

**St. Philomena School**

**MODEL CONTENT STANDARDS  
&  
GRADE LEVEL EXPECTATIONS**

**MATHEMATICS**

# INTRODUCTION

## Model Content Standards for Mathematics

Responsible and productive members of today’s technological society need to have a broad, connected, and useful knowledge of mathematics. The St. Philomena School Model Content Standards for Mathematics are designed to serve as a guide that will enable every student to develop the mathematical literacy needed for citizenship and employment in the 21<sup>st</sup> century.

“Today’s students will live and work in the 21<sup>st</sup> century, in an era dominated by computers, by worldwide communication, and by a global economy. Jobs that contribute to this economy will require workers who are prepared to absorb new ideas, to perceive patterns, and to solve unconventional problems. Mathematics is the key to opportunity for these jobs.”<sup>1</sup>

Mathematics is not simply a collection of facts and procedures, and doing mathematics is not simply recalling these facts, nor performing memorized procedures. Mathematics is a coherent and useful discipline that has expanded dramatically in the last 25 years. The mathematics students study in school must reflect these changes, and the ways students study mathematics must capitalize on the growth in our understanding of how students learn.

“There has been a mentality that you have to be ... special to be successful in mathematics, that you have to be the best and the brightest. Well, we are demystifying mathematics. We can no longer say that there is any segment of society that doesn’t need mathematics.”<sup>2</sup>

Three questions have guided the development of the St. Philomena School Model Content Standards for Mathematics: What is mathematics? What does it mean to know, use, and do mathematics? What mathematics should every student learn?

Responses to these questions have resulted in six goals, adapted from those of the National Council of Teachers of Mathematics<sup>3</sup>, that serve as the framework for the St. Philomena School Model Content Standards for Mathematics. The six goals that students should reach are stated on the following page.

<sup>1</sup> L. Steen, (1989), “ Teaching Mathematics for Tomorrow’s World”, *Educational Leadership*, 47: 18-22.

<sup>2</sup> Quote by Iris Carl found in A. Wheelock, (1992), *Crossing the Tracks*, (New York: The New Press).

<sup>3</sup> National Council of Teachers of Mathematics, (1989), *Curriculum and Evaluation Standards for School Mathematics*, (Reston, VA: author).

## **Model Content Standards**

### **Mathematics**

- 1. Students develop number sense and use numbers and number relationships in problem-solving situations and communicate the reasoning used in solving these problems.**
- 2. Students use algebraic methods to explore, model, and describe patterns and functions involving numbers, shapes, data, and graphs in problem-solving situations and communicate the reasoning used in solving these problems.**
- 3. Students use data collection and analysis, statistics, and probability in problem-solving situations and communicate the reasoning used in solving these problems.**
- 4. Students use geometric concepts, properties, and relationships in problem-solving situations and communicate the reasoning used in solving these problems.**
- 5. Students use a variety of tools and techniques to measure, apply the results in problem-solving situations, and communicate the reasoning used in solving these problems.**
- 6. Students link concepts and procedures as they develop and use computational techniques, including estimation, mental arithmetic, paper-and-pencil, calculators, and computers, in problem-solving situations and communicate the reasoning used in solving these problems.**

## Six Goals for Students of Mathematics

- ***Become mathematical problem solvers.*** To be problem solvers, students need to know how to find ways to reach a goal when no routine path is apparent. To develop the flexibility, perseverance, and wealth of strategies that are characteristic of good problem solvers, students need to be challenged frequently and regularly with non-routine problems, including those they pose themselves.
- ***Learn to communicate mathematically.*** The development of students' power to use mathematics involves learning the signs, symbols, and terms of mathematics. This is best accomplished in problem situations where students have an opportunity to read, write, and discuss ideas in the language of mathematics. As students communicate their ideas, they learn to clarify, refine, and consolidate their thinking.
- ***Learn to reason mathematically.*** Students who reason mathematically gather data, make conjectures, assemble evidence, and build an argument to support or refute these conjectures. Such processes are fundamental to doing mathematics.
- ***Make mathematical connections.*** The study of mathematics should provide students with many opportunities to make connections among mathematical ideas (for example, the connection between geometric and algebraic concepts) and among mathematics and other disciplines (for example, art, music, psychology, science, business). The curriculum should portray mathematics as an integrated whole that permeates activities both in and out of school. These connections make mathematics meaningful and useful to each student.
- ***Become confident of their mathematical abilities.*** As a result of studying mathematics, students need to view themselves as capable of using their growing mathematical power to make sense of new problem situations in the world around them. School mathematics must endow all students with a realization that doing mathematics is a common human activity. Students learn to trust their own mathematical thinking by having numerous and varied experiences.
- ***Learn the value of mathematics.*** In addition to providing the tools to solve problems, mathematics provides a way of thinking about and understanding the world around us. Students should have numerous and varied opportunities to think mathematically about their world. They should also explore the cultural, historical, and scientific evolution of mathematics so that they can appreciate the role of mathematics in the development of our contemporary society.

The following Model Content Standards for Mathematics provide a new vision of the content students should study in order to achieve these goals. The standards reinforce the need for technical skills, long a goal of school mathematics, and also the need to know when to apply them and why they work. They also broaden considerably the context in which these technical skills might be attained. Students who have a working knowledge of the mathematics in each of these standards will be better able to reason critically, vote responsibly, and work productively in today's complex world.

## **STANDARD 1:**

**Students develop number sense and use numbers and number relationships in problem-solving situations and communicate the reasoning used in solving these problems.**

In order to meet this standard, a student will

- Construct and interpret number meanings through real-world experiences and the use of hands-on materials;
- Represent and use numbers in a variety of equivalent forms (*for example, fractions, decimals, percents, exponents, scientific notations*);
- Know the structure and properties of the real number system (*for example, primes, factors, multiples, relationships among sets of numbers*); and
- Use number sense, including estimation and mental arithmetic, to determine the reasonableness of solutions.

### **RATIONALE:**

*Numbers play a vital role in our daily lives, from cooking to reading the newspaper to performing jobs. Because we use numbers to measure, to count, to order, and to label, it is important to understand the many uses of numbers. These include knowing both the symbols for and the meanings of various kinds of numbers, including whole numbers, fractions, decimals, percents, roots, exponents, and scientific notation.*

*Number sense is “common sense” about numbers. Students with number sense recognize the relative magnitudes of numbers and relationships between numbers; for example,  $\frac{1}{2}$  is equivalent to .5 and 50%. In addition, they have references for measures of common objects and situations in the environment. They know how much a million is and how much a loaf of bread costs. Developing number sense strengthens students’ ability to acquire basic facts, to solve problems, and to determine the reasonableness of results.*

***1.1 Demonstrating meanings for whole numbers, commonly-used fractions and decimals (for example,  $\frac{1}{3}$ ,  $\frac{3}{4}$ , 0.5, 0.75), and representing equivalent forms of the same number through the use of physical models, drawings, calculators, and computers.***

### **GRADE K**

- Using objects and pictures, represent whole numbers from 0 to 50 in a variety of ways
- Using two or more sets of objects, demonstrate which set is equal to, less than, or greater than the other set

- Using concrete materials, demonstrate the meaning of wholes and parts (for example, halves)
- Name pennies, nickels and dimes.

### **GRADE 1**

- Using objects and pictures, represent whole numbers from 0 to 100 in a variety of ways
- Using objects, demonstrate the meanings of equal, less than, and greater than with the whole numbers 0 to 100
- Apply equalities using the '=' symbol
- Using concrete materials, demonstrate the meanings of halves, thirds, and fourths of sets and wholes
- Name pennies, nickels, dimes, quarters, and dollars
- Demonstrate the value of nickels, dimes, quarters, and dollars in terms of pennies (for example, 25 pennies = 1 quarter).

### **GRADE 2**

- Using objects and pictures, represent whole numbers including odds and evens from 0 to 1,000
- Apply equalities and inequalities with whole numbers from 0 to 1,000 using the symbols =, <, >
- Using concrete materials, demonstrate the meanings of fractions, including halves, thirds, fourths, and eighths of sets and wholes
- Demonstrate equivalencies of coins (for example, 5 nickels = 1 quarter)
- Combine coins up to \$1.00 (for example,  $\square\square\text{\$}$  = 2 dimes = 1 dime + 2 nickels = 4 nickels)

### **GRADE 3**

- Using objects and pictures, represent whole numbers including odds and evens from 0 to 10,000
- Apply equalities and inequalities with whole numbers from 0 to 100,000 using the symbols =, <, >
- Using concrete materials (for example, fraction strips), compare and order fractions with like denominators, such as halves, thirds, fourths, eighths, and tenths
- Demonstrate different combinations of coins for change (for example, 52c = 2 quarters and 2 pennies)
- Using concrete materials, make change up to \$1.00.

