and rules Model and solve contextualized linear problems using various representations (e.g., tables, graphs, equations) with respect to starting point and rate of change. Describe how the dependent and independent variables are related in a given situation <p>Symbols:</p> <ul style="list-style-type: none"> Write an equation to show how two variables are related Evaluate an algebraic expression for a given value of the variable 	<p>Patterns and change:</p> <ul style="list-style-type: none"> Determine the slope of a line given two points on the line (as coordinates, in a graph, in a table) Use y-intercept and slope to graph the equation of a line Compare the rates of change in tables and graphs and classify them as linear or nonlinear Recognize exponential rates of growth and decay in tables and graphs <ul style="list-style-type: none"> Use an algebraic expression to represent any term in a numeric or geometric pattern <p>Representations:</p> <ul style="list-style-type: none"> Write an equation given the tabular or graphic form of a linear problem Analyze the interrelationships among tables, graphs, and equations of lines, paying particular attention to the meaning of intercept and slope in the context of the problem Demonstrate the equivalence of two 	<p>Patterns and change:</p> <ul style="list-style-type: none"> Explain slope as a rate of change between dependent and independent variables Compare proportional relationships (direct variation) with linear relationships Describe the effect of parameter changes on linear and exponential functions Classify functions as linear or exponential given a table of values, graph, or equation Compare write linear and exponential functions using tables and graphs Write a linear expression for the general term of an arithmetic sequence and use it to find a specific term <p>Representations:</p> <ul style="list-style-type: none"> Model and solve real-world linear situations, including linear inequalities, using tables, graphs, and symbols Model and solve situations involving 	<p>Patterns and change:</p> <ul style="list-style-type: none"> Use linear, quadratic, cubic functions to describe length, area, and volume relationships Compare direct variation with inverse variation Describe the effect of parameter changes on exponential and quadratic functions Analyze the rate of change in exponential and quadratic functions using tables and graphs Write an expression for the general term of a geometric sequence and use it to find a specific term <p>Representations:</p> <ul style="list-style-type: none"> Model and solve situations involving systems of equations Determine the appropriateness of exponential or quadratic models given a real-world situation Convert flexibly among relationships expressed in tables, graphs, and equations for exponential and quadratic functions 	<p>Patterns and change:</p> <ul style="list-style-type: none"> Use expressions or equations to describe arithmetic and geometric sequences (nth term) and series (sum) Predict transformations of trigonometric, or inverse functions caused by parameter changes Use rates of change to classify families of functions Describe how a change in one variable affects other variables in a multivariable situation <p>Representations:</p> <ul style="list-style-type: none"> Evaluate the advantages and disadvantages of various representations Solve linear inequalities in two variables graphically on a coordinate plane ($y > 2x + 3$) Model constraints to solve linear programming problems Analyze linear, quadratic, exponential, periodic, trigonometric, or inverse relationships