### **GRADE 4**

- Using objects and pictures, represent whole numbers including odds and evens from 0 to 1,000,000
- Apply equalities and inequalities with whole numbers from 0 to 1,000,000 using the symbols =, <, >

- Using concrete materials (for example, fraction strips), compare and order fractions with like and unlike denominators, such as halves, thirds, fourths, eighths, and tenths
- Using concrete materials (for example, base ten blocks), represent the decimal fractions of tenths and hundredths
- Equate terminating decimals to their common fraction equivalents (for example,  $0.25 = \frac{1}{4}$ )
- Demonstrate different combinations of currency and coins for change (for example,  $\$2.39 = 2$  dollar bills, 1 quarter, 1 dime, and 4 pennies)
- Using concrete materials, count change from the cost of the item, where the item costs no more than  $\$10.00$ , up to the amount of money received.

***1.2 Reading and writing whole numbers and knowing place-value concepts and numeration through their relationships to counting, ordering, and grouping.***

**GRADE K**

- Read and write numerals from 0 to 10 in meaningful contexts
- Group objects into sets of ten

**GRADE 1**

- Read and write numerals from 0 to 100 in meaningful contexts
- Read the number words for zero to ten
- Group objects by ones and tens
- Order according to place value (for example, given 9 ones and 2 tens, the student can write the number 29; given the number 29 the student can show 2 tens and 9 ones)
- Write one- and two-digit whole numbers in expanded form (for example,  $29 = 20 + 9$ )

**GRADE 2**

- Read and write numerals from 0 to 1,000 in meaningful contexts
- Read and write the number words for zero to one hundred
- Group objects by ones, tens and hundreds
- Order according to place value (for example, given 9 ones, 5 tens, and 4 hundreds, the student can write the number 459; given the number 459 the student can show 4 hundreds, 5 tens, and 9 ones)
- Write three-digit numbers in expanded form (for example,  $459 = 400 + 50 + 9$ )

**GRADE 3**

- Read and write numerals from 0 to 100,000 in meaningful contexts
- Read and write the number words for selected numbers from zero to one thousand
- Order according to place value (for example, given 9 ones, 5 tens, 4 hundreds, and 7 thousands, the student can write the number 7,459; given the number 7,459, the student can show 7 thousands, 4 hundreds, 5 tens, and 9 ones)
- Identify place value through ten thousands (for example, in 86,243, '6' is in the thousands place)

- Write four-digit numbers in expanded form (for example,  $7,459 = 7,000 + 400 + 50 + 9$ )

#### **GRADE 4**

- Read and write numerals from 0 to 1,000,000 in meaningful contexts
- Read the number words for selected numbers from zero to one million
- Order according to place value (for example, given 9 ones, 5 tens, 4 hundreds, 7 thousands, and 8 hundred thousands, the student can write the number 807,459; given the number 807,459, the student can show 8 hundred thousands, 7 thousands, 4 hundreds, 5 tens, and 9 ones)
- Identify place value through hundred thousands (for example, in 807,459, '8' is in the hundred thousands place)
- Write six-digit numbers in expanded form (for example,  $807,459 = 800,000 + 7,000 + 400 + 50 + 9$ )
- Relate decimals and fractions (that is, tenths and hundredths) to one another using objects and pictures.

#### ***1.3 Using numbers to count, to measure, to label, and to indicate location.***

#### **GRADE K**

- Count from 1 to 50
- Use one-to-one correspondence to count and compare sets of objects containing 0 to 10 members
- Starting with any whole number less than 50, count forward to 50
- Use ordinal positions for first through tenth
- Sequence whole numbers from 0 to 10 (for example, 5 is before 7; 5 is after 4)
- Count from 1 to 100 by 10's

#### **GRADE 1**

- Count from 1 to 20 by 2's
- Count from 1 to 100 by 1's, 5's, and 10's
- Starting with any whole number less than 100, count forward to 100
- Use ordinal positions for first through twentieth
- Sequence selected whole numbers from 0 to 100

#### **GRADE 2**

- Count by 1's, 2's, 5's and 10's
- Count from 1 to 1,000 by 100's
- Starting with any whole number less than 1,000, count forward to 1,000
- Use ordinal positions for first through thirty-first
- Sequence selected whole numbers from 0 to 1,000
- Locate and label the halfway point between whole numbers on the number line



- Locate and label a point in the first quadrant of the coordinate plane (for example, locate the point (4,1))

### **GRADE 3**

- Count forward from any even number by 2's; and from any number by 10's and 100's (for example, 216, 316, 416, 516, ...)
- Use ordinal positions for selected whole numbers greater than thirty-first
- Sequence selected whole numbers from 0 to 10,000
- Locate and label  $\frac{1}{2}$ 's between whole numbers on the number line
- Locate and label a point in the first quadrant of the coordinate plane (for example, locate the point (1,5))

### **GRADE 4**

- Count forward from any number by 2's, 3's, 5's, 10's, and 100's
- Sequence selected whole numbers from 0 to 100,000
- Locate and label  $\frac{1}{2}$ 's and multiples of  $\frac{1}{4}$ 's and  $\frac{1}{3}$ 's between whole numbers on the number line
- Locate and label a point in the first quadrant of the coordinate plane (for example, locate the point (27,15)) and on a city map (for example, (E,11))

### ***1.4 Developing, testing and explaining conjectures about properties of whole numbers, and commonly used fractions and decimals (for example, $\frac{1}{3}$ , $\frac{3}{4}$ , 0.5, 0.75).***

### **GRADE K**

- Describe the concept of zero

### **GRADE 1**

- Know the commutative property of addition of whole numbers
- Verify the addition and subtraction properties of zero with whole numbers

### **GRADE 2**

- Verify the commutative and associative properties of addition of whole numbers
- Verify that subtraction of whole numbers is not commutative

### **GRADE 3**

- Verify the commutative and associative properties of addition and multiplication of whole numbers
- Verify the multiplication properties of zero and one with whole numbers

### **GRADE 4**

- Verify division of whole numbers is not commutative
- Continue to verify number properties from previous grades

*1.5 Using number sense to estimate and justify the reasonableness of solutions to problems involving whole numbers, and commonly used fractions and decimals (for example,  $1/3$ ,  $3/4$ , 0.5, 0.75).*

**GRADE K**

- Estimate a reasonable quantity for a given number of objects less than 20
- Describe a relationship between two sets of quantities with more, less, or equal numbers of objects

**GRADE 1**

- Estimate a reasonable quantity for a given number of objects from 0 to 100

**GRADE 2**

- Estimate sums and differences first by rounding to the nearest ten prior to performing the operation, and then use the estimate to determine the reasonableness of the solution

**GRADE 3**

- Estimate sums and differences first by rounding to the nearest ten or hundred prior to performing the operation, and, then, use the estimate to determine the reasonableness of the solution
- Estimate products first by rounding to the nearest ten prior to performing the operation, and, then, use the estimate to determine the reasonableness of the solution

**GRADE 4**

- Estimate sums and differences first by rounding to the nearest ten, hundred, or thousand prior to performing the operation, and then use the estimate to determine the reasonableness of the solution
- Estimate products first by rounding to the nearest ten or hundred prior to performing the operation and, then use the estimate to determine the reasonableness of the solution.

*1.1 Demonstrating meanings for integers, rational numbers, percents, exponents, absolute value, square roots, and pi, using physical materials and technology in problem-solving situations.*

**GRADE 5**

- Locate commonly-used positive rational numbers, including fractions, mixed numbers, terminating decimals through thousandths, and percents, on the number line
- Using concrete materials, demonstrate the equivalence of commonly-used fractions, terminating decimals, and percents (for example,  $7/10 = 0.7 = 70\%$ )

## **GRADE 6**

- Continue to locate commonly-used positive rational numbers, including fractions, mixed numbers, terminating decimals through thousandths, and percents, on the number line
- Demonstrate the equivalence of commonly-used fractions, decimals, and percents
- Demonstrate the meaning of square roots of perfect square numbers through 100

## **GRADE 7**

- Locate integers and positive rational numbers on the number line (for example,  $-6$ ,  $\frac{3}{4}$ ,  $1.81$ )
- Identify subsets of rational numbers, including counting and whole numbers and integers
- Demonstrate the meaning of absolute value as distance on the number line
- Demonstrate the equivalence of positive fractions, decimals, and percents
- Demonstrate the relationship of the circumference to the diameter of a circle as approximating pi
- Demonstrate the meaning of square roots of perfect square numbers

## **GRADE 8**

- Locate rational numbers and commonly-used irrational numbers on the number line (for example,  $-\frac{7}{2}$ ,  $-2.48$ ,  $0$ ,  $\frac{15}{16}$ ,  $\frac{1}{2}$ ,  $\pi$ )
- Demonstrate the equivalence of fractions, terminating decimals, and percents of positive and negative rational numbers
- Demonstrate the relationships among subsets of the real number system, including counting, whole, integer, rational, and irrational numbers, to one another
- Determine the two consecutive whole numbers between which the square root of a whole number lies (for example,  $\sqrt{72}$  lies between 8 and 9)
- Demonstrate the meaning of commonly-used irrational numbers

### ***1.2 Reading writing, and ordering integers, rational numbers, and common irrational numbers such as $\frac{1}{2}$ , $\frac{3}{4}$ , and $\pi$ .***

## **GRADE 5**

- Read, write, and order positive rational numbers, including commonly-used fractions and terminating decimals through thousandths
- Compare commonly-used proper fractions and terminating decimals using the symbols  $=$ ,  $<$ ,  $>$

## **GRADE 6**

- Read, write, and order positive rational numbers, including commonly-used fractions and terminating decimals through thousandths
- Compare positive fractions and decimals using the symbols  $=$ ,  $<$ ,  $>$

## **GRADE 7**

- Read, write, and order integers and positive rational numbers
- Compare integers and positive rational numbers using the symbols =, <, >

## **GRADE 8**

- Read, write, and order rational numbers and commonly-used irrational numbers
- Compare rational numbers and commonly-used irrational numbers using the symbols =, <, >

### ***1.3 Applying number theory concepts (for example, primes, factors, multiples) to represent numbers in various ways.***

## **GRADE 5**

- Identify factors, multiples, prime and composite numbers
- Write the prime factorization of whole numbers up to 50 (for example,  $36 = 2 \cdot 2 \cdot 3 \cdot 3$ )
- Relate exponential notation to repeated multiplication (for example,  $81 = 3 \cdot 3 \cdot 3 \cdot 3 = 3^4$ )
- Write whole numbers in expanded form without powers of ten (for example  $579 = 500 + 70 + 9 = (5 \times 100) + (7 \times 10) + (9 \times 1)$ )
- Demonstrate the divisibility rules for 2, 5, and 10

## **GRADE 6**

- Identify factors, multiple, primes and composites
- Write the prime factorization of whole numbers in exponential form (for example,  $36 = 2^2 \cdot 3^2$ )
- Demonstrate  $a^n = a \cdot a \cdot \dots \cdot a$ , where 'a' and 'n' are counting numbers
- Write whole numbers in expanded form with powers of ten (for example,  $579 = 500 + 70 + 9 = 5 \times 100 + 7 \times 10 + 9 \times 1 = 5 \times 10^2 + 7 \times 10^1 + 9 \times 10^0$ )
- Demonstrate the divisibility rules for 2, 3, 5, 6, 9, and 10
- Determine the greatest common factor and least common multiple of a pair of whole numbers

## **GRADE 7**

- Express any counting number to the zero power as 1 ( $2^0 = 1$ ,  $9^0 = 1$ )
- Write rational numbers in expanded form without negative powers of ten (for example,  $579.42 = 5 \times 100 + 7 \times 10 + 9 \times 1 + 4 \times 1/10 + 2 \times 1/100$ )
- Demonstrate the divisibility rules for 2, 3, 4, 5, 6, 8, 9, and 10
- Identify and list factors and multiples of two digit numbers
- Determine the greatest common factor and least common multiple of whole numbers using lists or prime factorization
- Define and name prime and composite numbers

- Demonstrate the meaning of  $a^n$  where 'a' is a positive rational number and 'n' is a counting number
- Write large whole numbers using scientific notation (for example,  $246,000,000 = 2.46 \times 10^8$ ;  $2.46 \times 10^8 = 246,000,000$ )

### **GRADE 8**

- Express any non-zero number to the zero power as 1 ( $x^0 = 1$ , if  $x \neq 0$ )
- Write and use appropriately negative powers of ten (for example,  $10^{-2} = 1/10^2 = 1/100$ )
- Write rational numbers in expanded form with negative powers of ten (for example,  $579.42 = 5 \times 100 + 7 \times 10 + 9 \times 1 + 4 \times 10^{-1} + 2 \times 10^{-2}$ )
- Write large whole numbers using scientific notation (for example,  $246,000,000 = 2.46 \times 10^8$ ;  $2.46 \times 10^8 = 246,000,000$ )
- Write very small rational numbers in scientific notation (for example,  $.00036 = 3.6 \times 10^{-4}$ )
- Demonstrate the meaning of  $a^n$  where 'a' is any rational number and 'n' is a counting number

### ***1.4 Using the relationships among fractions, decimals, and percents, including the concepts of ratio and proportion, in problem-solving situations.***

### **GRADE 5**

- Demonstrate the meaning of ratio in different contexts
- Use appropriate notation to express ratios, including a/b, a to b, and a:b

### **GRADE 6**

- Demonstrate the meaning of ratio in different contexts
- Use appropriate notation to express ratios, including a/b, a to b, and a:b
- Represent fractions, decimals, and percents as ratios

### **GRADE 7**

- Demonstrate the similarities and differences between ratios and fractions
- Interpret and use ratios in different contexts (e.g. batting averages, miles per hour) to show the relative sizes of two quantities using appropriate notations, including a/b, a to b, a:b
- Demonstrate the equivalent relationships among fractions, decimals, and percents
- Apply proportional reasoning to solve problems

### **GRADE 8**

- Interpret and use ratios in different contexts (e.g. batting averages, miles per hour) to show the relative sizes of two quantities using appropriate notations, including a/b, a to b, a:b
- Demonstrate the equivalent relationships among fractions, decimals, and percents

- Apply proportional reasoning to solve problems

***1.5 Developing, testing and explaining conjectures about properties of integers and rational numbers.***

**GRADE 5**

- Demonstrate the commutative, associative, and identity properties for addition and multiplication, and the multiplication property of zero

**GRADE 6**

- Demonstrate the commutative, associative, and identity properties for addition and multiplication, and the multiplication property of zero
- Demonstrate multiplication inverses of positive rational numbers (for example,  $1/9 \cdot 9 = 1$ )

**GRADE 7**

- Demonstrate properties for integers
- Demonstrate that division by zero is undefined
- Demonstrate the distributive property of multiplication over addition for whole numbers

**GRADE 8**

- Demonstrate that division by zero is undefined
- Demonstrate properties for rational numbers, including closure

***1.6 Using number sense to estimate and justify the reasonableness of solutions to problems involving integers, rational numbers, and common irrational numbers such as  $e$ ,  $\phi$ , and  $\pi$ .***

**GRADE 5**

- Estimate sums and differences of fractions and decimals using benchmarks (for example,  $5/6 + 7/8$  must be equal to an amount less than 2, since each fraction is less than 1)
- Estimate, using appropriate techniques, determine, and then justify the reasonableness of solutions to problems involving whole numbers

**GRADE 6**

- Estimate, using appropriate techniques, determine, and then justify the reasonableness of solutions to problems involving whole numbers and sums and differences of commonly-used fractions and decimals

**GRADE 7**

- Estimate, using appropriate techniques, determine, and then justify the reasonableness of solutions to problems involving positive rational numbers

**GRADE 8**

- Estimate, using appropriate techniques, determine, and then justify the reasonableness of solutions to problems involving positive and negative rational numbers

## **STANDARD 2:**

**Students use algebraic methods to explore, model, and describe patterns and functions involving numbers, shapes, data, and graphs in problem-solving situations and communicate the reasoning used in solving these problems.**

In order to meet this standard, a student will

- Identify, describe, analyze, extend, and create a wide variety of patterns in numbers, shapes, and data;
- Describe patterns using mathematical language;
- Solve problems and model real-world situations using patterns and functions;
- Compare and contrast different types of functions; and
- Describe the connections among representations of patterns and functions, including words, tables, graphs, and symbols.

### **RATIONALE:**

*The study of patterns, functions, and algebra helps learners to recognize and generalize patterns; identify and clarify functional relationships; and represent and manipulate these relationships verbally, numerically, symbolically, and graphically. Symbolic representation, including the many interpretations of the concept of variable, is important but only one of many ways to represent patterns and functions. Students who are adept at identifying and classifying patterns and functional relationships are better able to use these relationships in real situations, both in school and out. The portrayal of functions and algebra in this standard is broader, deeper, more connected, and more useful to learners than in the traditional high school algebra curriculum.*

*Because the understandings developed through this standard are critical to success in mathematics and to the appropriate use of quantitative reasonings in other disciplines, students should explore and use the ideas of functions, patterns, and algebra from kindergarten through 12<sup>th</sup> grade.*

**2.1 Reproducing, extending, creating, and describing patterns and sequences using a variety of materials (for example, beans, toothpicks, pattern blocks, calculators, unifix cubes, colored tiles.)**



### **GRADE K**

- Recognize, construct, and extend patterns in a variety of motions, colors, designs, sounds, rhythms, music, positions, sizes, or quantities

### **GRADE 1**

- Create and extend patterns using concrete materials (for example, use pattern blocks to create a pattern and have another student extend the pattern)

### **GRADE 2**

- Verbally describe patterns
- Create and extend patterns using symbols, such as words and numbers
- Find missing elements of a repeating pattern (for example, 1,3,\_,7)

### **GRADE 3**

- Reproduce, extend, create, and describe patterns, such as in geometric shapes, money, measurement, addition, subtraction, and multiplication facts
- Find missing elements of patterns of multiples

### **GRADE 4**

- Reproduce, extend, create, and describe patterns, such as in common fractions, geometric shapes, measurement, addition, subtraction, multiplication, and division facts
- Find missing elements of a complex repeating pattern (for example, 1,1,2,3,5,\_,13,...)