Building upon the K–5 expectations, all students in Grade 6 will be able to:	Building upon the K–6 expectations, all students in Grade 7 will be able to:	Building upon the K–7 expectations, all students in Grade 8 will be able to:	Building upon the K–8 expectations, all students in Grade 9 will be able to:	Building upon the K–9 expectations, all students in Grade 10 will be able to:	Building upon the K–10 expectations, all students in Grade 11 will be able to:
	<ul style="list-style-type: none"> Solve linear equations using a variety of strategies Translate visual patterns into symbolic form 	<p>algebraic expressions using physical models</p> <ul style="list-style-type: none"> Use tables, graphs and symbolic reasoning to identify functions as linear or nonlinear <p>Symbols:</p> <ul style="list-style-type: none"> Apply the order of operations Explore the factor/product relationship between a quadratic expression and its linear factors. Use physical models to develop and write exponential and power models Combine two algebraic expressions to form a new expression Demonstrate the equivalence of linear expressions. Solve linear equations using inverse operations and properties of equality. 	<p>systems of equations with tables or graphs using technology</p> <ul style="list-style-type: none"> Determine the appropriateness of linear models given a real world situation Analyze linear and exponential relationships using technology to find an appropriate mathematical model. Convert flexibly among relationships expressed in tables, graphs, and equations for linear functions Interpret the parameters of a linear or exponential function in terms of the situation it represents Determine if a given value is a solution to a given equation or inequality <p>Symbols:</p> <ul style="list-style-type: none"> Use symbols, tables, and graphs as tools to evaluate expressions Determine symbolically the equation of a line given combinations of point, slope, and intercept information Write equivalent forms of linear functions Solve single variable equations and inequalities algebraically 	<ul style="list-style-type: none"> Estimate solutions to exponential and quadratic function using tables and graphs Make strategic selection of graphing calculator viewing window and scale to solve problems Represent and analyze problem situations using matrices <p>Symbols:</p> <ul style="list-style-type: none"> N/A 	<p>in graphs using best fit lines and curves (regression lines and curve fitting)</p> <ul style="list-style-type: none"> Understand the difference and connection between roots of a quadratic equation and factors of a quadratic expression <p>Symbols:</p> <ul style="list-style-type: none"> Use function notation to represent functions Write equivalent symbolic forms of linear, quadratic, or exponential functions Use geometric models and algebraic symbols to multiply binomials and complete the square Use algebraic techniques to identify the vertex and intercepts for quadratic functions Apply the quadratic formula to solve problems

Standard 3 (K–5) – Geometric Reasoning: Students will develop Geometric Reasoning and an understanding of Geometry and Measurement by solving problems in which there is a need to recognize, construct, transform, analyze properties of, and discover relationships among geometric figures; and to measure to a required degree of accuracy by selecting appropriate tools and units.

Essential Questions:

Enduring Understandings:

All students in Kindergarten will be able to:	Building upon the kindergarten expectations, all students in Grade 1 will be able to:	Building upon the K–1 expectations, all students in Grade 2 will be able to:	Building upon the K–2 expectations, all students in Grade 3 will be able to:	Building upon the K–3 expectations, all students in Grade 4 will be able to:	Building upon the K–4 expectations, all students in Grade 5 will be able to:
<p>Classification:</p> <ul style="list-style-type: none"> Name and sort figures by shape (e.g., rectangle, triangle, circle) Recognize attributes and parts of two-dimensional and three-dimensional shapes Recognize geometric shapes and structures in the environment <p>Location and transformation:</p> <ul style="list-style-type: none"> Find and name locations with simple relationships (e.g., near to, over, under, beside, between, outside, inside) <p>Measurement:</p> <ul style="list-style-type: none"> Compare the length of two objects by placing them side by side Find items that are longer than or shorter than a given measure (e.g., longer than 10 linker cubes) Talk about time using calendar (e.g., today, tomorrow and yesterday, and the date) 	<p>Classification:</p> <ul style="list-style-type: none"> Name and sort plane figures by size and shape Identify the new shape formed by combining two shapes Recognize and compare attributes and parts of two-dimensional and three-dimensional shapes <p>Location and transformation:</p> <ul style="list-style-type: none"> Explore symmetry through drawings and use of manipulatives Describe distance in informal terms (e.g., near, far) <p>Measurement:</p> <ul style="list-style-type: none"> Compare the length of two objects by aligning them Put objects in order according to their length Compare the weight of two objects using a balance Use nonstandard units to represent how long an object is 	<p>Classification:</p> <ul style="list-style-type: none"> Name and sort solid and plane figures by common attributes <p>Location and transformation:</p> <ul style="list-style-type: none"> Recognize shapes that have symmetry <p>Measurement:</p> <ul style="list-style-type: none"> Find objects that are the same in length Compare the length of two objects by counting the number of nonstandard units used to measure them (e.g., linking cubes) Balance an object using nonstandard units (e.g., it takes 5 paper clips to balance my pencil) Measure an object by counting repetitions of the same unit of measure (e.g., the length of the desk measured by an index card) Measure a large object more than once using a different tool as the unit of measure each time—decide which one is the “best” for the task 	<p>Classification:</p> <ul style="list-style-type: none"> Name and sort solid and plane figures using several attributes (e.g., number of corners, number of sides, size) Recognize and represent shapes from different perspectives Describe, and reason about the results of subdividing and combining shapes <p>Location and transformation:</p> <ul style="list-style-type: none"> Describe a flip or slide of a given shape that demonstrates that the two shapes are congruent Describe location and movement using geometric vocabulary (e.g., left, right, front, back) Describe direction of a turn using benchmark turns (e.g., 1/4 turn, 1/2 turn, full turn) <p>Measurement:</p> <ul style="list-style-type: none"> Explain the need for standard measurement 	<p>Classification:</p> <ul style="list-style-type: none"> Identify and classify two-dimensional and three-dimensional shapes according to their properties Identify and build a three-dimensional object from two-dimensional representation of that object <p>Location and transformation:</p> <ul style="list-style-type: none"> Identify line and rotational symmetry in two-dimensional shapes Describe a motion or series of motions that will show that two shapes are congruent (e.g., flip, slide, turn) Demonstrate an understanding of turn rotation through an angle <p>Measurement:</p> <ul style="list-style-type: none"> Estimate and then measure the length of objects to the nearest whole unit (e.g., find your height in inches or centimeters) Extend the precision of a standard measurement by using 	<p>Classification:</p> <ul style="list-style-type: none"> Analyze and classify two-dimensional shapes according to their properties and develop definitions for classes of shapes (e.g., a square is a rectangle is a parallelogram is a quadrilateral) Draw the results of subdividing and combining shapes Identify and classify angles as acute, right, obtuse, or straight <p>Location and transformation:</p> <ul style="list-style-type: none"> Predict and describe the results of a slide, flip, or turn of two-dimensional shapes Use the coordinate system to specify locations and to describe paths between locations <p>Measurement:</p> <ul style="list-style-type: none"> Measure and compare objects using standard measures to the nearest 1/2, 1/4 or 1/8th unit