## ***2.2 Describing patterns and other relationships using tables, graphs, and open sentences.***

### **GRADE K**

- Sort, classify, describe, and order collections of objects in a variety of ways (for example, sort buttons into two groups and explain why he/she sorted them this way)

### **GRADE 1**

- Continue the pattern given in a table of data using numbers and/or concrete materials

### **GRADE 2**

- Match tables and graphs of points on a coordinate plane

### **GRADE 3**

- Match tables and graphs of points on a coordinate plane

### **GRADE 4**

- Given data, extend a table and plot points on a coordinate plane

**2.3 Recognizing when a pattern exists and using that information to solve a problem.**

**GRADE K**

- Recognize when a pattern exists, describe the pattern verbally, reproduce that pattern, and create a new pattern (for example, describe red, blue, red, blue as a pattern)

**GRADE 1**

- Continue a pattern from a table and verbally describe the pattern

**GRADE 2**

- Verbally describe the relationship between a graph and a table

**GRADE 3**

- Identify a rule using addition or subtraction and solve a problem using the rule

**GRADE 4**

- Identify a rule using addition, subtraction, or multiplication, and solve a problem using the rule

**2.4 Observing and explaining how a change in one quantity can produce a change in another (for example, the relationship between the number of bicycles and the number of wheels).**

**GRADE 1**

- Using concrete or pictorial patterns, determine how the change in one variable affects the change in another (for example, how changing the number of bicycles changes the number of wheels)

**GRADE 2**

- Using concrete or pictorial patterns, determine how the change in one variable affects the change in another (for example, how changing the number of hands changes the number of fingers)

**GRADE 3**

- Determine how the change in one variable affects the change in the other by addition or subtraction

**GRADE 4**

- Determine how the change in one variable affects the change in the other by addition, subtraction, or multiplication

**2.1 Representing, describing, and analyzing patterns and relationships using tables, graphs, verbal rules, and standard algebraic notation.**

### **GRADE 5**

- Represent, describe, and analyze patterns for relationships involving whole numbers and common proper fractions
- Recognize that a variable is used to represent an unknown quantity

### **GRADE 6**

- Represent, describe, and analyze patterns for relationships involving positive rational numbers
- Use variables such as boxes, letters, or other symbols to describe a general rule and to solve problems

### **GRADE 7**

- Represent, describe, and analyze patterns with positive rational numbers and integers
- Identify the algebraic terms ‘expression’, ‘equation’, ‘term’, ‘variable’, ‘coefficient’, and ‘constant’

### **GRADE 8**

- Represent, describe, and analyze patterns with rational numbers
- Identify the algebraic terms ‘expression’, ‘equation’, ‘term’, ‘variable’, ‘coefficient’, and ‘constant’
- Describe a real-world situation using expressions, equations, inequalities

## ***2.2 Describing patterns using variables, expressions, equations, and inequalities in problem-solving situations.***

### **GRADE 5**

- Solve problems from patterns involving whole numbers and common proper fractions using tables, graphs, and rules

### **GRADE 6**

- Solve problems from patterns involving positive rational numbers using tables, graphs, and rules

### **GRADE 7**

- Solve problems from patterns involving positive rational numbers and integers using tables, graphs, and rules

### **GRADE 8**

- Solve problems from patterns involving rational numbers using tables, graphs, and rules
- Use a variety of equations and inequalities to represent real-world and mathematical relationships

**2.3 Analyzing functional relationships to explain how a change in one quantity results in a change in another (for example, how the area of a circle changes as the radius increases, or how a person’s height changes over time).**

**GRADE 5**

- In any functional relationship involving whole numbers and common proper fraction, describe how a change in one quantity affects the other

**GRADE 6**

- In any functional relationship involving positive rational numbers, describe how a change in one quantity affects the other

**GRADE 7**

- In any functional relationship involving positive rational numbers and integers, describe how a change in one quantity affects the other

**GRADE 8**

- In any functional relationship involving rational numbers, describe how a change in one quantity affects the other
- In a linear function, explain the meaning of slope as a rate of change
- Identify independent and dependent variables

**2.4 Solving simple equations in problem-solving situations using a variety of methods (informal, formal, and graphical).**

**GRADE 5**

- Solve problems involving linear relationships in whole numbers
- Solve simple linear equations with coefficients of 1 by informal methods

**GRADE 6**

- Solve problems involving linear relationships in whole numbers
- Solve simple linear equations with whole number coefficients by informal methods

**GRADE 7**

- Translate written expressions or equations to algebraic expressions or equations, and vice versa
- Using formal methods, solve one-step linear equations involving integers

**GRADE 8**

- Translate written expressions or equations to algebraic expressions or equations, and vice versa
- Using formal methods, solve one-step and two-step linear equations involving rational numbers
- Solve linear equations involving integers with variables and constants on both sides of the equation.

## **STANDARD 3:**

**Students use data collection and analysis, statistics, and probability in problem-solving situations and communicate the reasoning used in solving these problems.**

In order to meet this standard, a student will

- Solve problems by systematically collecting, organizing, describing, and analyzing data using surveys, tables, charts, and graphs;
- Make valid inferences, decisions, and arguments based on data analysis; and
- Use counting techniques, experimental probability, or theoretical probability, as appropriate, to represent and solve problems involving uncertainty.

### **RATIONALE:**

*Statistics are used to understand how information is processed and translated into usable knowledge. Through the study of statistics, students learn to collect, organize, and summarize information. Students also need to know how to interpret data and make decisions based on their interpretations. Probability is part of this standard because statistical data are often used to predict the likelihood of future events and outcomes. Students learn probability – the study of chance – so that numerical data can be used to predict future events as well as record the past. A command of statistics and probability is important in adult life.*

### **3.1 Constructing, reading, and interpreting displays of data including tables, charts, pictographs, and bar graphs.**

#### **GRADE K**

- Read and display simple picture and real object graphs
- Gather data relating to familiar experiences by counting and tallying

#### **GRADE 1**

- Gather data about recurring and quantifiable events (for example, daily temperature or attendance)
- Display and explain data from a bar graph or tallies

#### **GRADE 2**

- Design a survey and collect data
- Display data using tallies, bar graphs, pictographs, or tables

- Transfer the same set of data to different displays (for example, from a table to a bar graph)

### **GRADE 3**

- Collect and display data using surveys, tallies, bar graphs, pictographs, or tables
- Use a timeline to display a sequence of events

### **GRADE 4**

- Select the appropriate type of graph to use in various problem-solving situations
- Collect and display data using line, stem and leaf plots, circle, or bar graphs
- Use graph paper using the horizontal and vertical axes appropriately

### ***3.2 Interpreting data using the concepts of largest, smallest, most often, and middle.***

#### **GRADE K**

- Use “more” and “fewer” or “most,” “same” and “fewest” to describe sets of manipulatives, pictures, or object graphs

#### **GRADE 1**

- Using a bar graph, interpret data for “more” and “fewer” or “most”, “same,” and “fewest”

#### **GRADE 2**

- Interpret and compare data from displays, using the terms “least often,” “most often,” and “how much more” or “how much less”

#### **GRADE 3**

- Using various displays of data, interpret and draw conclusions

#### **GRADE 4**

- Determine the median and mode from a data set
- Choose between median and mode to best describe the “middle” of a data set
- Using various displays of data, formulate questions, interpret and draw conclusions

### ***3.3 Generating, analyzing, and making predictions based on data obtained from surveys and chance devices.***

#### **GRADE K**

- Flip a two-colored counter or coin to generate and tally results

#### **GRADE 1**

- Use survey data displayed on a bar graph to make a prediction
- Spin a spinner to generate and record results
- Analyze the results from flipping a two-colored counter or coin

## **GRADE 2**

- Use survey data to make predictions about a larger similar population (for example, from a class survey make a prediction about all second graders in the school)
- Roll a number cube to generate and record results
- Analyze the results (including likely, more likely, less likely, and unlikely outcomes ) of spinning a spinner
- Analyze the results of rolling a number cube

## **GRADE 3**

- Use survey data to make a prediction from various displays of data
- Predict the most likely outcome from spinners
- Recognize if different spinners are fair or unfair

## **GRADE 4**

- Use survey data to make and justify a real-world decision
- Compare the outcomes of flipping a coin, spinning a spinner with four congruent sectors, and rolling a number cube
- Analyze and predict which outcome is more likely from several events such as obtaining “heads” when flipping a coin, the spinner landing in one of the sectors, or rolling a ‘1’ on a number cube
- Analyze the fairness of various chance devices