All students in Kindergarten will be able to:	Building upon the kindergarten expectations, all students in Grade 1 will be able to:	Building upon the K–1 expectations, all students in Grade 2 will be able to:	Building upon the K–2 expectations, all students in Grade 3 will be able to:	Building upon the K–3 expectations, all students in Grade 4 will be able to:	Building upon the K–4 expectations, all students in Grade 5 will be able to:
<ul style="list-style-type: none"> Describe and compare volume/capacity of two objects (e.g., full/empty, more/less) Describe and compare the mass/weight of two objects (e.g., light/heavy) 	<ul style="list-style-type: none"> Fill containers using nonstandard units (e.g., water, sand, centimeter cubes) Talk about the days of the week and the days of the month during calendar time Recognize coins 	<ul style="list-style-type: none"> Cover up or “fill in” a design using manipulatives (e.g., pattern blocks, color tiles) Fill up containers and estimate which container hold more Talk about the time that events happen (e.g., get up, go to lunch, go home, go to bed) Tell time to the hour Identify combinations of coin to make one dollar 	<ul style="list-style-type: none"> Find objects that match a standard unit (e.g., one inch, one foot, one centimeter, one meter) Measure objects (height, length of arms, length of foot) using standard measurement units (e.g., cm, inches, feet) Explore what to do if the unit of measure does not work precisely Make number lines and break each unit into smaller units (e.g., 1/2 units, 1/3 units, 1/4 units) Find the area of a design by counting the number of units used to cover or fill it (e.g., pattern blocks, color tiles) Fill up measuring devices (e.g., measuring cups) to informally find volume Estimate how much time has passed during an event Tell time to the half hour 	<ul style="list-style-type: none"> fraction strips to develop 1/2, 1/4 or 1/10 as a “unit of measure.” Describe the size of a turn angle using clock faces or geo logo Use a ruler to draw lines or geometric figures with given measurements Find the distance around a geometric figure to the nearest whole number (perimeter) Find the number of square units it takes to cover a rectangle (area) Count the number of cubes it takes to fill a three-dimensional figure (volume) Use measuring cups and graduated cylinders to find volume Estimate and then measure the mass of an object to the nearest whole unit Tell time to the nearest five minutes 	<ul style="list-style-type: none"> Measure and compare objects using metric units to the nearest 1/10th Use measuring tools to find the size of turn angles in degrees Draw benchmark turn angles (30, 45, 60, 90, 180 degrees) Find the distance around a geometric figure to the nearest 1/2, 1/4 or 1/10th of a unit (perimeter) Find the number of square units it takes to cover a geometric figure (area) Find the volume of an object . Find the mass of an object to the nearest 1/2, ¼, or 1/10 of a unit Convert a measurement from feet to inches, or from meters to centimeters Find elapsed time