***3.4 Solving problems using various strategies for making combinations (for example, determining the number of different outfits that can be made using two blouses and three skirts).***

## **GRADE 1**

- Determine the number of outcomes when flipping a coin
- Using manipulatives or pictures, determine the possible combinations of matching a set containing one element with a set containing two elements

## **GRADE 2**

- Determine the number of outcomes when spinning a spinner
- Using manipulatives or pictures, determine the possible combinations of matching a set containing two elements with a different set containing two elements

## **GRADE 3**

- Determine the number of outcomes when spinning a spinner
- Using manipulatives or pictures, determine the possible combinations of matching a set containing two elements with a different set containing three elements

## **GRADE 4**

- Determine the number of outcomes when rolling a number cube

- Determine the number of outcomes obtained from a variety of chance devices
- Using paper-and-pencil techniques (for example, tree diagrams), display the possible combinations of matching two sets of elements

**3.1 *Reading and constructing displays of data using appropriate techniques (for example, line graphs, circle graphs, scatter plots, box plots, stem-and-leaf plots) and appropriate technology.***

**GRADE 5**

- Differentiate between categorical and numerical data
- Organize and display data using appropriate graphs, such a line, bar, circle, frequency tables, and stem-and-leaf
- Read, interpret, and draw conclusions from various displays of data

**GRADE 6**

- Organize and display data using appropriate graphs, such as line, bar, circle, frequency tables, stem-and-leaf, and histograms
- Read, interpret, and draw conclusions from various displays of data

**GRADE 7**

- Organize and display data using appropriate graphs, such as line, bar, circle, frequency tables, stem-and-leaf, histograms, scatter plots, and box-and-whiskers
- Read, interpret, and draw conclusions from various displays of data

**GRADE 8**

- Organize and display data using appropriate graphs, such as line, bar, circle (using ratios to determine degrees and draw with protractors), frequency tables, stem-and-leaf, histograms, scatter plots, and box-and-whiskers
- Read, interpret, and draw conclusions from various displays of data

**3.2 *Displaying and using measures of central tendency, such as mean, median, and mode, and measures of variability, such as range and quartiles.***

**GRADE 5**

- Determine the mean of a set of data using manipulatives
- Informally distinguish between mean, median, and mode
- Determine the range of a set of data
- Given various displays of the same set of data, determine which measure of central tendency is most evident

**GRADE 6**

- Determine the mean of a set of data by using an algorithm



- Formally distinguish between mean, median, and mode
- Determine the range of a set of data

### **GRADE 7**

- Determine the quartiles of a set of data
- Demonstrate the basic concepts of frequency distribution and dispersion of data (for example, evenly distributes, one or more outliers)
- Given various displays of the same set of data (line, bar, circle, stem-and-leaf, histograms, and box-and-whiskers), determine which measure of central tendency is most evident
- Given sets of data, identify the most appropriate measure of central tendency which typifies each set

### **GRADE 8**

- State the purpose of using measures of central tendency and variability with data sets
- Create sets of data with the same mean and different ranges and compare the variability
- In a problem-solving situation, select the most appropriate display and measure of central tendency to solve the problem

### ***3.3 Evaluating arguments that are based on statistical claims.***

#### **GRADE 5**

- Critically evaluate line graphs, bar graphs, or pictographs which do not begin at zero

#### **GRADE 6**

- Critically evaluate line graphs, bar graphs, or pictographs which do not begin at zero

#### **GRADE 7**

- Recognize a misleading display of data due to scaling
- Critically evaluate biased sampling of a survey

#### **GRADE 8**

- Evaluate and correct an improperly selected measure of central tendency
- Determine the improper computation of percent of increase or decrease
- Recognize a misleading display of data

### ***3.4 Formulating hypotheses, drawing conclusions, and making convincing arguments based on data analysis.***

#### **GRADE 5**

- Distinguish between a census and a survey

- Display and draw conclusions from a given set of data

### **GRADE 6**

- Display, analyze and draw conclusions from a given set of data

### **GRADE 7**

- Explain why there may be differences in the data of two or more samples
- Demonstrate the meaning of random sampling and biased versus unbiased samples
- Display, analyze, and draw conclusions from a given set of data or student-generated set of data

### **GRADE 8**

- Critically evaluate survey questions
- Display, analyze, and draw conclusions from a given set of data or student-generated set of data
- Draw conclusions about a large population based upon a properly chosen random sample

## ***3.5 Determining probabilities through experiments or simulations.***

### **GRADE 5**

- Apply probability terms such as event, outcome, trials, and sample space
- Assign a number between 0 and 1, inclusive, to the probability of an event

### **GRADE 6**

- Apply probability terms such as event, outcome, trials, and sample space
- Assign 0% to an impossible event and 100% to a certain event

### **GRADE 7**

- Demonstrate the equivalence of probabilities as either a common fraction, decimal, or percent
- Perform experiments of independent compound events to estimate probability
- Perform experiments of sampling with replacement to estimate probability

### **GRADE 8**

- Perform experiments of simple independent and dependent events to estimate probability
- Perform experiments to estimate the probability of complementary events

## ***3.6 Making predictions and comparing results using both experimental and theoretical probability drawn from real-world problems.***

### **GRADE 5**

- Predict the probability of independent compound events, such as tossing two coins or determining the gender of two children in a family, and conduct an experiment or simulation to determine the probability
- Demonstrate that the sum of the probabilities equals one (as applied to the sample space)
- Using one chance device, such as a number cube or spinner, design a fair game and an unfair game

### **GRADE 6**

- Predict the probability of independent compound events, such as the sum of two number cubes, conduct an experiment or simulation to determine the probability, and assign the probability to all possible sums of two number cubes
- Demonstrate that the sum of all probabilities of two number cubes equals one
- Using one chance device, such as a number cube or a spinner, design a fair game and an unfair game

### **GRADE 7**

- Predict the probability of independent compound events with two different chance devices and conduct an experiment or simulation to determine the probability
- Demonstrate that the probability of independent compound events is the same as the product of the probabilities of the two simple events
- Demonstrate that the sum of all the probabilities of the events in a sample space is equal to one
- Analyze games of chance to determine whether they are fair or unfair

### **GRADE 8**

- Determine the probability of independent, dependent, and complementary events with replacement and without replacement
- Analyze games of chance to determine whether they are fair or unfair

***3.7 Using counting strategies to determine all the possible outcomes from an experiment (for example, the number of ways students can line up to have their picture taken).***

### **GRADE 5**

- Determine the number of outcomes of independent compound events, such as tossing two coins or determining the gender of two children in a family by making a list or tree diagram

### **GRADE 6**

- Determine the number of outcomes of independent compound events, such as the sum of tossing two number cubes by making a list or tree diagram

**GRADE 7**

- Determine the number of outcomes of independent compound events involving two different chance devices by making a list or tree diagram

**GRADE 8**

- Determine the number of outcomes of independent compound events by using the fundamental counting principle (for example, if one choice occurs in “m” ways and the second choice occurs in “n” ways, then the number of ways for them to occur together is  $m \times n$ )

## **STANDARD 4:**

**Students use geometric concepts, properties, and relationships in problem-solving situations and communicate the reasoning used in solving these problems.**

In order to meet this standard, a student will

- Connect various physical objects with their geometric representation;
- Connect mathematical concepts from across the standards with their geometric representations;
- Recognize, draw, describe, and analyze geometric shapes in one, two, and three dimensions;
- Make, investigate, and test conjectures about geometric ideas; and
- Solve problems and model real-world situations using geometric concepts.

### **RATIONALE:**

*Long before humans computed, they observed that the full moon, the iris of an eye, and circular ripples of water emanating from a cast stone all have the same shape.*

*Recording and analyzing shapes and their properties eventually gave us the branch of mathematics called geometry. The process continues today as mathematicians develop powerful models of our world. Students who understand the concepts and language of geometry are better prepared to learn number and measurement ideas as well as other advanced mathematical topics. Students' spatial capabilities frequently exceed their numerical skills and tapping these strengths can foster an interest in mathematics and improve number understandings and skills.*

***4.1 Recognizing shapes and their relationships (for example, symmetry and congruence) using a variety of materials (for example, pasta, boxes, pattern blocks).***

### **GRADE K**

- Place manipulatives on pictures of shapes congruent to the manipulatives

### **GRADE 1**

- Recognize two-dimensional congruent figures in different positions
- Create simple designs using concrete materials such as tangrams and pattern blocks

## **GRADE 2**

- Identify congruent figures from a selection of similar figures
- Slide, flip, and turn concrete materials such as tangrams and pattern blocks to create and reproduce simple designs
- Describe symmetry
- Identify lines of symmetry of squares and rectangles

## **GRADE 3**

- Compare similarities and differences between the concepts of similarity and congruence
- Make a pattern by rotating, flipping, and sliding a two-dimensional figure
- Identify lines of symmetry of regular pentagons, hexagons, and octagons

## **GRADE 4**

- Define similarity and congruence
- Identify the transformation that occurs when a figure is rotated
- Identify the lines of symmetry of regular polygons

### ***4.2 Identifying, describing, drawing, comparing, classifying, and building physical models of geometric figures.***

## **GRADE K**

- Recognize and identify circles, triangles, squares, rectangles, ovals (ellipses), and diamonds (rhombuses)
- Using manipulatives, build circles, triangles, square, rectangles, ovals (ellipses) and diamonds (rhombuses)

## **GRADE 1**

- Describe the number of sides in triangles and in quadrilaterals such as squares and rectangles
- Draw triangles, squares, rectangles, and circles

## **GRADE 2**

- Describe the attributes of circles, triangles, and quadrilaterals such as squares and rectangles
- Recognize the three-dimensional figures: cubes, spheres, cylinders, cones, and pyramids

## **GRADE 3**

- Identify points, lines, line segments, and rays
- Recognize and identify pentagons, hexagons, and octagons
- Compare what is the same and what is different between two-dimensional figures and three-dimensional figures

- Identify cubes, spheres, cylinders, cones, and pyramids

#### **GRADE 4**

- Identify parallel, perpendicular, and intersecting lines
- Identify attributes of closed curves
- Recognize and identify polygons including quadrilaterals such as squares, rectangles and parallelograms
- Draw geometric polygons including quadrilaterals
- Describe squares as rectangles
- Classify angles as obtuse, acute, or right
- Describe a right angle as having a measure of  $90^{\circ}$
- Draw obtuse, acute and right angles
- Classify triangles by their angles (obtuse, acute, right)
- Draw rectangles, squares and obtuse, acute, and right triangles on a coordinate plane and identify the vertices with coordinates
- Compare what is the same and what is different between two-dimensional figures and three-dimensional figures
- Identify rectangular prisms
- Recognize and identify in three-dimensional figures the vertices, edges, and faces

#### ***4.3 Relating geometric ideas to measurement and number sense.***

#### **GRADE 1**

- Measure the lengths of the sides of triangles, squares, rectangles to the nearest inch and centimeter

#### **GRADE 2**

- Measure the lengths of the sides of triangles, squares, and rectangles to the nearest inch and centimeter
- Measure the perimeter of triangles, squares, and rectangles using non-standard and standard units

#### **GRADE 3**

- Measure the sides and perimeter of geometric shapes to the nearest inch and centimeter
- Measure the area of geometric figures using nonstandard units

#### **GRADE 4**

- Measure the sides and perimeter of geometric shapes to the nearest half inch and centimeter
- Measure the area of geometric figures using standard units

#### **4.4 Solving problems using geometric relationships and spatial reasoning.**

##### **GRADE K**

- Use geometric shapes to solve a problem (for example, use geometric shapes to create a house)
- Indicate positions of three or more objects or pictures (for example, left to right, top to bottom, next, last)
- Combine triangular manipulatives to make a square, and square manipulatives to make a rectangle

##### **GRADE 1**

- Draw a picture or diagram to solve a problem (for example, use a circle to create a clock face; fold a rectangle to show one half)
- Manipulate pattern blocks to form a variety of geometric shapes

##### **GRADE 2**

- Draw a picture or diagram to solve a problem (for example, draw a map of the room to show how to get from a desk to the reading area; draw a map of the neighborhood)
- Investigate and predict which pattern block shapes can be formed from the pattern block triangles
- Investigate and predict the geometric shapes that result from cutting along a line of symmetry

##### **GRADE 3**

- Draw a picture or diagram to solve a problem (for example, use a number line to locate one half)
- Investigate and predict the geometric figures that result from cutting along a line of symmetry

##### **GRADE 4**

- Draw a picture or diagram to solve a problem
- Investigate and predict the changing of angles (for example, those made from the hands of a clock over time)
- Investigate and predict the result of changing the lengths of sides of polygons
- Investigate and predict what must occur for similar figures to become congruent figures
- Investigate and predict the geometric figures that result from drawing or cutting along a line of symmetry

***4.1 Describing, analyzing, and reasoning informally about the properties (for example, parallelism, perpendicularity, congruence) of two- and three-dimensional figures; and***



#### ***4.2 Applying the concepts of ratio, proportion, and similarity in problem-solving situations***

##### **GRADE 5**

- Know that the measurement of an acute angle is less than  $90^\circ$ , a right angle is  $90^\circ$ , and an obtuse angle is greater than  $90^\circ$
- Use correct geometric symbols for lines, segments, rays, and angles
- Reason informally about properties of parallel lines, perpendicular lines, intersecting lines, line segments, and rays
- Reason informally about properties (including lines of symmetry) of rectangles, squares, triangles (named by both lengths of sides and angles)
- Reason informally about congruence involving rectangles, squares, and triangles

##### **GRADE 6**

- Use correct geometric symbols for parallelism, perpendicularity, and triangles
- Reason informally about the properties (including lines of symmetry) of parallelograms, rhombuses, and triangular prisms
- Reason informally about congruence involving parallelograms, rhombuses, and triangular prisms

##### **GRADE 7**

- Describe complementary and supplementary angles
- Describe the properties of circles (including radius and diameter)
- Recognize properties and use correct geometric symbols
- Identify and reason informally about angle relationships formed by intersecting lines (for example, adjacent and vertical angles)
- Reason informally about the sum of the measures of the angles of a triangle equaling  $180^\circ$
- Reason informally about the properties (including lines of symmetry) of isosceles trapezoids and pyramids
- Reason informally about the sides and angles of congruent and similar polygons

##### **GRADE 8**

- Reason informally about the relationships among angles formed by two lines cut by a transversal and two parallel lines cut by a transversal
- Continue to reason informally about the sides and angles of congruent and similar polygons
- Demonstrate proportional reasoning to indirectly determine lengths of segments of similar polygons

#### ***4.3 Solving problems using coordinate geometry.***

##### **GRADE 5**

- Set up a coordinate graph (include axes, origin, and scale) and use it to mark and read coordinate pairs in the first quadrant
- From a scenario, choose the correct graph

### **GRADE 6**

- *Set up a coordinate graph (include axes, origin, and scale) and use it to mark and read coordinate pairs in the first quadrant*
- From a scenario, choose the correct graph

### **GRADE 7**

- Identify the four quadrants of the coordinate plane
- Set up a coordinate graph (include axes, origin and scale) and use it to mark and read coordinate pairs in all four quadrants
- Draw a graph from a given scenario
- Given a distance, find pairs of points on the coordinate plane separated by that horizontal or vertical distance

### **GRADE 8**

- Set up a coordinate graph (include axes, origin, and scale) and use it to mark and read coordinate pairs in all four quadrants
- Draw a graph from a given scenario
- Describe the relationship between two different points on the coordinate plane
- Given a distance, find pairs of points on the coordinate plane separated by that distance

## ***4.4 Solving problems involving perimeter and area in two dimensions, and involving surface area and volume in three dimensions.***

### **GRADE 5**

- Solve problems involving perimeter and area of rectangles, squares, and triangles
- Solve problems involving volume of rectangular prisms

### **GRADE 6**

- Solve problems involving perimeter and area of parallelograms and rhombuses
- Solve problems involving volume of triangular prisms
- Solve problems involving surface area of rectangular prisms

### **GRADE 7**

- Solve problems involving circumference and area of circles
- Solve problems involving volume of cylinders
- Solve problems involving surface area of triangular prisms

**GRADE 8**

- Solve problems involving perimeter and area of trapezoids
- Solve problems involving volume of square pyramids and cones
- Solve problems involving surface area of cylinders

## **STANDARD 5:**

**Students use a variety of tools and techniques to measure, apply the results in problem-solving situations, and communicate the reasoning used in solving these problems.**

In order meet this standard, a student will

- Understand and apply the attributes of length, capacity, weight, mass, time, temperature, perimeter, area, volume, and angle measurement in problem-solving situations;
- Make and use direct and indirect measurements to describe and compare real-world phenomena;
- Understand the structure and use of systems of measurements;
- Describe and use rates of change (*for example, temperature as it changes throughout the day, or speed as the rate of change of distance over time*) and other derived measures; and
- Select appropriate units, including metric and US customary, and tools (*for example, rulers, protractors, compasses, thermometers*) to measure to the degree of accuracy required to solve a given problem.