Standard 3 (6–11) – Geometric Reasoning: Students will develop Geometric Reasoning and an understanding of Geometry and Measurement by solving problems in which there is a need to recognize, construct, transform, analyze properties of, and discover relationships among geometric figures; and to measure to a required degree of accuracy by selecting appropriate tools and units.

Essential Questions:

Enduring Understandings:

Building upon the K–5 expectations, all students in Grade 6 will be able to:	Building upon the K–6 expectations, all students in Grade 7 will be able to:	Building upon the K–7 expectations, all students in Grade 8 will be able to:	Building upon the K–8 expectations, all students in Grade 9 will be able to:	Building upon the K–9 expectations, all students in Grade 10 will be able to:	Building upon the K–10 expectations, all students in Grade 11 will be able to:
<p>Classification:</p> <ul style="list-style-type: none"> Estimate, measure, and classify angles Identify geometric relationships in the real world (e.g., parallel lines, perpendicular lines, etc.) Explore the measure of a single angle and find the sum of the angles of a regular polygon <p>Location and transformation:</p> <ul style="list-style-type: none"> Measure angles and sides to demonstrate that transformations such as reflections (flips), translations (slides), and rotations (turns) maintain congruence Identify the properties of shapes that tile a plane <p>Measurement:</p> <ul style="list-style-type: none"> Use the conceptual knowledge of the area of rectangles to develop formulas for the areas of triangles and parallelograms Demonstrate an understanding that the perimeters of rectangles with a fixed area can vary 	<p>Classification:</p> <ul style="list-style-type: none"> Demonstrate geometric relationships between the measures of angles and sides of triangles and other polygons Find the measure of the sum of the angles of a closed figure Build three-dimensional objects from two-dimensional representations and draw two-dimensional representations of three-dimensional objects Create models of nets of three dimensional figures (e.g., cube, rectangular prism, cylinder) Describe the geometric relationships between the measure of the angles of a triangle and the length of the opposite sides <p>Location and transformation:</p> <ul style="list-style-type: none"> Describe the effects that transformations (i.e., reflections, translations, and rotations) and changes in scale have on similarity and congruence 	<p>Classification:</p> <ul style="list-style-type: none"> Apply angle relationships to solve problems <p>Location and transformation:</p> <ul style="list-style-type: none"> Apply proportional reasoning strategies to find unknown sides of similar triangle Develop and evaluate mathematical arguments to demonstrate geometric relationships such as similarity, congruence, or symmetry Use the Pythagorean Theorem to find missing sides of right triangles <p>Measurement:</p> <ul style="list-style-type: none"> Demonstrate the relationship between the area of the base and volume of prisms and cylinders Demonstrate the effects of scaling on volume and surface area of rectangular prisms (i.e., how does doubling the side lengths affect the volume?) Compare the surface area of rectangular prisms which have the 	<p>Classification:</p> <ul style="list-style-type: none"> Represent and verify parallel and perpendicular relationships in linear functions Classify 3-dimensional figures according to the shapes of their base(s) and/or faces <p>Location and transformation:</p> <ul style="list-style-type: none"> Use properties of polygons to construct them in the coordinate plane <p>Measurement:</p> <ul style="list-style-type: none"> Make sound decisions about how to measure quantities using appropriate units Analyze precision, accuracy, and approximate error in measurement situations Use formulas for area, surface area, and volume of geometric figures including pyramids, cones, spheres, and cylinders Apply the Pythagorean Theorem 	<p>Classification:</p> <ul style="list-style-type: none"> Determine whether a triangle is a right triangle (e.g., Converse of Pythagorean Theorem, slopes of adjacent sides) Identify necessary and sufficient conditions that determine the existence of special parallelograms or triangles Justify whether two figures are similar or congruent Use and justify angle relationships created by intersecting and parallel lines Use inductive reasoning to make conjectures and deductive reasoning to justify conclusions <p>Location and transformation:</p> <ul style="list-style-type: none"> Determine the results of multiple transformations and determine the transformations required to obtain the finished product from the original shape in the coordinate plane Use appropriate technologies to model 	<p>Classification:</p> <ul style="list-style-type: none"> Connect the right angle relationships with the unit circle and periodic functions for any angle Use Sin and Cos functions to explore periodic real world phenomena Justify whether two triangles are congruent using triangle congruence and similarity theorems Describe and use angle relationships in circles <p>Location and transformation:</p> <ul style="list-style-type: none"> Stretch and shrink periodic functions by changing parameters Visualize three-dimensional objects from different perspectives and analyze cross-sections <p>Measurement:</p> <ul style="list-style-type: none"> Measure angles in degrees and radians Convert between degree measures and radian measures

Building upon the K–5 expectations, all students in Grade 6 will be able to:	Building upon the K–6 expectations, all students in Grade 7 will be able to:	Building upon the K–7 expectations, all students in Grade 8 will be able to:	Building upon the K–8 expectations, all students in Grade 9 will be able to:	Building upon the K–9 expectations, all students in Grade 10 will be able to:	Building upon the K–10 expectations, all students in Grade 11 will be able to:
<ul style="list-style-type: none"> • Demonstrate an understanding that the areas of rectangles with a fixed perimeter can vary • Find the ratio of the circumference to the diameter of a circular objects to obtain an estimate of π • Use an angle ruler or protractor to measure angles • Sketch a geometric figure given the measure of turn angles and the length of sides • Find the circumference of circles and explore finding the area. 	<ul style="list-style-type: none"> • Demonstrate dilations of scale on the coordinate plane • Represent reflections, rotations, and translations on the coordinate plane <p>Measurement:</p> <ul style="list-style-type: none"> • Find the area of polygons by partitioning into rectangles and triangles • Find the surface area of prisms using physical models • Identify corresponding parts of similar figures • Determine the volume and surface areas of cylinders and prisms 	<p>same volume but different dimensions</p> <ul style="list-style-type: none"> • Find the measures of corresponding parts of similar figures 		<p>geometric structures and to develop conjectures about them</p> <ul style="list-style-type: none"> • Construct geometric figures in the coordinate plane and justify the properties of the figure (e.g., slope, side length) <p>Measurement:</p> <ul style="list-style-type: none"> • Apply trigonometric relationships to determine side lengths and angle measures of right triangle • Determine the error in measurement and its impact on consequent computations • Find missing dimensions of a shape given the area, volume, or surface area • Use the Pythagorean Theorem to develop the distance formula • Apply the Pythagorean Theorem and its converse • Use formulas for surface area and volume of complex shapes by partitioning • Compare the relationship between the volume of different shapes with the same base and height (e.g., cylinder and cone, prism and pyramid) 	<ul style="list-style-type: none"> • Use trigonometric relationships to determine side lengths and angle measures of any triangle

Standard 4 (K–5) – Quantitative Reasoning: Students will develop Quantitative Reasoning and an understanding of Data Analysis and Probability by solving problems in which there is a need to collect, appropriately represent, and interpret data; to make inferences or predictions and to present convincing arguments; and to model mathematical situations to determine the probability.