### **RATIONALE:**

*Every day, people measure to answer common questions: How long will it take? How high is it? How much will it hold? Using agreed-upon units, such as inches, paper clips, kilograms, heartbeats, paces, or degrees Celsius, we quantify the world in which we live. Measurement is one way to make numbers meaningful to students. Naturally, measurement is closely allied with geometry (for example, through angular, linear, area, and volume measurements), but measurement involves more than using a ruler and a protractor. Measuring diverse quantities involves making connections within mathematics and across the curriculum.*

**5.1 Knowing, using, describing, and estimating measures of length, perimeter, capacity, weight, time, and temperature; and**

**5.2 Demonstrating the process of measuring and explaining the concepts related to units of measurement.**

### **GRADE K**

- Tell time to the nearest hour, using an analog and digital clock
- Describe the units for measuring time
- Estimate and measure length in non-standard units (for example, use cubes to measure the length of a hand)
- Estimate the measurement of weight by “heavier” and “lighter”

### **GRADE 1**

- Tell time to the nearest hour and half-hour, using an analog and digital clock
- Name the days of the week in order
- Estimate and measure the length of objects to the nearest inch, foot and centimeter
- Estimate and measure the capacity of a container in cups
- Estimate and weigh an object on a balance with a non-standard unit
- Describe the units for measuring time, length, capacity, and temperature
- Tell the number of minutes in an hour, days in a week, pennies in a nickel, dime, quarter, and dollar

### **GRADE 2**

- Tell time to the nearest fifteen minutes, using an analog and digital clock
- Use AM and PM
- Estimate and measure the length of objects to the nearest half inch, foot, yard and centimeter
- Estimate and measure the perimeter of a figure using non-standard and standard units
- Estimate and measure the capacity of a container in cups, pints, quarts and gallons
- Estimate and weigh an object on a balance with a non-standard unit and use a scale to measure an object to the nearest pound
- Measure temperature to the nearest 5° and 10°F
- Describe the units for measuring time, length, capacity, weight, and temperature
- Know the number of hours in a day, months in a year, inches in a foot, feet in a yard, and cups in a pint

### **GRADE 3**

- Tell time to the nearest five minutes, using an analog and digital clock
- Estimate how long a minute is
- Estimate and measure the length of objects
- Estimate and measure the perimeter of an object in customary and metric units
- Estimate and measure areas using non-standard units
- Estimate and measure the capacity of a container in cups, pints, quarts, gallons, and liters
- Estimate and weigh an object on a balance or scale to the nearest ounce
- Measure temperatures in both Fahrenheit and Celsius
- Describe the units for measuring time, length, capacity and temperature
- Know the number of seconds in a minute, hours in a day, days in a month, days in a year, pints in a quart, quarts in a gallon, and centimeters in a meter

#### **GRADE 4**

- Tell time to the nearest minute, using an analog and digital clock
- Tell the number of minutes in a day, days in a year and when a leap year occurs
- Describe the units for measuring time
- Measure the lengths of the sides of squares and rectangles and determine the perimeters and areas
- Measure the lengths of the sides of cubes and determine the volumes
- Estimate and weigh objects on a balance to the nearest gram
- Compare the relationship between the temperature in Fahrenheit and Celsius
- Describe the units for measuring the length, area, volume, capacity, and temperature in US customary and metric units
- Know the number of years in a decade and a century, feet in a mile, millimeters and centimeters in a meter, ounces in a pound, and pounds in a ton

*5.3 Comparing and ordering objects according to measurable attributes (for example, longest to shortest, lightest to heaviest).*

#### **GRADE K**

- Compare objects according to the measurable attributes of length and weight
- Order objects according to the measurable attributes of length and weight
- Compare and order various times (for example, morning comes before lunch)

#### **GRADE 1**

- Compare objects according to the measurable attributes of length, capacity, weight, and temperature
- Order objects according to the measurable attributes of length, capacity, weight, and temperature
- Compare and order various times

#### **GRADE 2**

- Compare objects according to the measurable attributes of length, capacity, weight, and temperature
- Order objects according to the measurable attributes of length, capacity, weight, and temperature
- Compare and order various times

#### **GRADE 3**

- Compare objects according to the measurable attributes of length, capacity, weight, and temperature
- Order objects according to the measurable attributes of length, capacity, weight, and temperature
- Compare and order various times

#### **GRADE 4**

- Compare objects according to the measurable attributes of length, area, volume, capacity, weight, and temperature in US customary and metric units
- Order objects according to the measurable attributes of length, area, volume, capacity, weight, and temperature in US customary and metric units
- Compare and order various times

*5.4 Using the approximate measures of familiar objects (for example, the width of your finger, the temperature of a room, the weight of a gallon of milk) to develop a sense of measurement.*

#### **GRADE 1**

- Use familiar objects as referents for measurement (for example, the length of the student's index finger is about two paper clips)

#### **GRADE 2**

- Use familiar objects as referents for measurement (for example, a second grader is a little taller than a meter)

#### **GRADE 3**

- Use familiar objects as referents for measurement (for example, the width of the index fingernail equals approximately one centimeter; ten pennies weigh approximately an ounce)

#### **GRADE 4**

- Use familiar objects as referents for measurement (for example, one paper clip equals one gram; the length of the arm span equals approximately one meter)

*5.5 Selecting and using appropriate standard and non-standard units of measurement in problem-solving situations.*

#### **GRADE K**

- Select the appropriate units of measurement of time and length

#### **GRADE 1**

- Select the appropriate units of measurement of time, length, capacity, and temperature

#### **GRADE 2**

- Select the appropriate units of measurement of time, length, capacity, weight and temperature

### **GRADE 3**

- Select the appropriate units of measurement of time, length, capacity, weight and temperature

### **GRADE 4**

- Select the appropriate units of measurement of time
- Select the appropriate units of measurement of length, area, volume, capacity, weight and temperature in US customary and metric units

#### ***5.1 Estimating, using, and describing measures of distance, perimeter, area, volume, capacity, weight, mass, and angle comparison.***

### **GRADE 5**

- Estimate the length of the sides and height of rectangles, squares, triangles, and rectangular prisms
- Estimate the perimeter and area of rectangles, squares, and triangles
- Estimate the volume of rectangular prisms
- Continue to estimate and use the capacity, weight, and mass measurements from previous grades

### **GRADE 6**

- Estimate the length of the sides and height of parallelograms and rhombuses
- Estimate the perimeter and area of parallelograms and rhombuses
- Estimate the volume of triangular prisms
- Estimate the surface area of rectangular prisms
- Continue to estimate and use the capacity, weight, and mass measurements from previous grades
- Estimate measures of angles (for example,  $30^\circ$ ,  $45^\circ$ ,  $60^\circ$ ,  $90^\circ$ ,  $120^\circ$ ,  $150^\circ$ ,  $180^\circ$ )

### **GRADE 7**

- Estimate the radius and diameter of circles
- Estimate the circumference and area of circles
- Estimate the volume of cylinders
- Estimate the surface area of triangular prisms
- Continue to estimate and use the capacity, weight, and mass measurements from previous grades
- Estimate measures of angles

### **GRADE 8**

- Estimate the length of the sides and height of trapezoids
- Estimate the perimeter and area of trapezoids
- Estimate the volume of square pyramids and cones
- Estimate the surface area of cylinders



- Continue to estimate and use the capacity, weight, and mass measurements from previous grades
- Estimate measures of angles

**5.2 *Reading and interpreting various scales including those based on number lines, graphs, and maps.***

**GRADE 5**

- Read and interpret scales on number lines, graphs, and maps
- Select the appropriate scale for a given problem

**GRADE 6**

- Read and interpret scales on number lines, graphs, and maps
- Select the appropriate scale for a given problem

**GRADE 7**

- Read and interpret scales on number lines, graphs, and maps
- Select the appropriate scale for a given problem
- Construct scale drawings

**GRADE 8**

- Read and interpret scales on number lines, graphs, and maps
- Select the appropriate scale for a given problem
- Construct scale drawings

**5.3 *Developing and using formulas and procedures to solve problems involving measurement.***

**GRADE 5**

- Develop and use formulas for perimeter and area of rectangles, squares, and triangles using appropriate units
- Develop and use the formula for volume of rectangular prisms using appropriate units

**GRADE 6**

- Develop and use formulas for perimeter and area of rectangles, squares, and triangles using appropriate units
- Develop and use the formula for volume of rectangular prisms using appropriate units

**GRADE 7**

- Demonstrate the relationship of circumference to diameter of a circle to approximate units

- Develop and use the formula for circumference and area of circles using appropriate units
- Develop a procedure to find the area and perimeter of irregularly-shaped polygons
- Develop and use the formula for volume of cylinders using appropriate units

### **GRADE 8**

- Continue to use formulas for perimeter, area and volume
- Develop and use formulas for the perimeter and area of trapezoids using appropriate units
- Develop and use the formula for volume of square pyramids and cones using appropriate units
- Develop and use the Pythagorean Theorem

### ***5.4 Selecting and using appropriate units and tools to measure to the degree of accuracy required in a particular problem-solving situation.***

### **GRADE 5**

- Select and use the appropriate units and tools to measure to the degree of accuracy required in a particular problem
- Measure the length of the sides and heights of rectangles, squares, triangles, and rectangular prisms to the nearest inch and nearest centimeter
- Measure and draw angles using a protractor (for example,  $30^\circ$ ,  $45^\circ$ ,  $60^\circ$ ,  $90^\circ$ ,  $120^\circ$ ,  $150^\circ$ ,  $180^\circ$ )