Essential Questions:

Enduring Understandings:

All students in Kindergarten will be able to:	Building upon the kindergarten expectations, all students in Grade 1 will be able to:	Building upon the K–1 expectations, all students in Grade 2 will be able to:	Building upon the K–2 expectations, all students in Grade 3 will be able to:	Building upon the K–3 expectations, all students in Grade 4 will be able to:	Building upon the K–4 expectations, all students in Grade 5 will be able to:
<p>Collect:</p> <ul style="list-style-type: none"> Gather and report data about oneself and familiar surroundings using teacher defined categories (preference out of two choices) <p>Represent:</p> <ul style="list-style-type: none"> Use physical objects to organize and informally represent categorical data <p>Analyze:</p> <ul style="list-style-type: none"> Interpret data by making simple comparisons (e.g., more, less, the same) <p>Probability:</p> <ul style="list-style-type: none"> Explore events as likely or unlikely based on shared or personal experiences 	<p>Collect:</p> <ul style="list-style-type: none"> Collect categorical data (observe and count frequencies) to answer a question posed by the teacher <p>Represent:</p> <ul style="list-style-type: none"> Organize and informally represent categorical data (2 or 3 categories) using drawings or physical objects <p>Analyze:</p> <ul style="list-style-type: none"> Interpret data by making comparisons between frequencies of categorical data (e.g., how many more) <p>Probability:</p> <ul style="list-style-type: none"> Explore events as likely or unlikely, possible or impossible based on shared or personal experience 	<p>Collect:</p> <ul style="list-style-type: none"> Collect (e.g., observe, count, or survey) categorical data to answer a question posed by the teacher or students <p>Represent:</p> <ul style="list-style-type: none"> Demonstrate a variety of informal techniques for organizing and representing categorical data (e.g., tallies, pictures, or physical objects, bar graph with scale provided, line plot) <p>Analyze:</p> <ul style="list-style-type: none"> Interpret data by noting characteristics of the graph (e.g., most, least, the same) <p>Probability:</p> <ul style="list-style-type: none"> Explore events as more likely or less likely based on informal observation 	<p>Collect:</p> <ul style="list-style-type: none"> Collect categorical and numerical data to answer a question posed by the teacher or students <p>Represent:</p> <ul style="list-style-type: none"> Demonstrate a variety of informal and conventional techniques for representing and organizing categorical and numerical data (e.g., tallies, tables, pictographs, bar graphs) <p>Analyze:</p> <ul style="list-style-type: none"> See and describe data as a whole, describing the shape of the distribution; reason about how individual pieces of data relate to the whole Find and use the mode to describe and interpret data <p>Probability:</p> <ul style="list-style-type: none"> Describe the likelihood of an event based on experimental observations using simple randomizing devices (e.g. spinners, number cubes) and ideas such as certain, 	<p>Collect:</p> <ul style="list-style-type: none"> Pose questions that can be answered with data; systematically collect and organize both categorical and numerical data Collect categorical data where the data is described using numbers (e.g., how many have five letters in their first name?) <p>Represent:</p> <ul style="list-style-type: none"> Construct and use data displays (e.g., tables, scaled pictographs, bar graphs, line plots) in order to answer a question <p>Analyze:</p> <ul style="list-style-type: none"> Describe a set of data as a whole, noting important features such as concentration of values, spread of the values, and extreme values Find and use measures of center (mode and median) to summarize and interpret data <p>Probability:</p> <ul style="list-style-type: none"> Describe the outcomes of an experiment or 	<p>Collect:</p> <ul style="list-style-type: none"> Pose questions that can be answered with data; systematically collect and organize categorical and numerical/ measurement data <p>Represent:</p> <ul style="list-style-type: none"> Construct and use data displays (e.g., tables, scaled pictographs, line plots, bar graphs) in order to answer a question <p>Analyze:</p> <ul style="list-style-type: none"> Compare related data sets noting similarities and differences in the distributions Find and use measures of center (mean, median, mode) and spread (range) to summarize and interpret data Identify the typical or average value in a data set as well as any atypical values <p>Probability:</p> <ul style="list-style-type: none"> Conduct a probability experiment, represent the result as a number (fraction, decimal, percent) between 0 and

All students in Kindergarten will be able to:	Building upon the kindergarten expectations, all students in Grade 1 will be able to:	Building upon the K–1 expectations, all students in Grade 2 will be able to:	Building upon the K–2 expectations, all students in Grade 3 will be able to:	Building upon the K–3 expectations, all students in Grade 4 will be able to:	Building upon the K–4 expectations, all students in Grade 5 will be able to:
			impossible, and equally likely	event (e.g., possible/impossible, certain/uncertain, less likely/equally likely/more likely)	1, and draw conclusions from the results <ul style="list-style-type: none"> List all possible outcomes (i.e. the sample space) for a probability experiment involving a simple event

Standard 4 (6–11) – Quantitative Reasoning: Students will develop Quantitative Reasoning and an understanding of Data Analysis and Probability by solving problems in which there is a need to collect, appropriately represent, and interpret data; to make inferences or predictions and to present convincing arguments; and to model mathematical situations to determine the probability.

Essential Questions:

Enduring Understandings:

Building upon the K–5 expectations, all students in Grade 6 will be able to:	Building upon the K–6 expectations, all students in Grade 7 will be able to:	Building upon the K–7 expectations, all students in Grade 8 will be able to:	Building upon the K–8 expectations, all students in Grade 9 will be able to:	Building upon the K–9 expectations, all students in Grade 10 will be able to:	Building upon the K–10 expectations, all students in Grade 11 will be able to:
<p>Collect:</p> <ul style="list-style-type: none"> Collect and organize numerical (whole number or decimal) data in order to answer a question <p>Represent:</p> <ul style="list-style-type: none"> Construct displays of data (e.g., circle graphs, scatter plots, frequency counts) for a single data set <p>Analyze:</p> <ul style="list-style-type: none"> Defend conclusions drawn from the interpretation of data by comparing one data set to another Find and use summary measures of center (mean, median, mode) and spread (range) to compare sets of single variable data <p>Probability:</p> <ul style="list-style-type: none"> Use real-world data to estimate the probability of future events (e.g., batting averages, weather predictions) Analyze simple games to determine favorable outcomes and chances of winning or losing 	<p>Collect:</p> <ul style="list-style-type: none"> Pose questions that can be answered by collecting and organizing data from experiments, surveys, and relevant print and electronic resources <p>Represent:</p> <ul style="list-style-type: none"> Construct displays of data for single data sets (e.g., stem-and-leaf plots) or in order to study the relationship between related data sets (scatter plots) <p>Analyze:</p> <ul style="list-style-type: none"> Defend or dispute conclusions drawn from the interpretation of data by comparing one data set to another Choose an appropriate measures of center (mean, median, mode) and spread (range) to interpret data set(s) <p>Probability:</p> <ul style="list-style-type: none"> Construct a sample space (organized list, counting tree) to determine theoretical probabilities of an event Use proportional reasoning to predict how often a simple 	<p>Collect:</p> <ul style="list-style-type: none"> Pose questions that can be answered by collecting and organizing data from experiments, surveys, and relevant print and electronic resources Use random sampling methods to collect the necessary information to answer questions <p>Represent:</p> <ul style="list-style-type: none"> Construct displays of data to represent individual sets of data (e.g., histograms, box plots) or to explore the relationship between related sets of data (scatter plots, line graphs); describe the correspondence between data sets and their graphical displays <p>Analyze:</p> <ul style="list-style-type: none"> Defend or dispute conclusions drawn from the interpretation of data by comparing sets of data or exploring possible relationships based upon scatter plots of related data and approximate lines of fit 	<p>Collect:</p> <ul style="list-style-type: none"> Describe and explain how the validity of predictions are affected by number of trials, sample size, and the population <p>Represent:</p> <ul style="list-style-type: none"> Select and interpret the most appropriate display for a given purpose and set(s) of data (e.g., histograms, parallel box plots, stem and leaf plots, scatter plots) Model a scatter plot of a linear or exponential function and use the model to make predictions recognizing the limitations of the model <p>Analyze:</p> <ul style="list-style-type: none"> Analyze the validity of statistical conclusions and the misuse of data (choices of scale, measures of central tendency, curve fitting) Use graphic or symbolic representations of a least squares regression line appropriately to make predictions (e.g., discrete vs. continuous data, the effect of 	<p>Collect:</p> <ul style="list-style-type: none"> Understand permutations and combinations as counting techniques <p>Represent:</p> <ul style="list-style-type: none"> N/A <p>Analyze:</p> <ul style="list-style-type: none"> Recognize how linear transformations of one variable data effect shape, center, and spread <p>Probability:</p> <ul style="list-style-type: none"> Compute and interpret the expected value of independent and dependent events Compute the probability of both independent and dependent events Use computed outcomes with and without replacement to solve probability problems 	<p>Collect:</p> <ul style="list-style-type: none"> Understand the differences among the various kinds of studies (e.g., survey, controlled experiment) Determine factors which may affect the outcome of a survey Design surveys and apply random sampling techniques to avoid bias in the data collection <p>Represent:</p> <ul style="list-style-type: none"> Interpret least squares regression line as the line that minimizes the sum of the squared errors <p>Analyze:</p> <ul style="list-style-type: none"> Apply benchmark percents in a normal distribution Compute and use standard deviation to analyze data variability Recognize approximately norm distributions Interpret margin of error and confidence intervals <p>Probability:</p> <ul style="list-style-type: none"> Identify mutually exclusive events and apply the addition rule to

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	<p>probability event will occur in a given number of trials</p>	<ul style="list-style-type: none"> • Analyze a representative sample to make inferences about a population • Find and use appropriate measures of center (mean, media, mode) and spread (range, interquartile range) to interpret data • Compare the usefulness of the mean and median as measures of center; describe the effect of changes in the data on the mean and median of the data set(s) <p>Probability:</p> <ul style="list-style-type: none"> • Compare and make predictions based on theoretical and experimental probabilities, using sample data generated through actual experiments or computer simulations • Construct an appropriate sample space and apply principles of probability for a simple or compound event • Investigate and describe the difference between the experimental probability of a simulated event (experiment) and the theoretical probability of the same event • Explore the concepts of randomness and random sample 	<p>outliers on extrapolation)</p> <p>Probability:</p> <ul style="list-style-type: none"> • Use and design simulations or experiments to determine probabilities of independent and dependent events • Define a sample space to compare probabilities using the Fundamental Counting Principle • Use the Law of Large Numbers to show how experimental probability approaches theoretical probability • Demonstrate an understanding of the difference between discrete and continuous data 		<p>compute the probability of the occurrence</p>

Standard 5: Problem Solving – Students will develop their Problem Solving ability by engaging in developmentally appropriate problem-solving opportunities in which there is a need to use various approaches to investigate and understand mathematical concepts; to formulate their own problems; to find solutions to problems from everyday situations; to develop and apply strategies to solve a wide variety of problems; and to integrate mathematical reasoning, communication and connections.

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

Standard 6: Reasoning and Proof – Students will develop their Reasoning and Proof ability by solving problems in which there is a need to investigate significant mathematical ideas in all content areas; to justify their thinking; to reinforce and extend their logical reasoning abilities; to reflect on and clarify their own thinking; to ask questions to extend their thinking; and to construct their own learning.

- Understand that reasoning and proof are fundamental aspects of mathematics
- Make and investigate mathematical conjectures
- Develop and evaluate mathematical arguments and proofs
- Select and use various types of reasoning and methods of proof

Standard 7: Communication – Students will develop their mathematical Communication ability by solving problems in which there is a need to obtain information from the real world through reading, listening and observing; to translate this information into mathematical language and symbols; to process this information mathematically; and to present results in written, oral, and visual formats.

- Organize and consolidate their mathematical 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
- Use the language of mathematics to express mathematical ideas precisely

Standard 8: Connections – Students will develop mathematical Connections by solving problems in which there is a need to view mathematics as an integrated whole and to integrate mathematics with other disciplines, while allowing the flexibility to approach problems, from within and outside mathematics, in a variety of ways.

- Recognize and use connections among mathematical ideas
- Understand how mathematical ideas interconnect and build on one another to produce a coherent whole
- Recognize and apply mathematics in contexts outside of mathematics