### **GRADE 6**

- Select and use the appropriate units and tools to measure to the degree of accuracy required in a particular problem
- Measure the length of the sides and heights of geometric figures to the nearest half inch and nearest centimeter
- Measure and draw angles using a protractor

### **GRADE 7**

- Select and use the appropriate units and tools to measure to the degree of accuracy required in a particular problem
- Measure geometric figures to the nearest eighth inch and nearest centimeter
- Using a protractor, measure angles of adjacent and vertical angles of intersecting lines and draw complements and supplements of angles

### **GRADE 8**

- Select and use the appropriate units and tools to measure to the degree of accuracy required in a particular problem
- Measure the length of geometric figures to the nearest sixteenth inch and nearest millimeter

- Using a protractor, measure angles of two lines cut by a transversal and angles of two parallel lines cut by a transversal

## **STANDARD 6:**

**Students link concepts and procedures as they develop and use computational techniques, including estimation, mental arithmetic, paper-and-pencil, calculators, and computers, in problem-solving situations and communicate the reasoning used in solving these problems.**

In order to meet this standard, a student will

- Model, explain, and use the four basic operations – addition, subtraction, multiplication, and division – in problem-solving situations;
- Develop, use, and analyze algorithms; and
- Select and apply appropriate computational techniques to solve a variety of problems and determine whether the results are reasonable.

### **RATIONALE:**

*Computation is an indispensable part of mathematics and our daily lives. We use it to balance our checkbooks, figure our taxes, and make business decisions. The basic facts of addition, subtraction, multiplication, and division are similarly indispensable. Today's students must be able to use a variety of computational tools and techniques including estimation, mental arithmetic, paper-and-pencil, calculators, and computers. Estimation and mental arithmetic serve a practical function in our daily lives, and help students develop meaning for numbers and understanding of number relationships. The use of calculators and computers is not intended to replace proficiency with basic facts. Appropriate uses of calculators and computers include solving real-world problems that may involve tedious or time-consuming computations or exploring number patterns to develop understanding of numbers and number relationships. Proficiency with basic facts is essential for knowing when and how to use each of these tools and techniques.*

*Computational skill is related to “operation sense”. Students with operation sense know when and how to use addition, subtraction, multiplication, and division, and are able to apply them to solve real-world problems. Students build operation sense by modeling their understanding of number operations and their properties, by describing how number operations are related to one another, and by seeing how the use of a particular operation changes the value of the numbers involved.*

*Computational skill and operation sense go hand in hand with number sense. When children have a well-developed sense of number and operations, they can more easily evaluate the reasonableness of their solutions. The ability to apply computational skills*

*and operation sense will extend students' mathematical power by giving them confidence in their ability to work with numbers and to solve problems in a variety of situations.*

**6.1 Demonstrating conceptual meanings for the four basic arithmetic operations of addition, subtraction, multiplication, and division.**

**GRADE K**

- Add and subtract whole numbers by combining and separating objects
- Draw pictures to form sets of up to ten items
- Link the operations of addition and subtraction, and equality, with mathematical terms (for example, add, subtract, and equal) and mathematical symbols (for example, +, -, =)

**GRADE 1**

- Demonstrate the operations of addition and subtraction of whole numbers with concrete materials
- Link the operations of addition and subtraction, and equality, with mathematical terms (for example, add, subtract, and equal) and mathematical symbols (for example, +, -, =)
- Using concrete materials, demonstrate and verbally explain subtraction of whole numbers without regrouping for two-digit numbers

**GRADE 2**

- Using concrete materials, demonstrate and verbally explain addition of whole numbers with regrouping for two-digit numbers
- Using concrete materials, demonstrate and verbally explain subtraction of whole numbers without regrouping for two-digit numbers
- Using concrete materials or pictures, demonstrate multiplication without regrouping of whole numbers (for example, using arrays or grouping sets of objects)
- Using concrete materials or pictures, demonstrate division of whole numbers without remainders as partitioning of sets
- Using concrete materials or pictures, demonstrate the inverse relationship of addition and subtraction of whole numbers
- Using concrete materials or pictures, demonstrate multiplication of whole numbers as repeated addition

**GRADE 3**

- Using concrete materials, demonstrate and verbally explain addition and subtraction of whole numbers with regrouping for up to four-digit numbers
- Using concrete materials or pictures, demonstrate multiplication with regrouping of whole numbers
- Using concrete materials, demonstrate division of whole numbers with remainders

- Using paper-and-pencil, demonstrate the inverse relationship of addition and subtraction of whole numbers
- Using paper-and-pencil, demonstrate multiplication of whole numbers as repeated addition

#### **GRADE 4**

- Explain what addition, subtraction, multiplication, and division of whole numbers means
- Demonstrate the inverse relationship of multiplication and division of whole numbers
- Demonstrate division of whole numbers as repeated subtraction

#### ***6.2 Comparing, adding and subtracting commonly used fractions and decimals (for example, $\frac{1}{3}$ , $\frac{3}{4}$ , 0.5, 0.75).***

#### **GRADE 2**

- Using concrete materials or pictures, compare halves, thirds, and fourths
- Find the total value of coins not to exceed \$1.00

#### **GRADE 3**

- Using concrete materials, compare proper fractions with common denominators of ten or less
- Using coins as models, add and subtract decimals in which sums and differences may exceed \$1.00

#### **GRADE 4**

- Demonstrate addition and subtraction of proper fractions with common denominators of twelve or less without regrouping
- Demonstrate addition and subtraction of mixed numerals with common denominators of twelve or less
- Add and subtract decimals to the one-hundredths
- Compute the total cost of items to \$10.00
- Determine change received for \$10.00 or less

#### ***6.3 Demonstrating understanding of and proficiency with basic addition, subtraction, multiplication, and division facts without the use of a calculator.***

#### **GRADE 1**

- Demonstrate understanding of basic addition sums to 20 and subtraction differences of 10

#### **GRADE 2**

- Demonstrate understanding of basic addition and subtraction facts

- Demonstrate automatic recall of basic addition and subtraction facts
- Use sums on an addition facts table to locate all addends for a particular sum (for example,  $7=0+7$ ,  $7=1+6$ , ...)

### **GRADE 3**

- Demonstrate understanding of basic multiplication and division facts of 1's, 2's, 3's, 5's, and 10's
- Demonstrate automatic recall of basic multiplication facts of 1's, 2's, 3's, 5's, and 10's
- Continue automatic recall of basic addition and subtraction facts
- Use a multiplication facts table to locate all factors for a particular product (for example,  $6=1\times 6$ ,  $6=2\times 3$ , ...)

### **GRADE 4**

- Demonstrate understanding of basic multiplication and division facts through 100
- Demonstrate automatic recall of basic multiplication and division facts through 100
- Continue automatic recall of basic addition and subtraction facts

## ***6.4 Constructing, using, and explaining procedures to compute and estimate with whole numbers.***

### **GRADE K**

- Add and subtract whole numbers by combining and separating objects
- Draw pictures to form sets of up to ten items

### **GRADE 1**

- Demonstrate the operations of addition and subtraction of whole numbers with concrete materials
- Using paper-and-pencil, demonstrate simple single-digit addition and subtraction

### **GRADE 2**

- Use estimation techniques such as rounding and compatible numbers (numbers whose sum is 10) before performing operations
- Using paper-and-pencil, demonstrate addition of two-digit whole numbers with and without regrouping
- Using paper-and-pencil, demonstrate subtraction of two-digit whole numbers without regrouping

### **GRADE 3**

- Use estimation techniques such as front-end rounding, rounding, and compatible numbers (numbers whose sum is 10 or 100) before performing operations
- Using paper-and-pencil, demonstrate the four basic operations of whole numbers including

- a) addition and subtraction of four digits
- b) multiplication of two digits by one digit, regrouping included
- c) division of two digits by a one-digit divisor obtaining one-digit quotients

#### **GRADE 4**

- Use estimation techniques such as front-end rounding, rounding, compatible numbers (numbers whose sum is 10, 100, 1000 ...) and clustering (for example,  $27+28+30+31$  equals approximately  $4 \times 30 = 120$ ) before performing operations
- Using paper-and-pencil, demonstrate the four basic operations of whole numbers including
  - a) multiplication of two digits by two digits and three digits by one digit with regrouping
  - b) division of two digits by a one- or two-digit divisor

#### ***6.5 Selecting and using appropriate methods for computing with whole numbers in problem-solving situations from among mental arithmetic, estimation, paper-and-pencil, calculator and computer methods.***

#### **GRADE 1**

- Given a real-world problem-solving situation, use the correct operation (addition or subtraction with concrete materials) and appropriate method (mental arithmetic, estimation, paper-and-pencil, calculator, or computer) to solve the problem

#### **GRADE 2**

- Given a real-world problem-solving situation, use the correct operation (addition or subtraction) and appropriate method (mental arithmetic, estimation, paper-and-pencil, calculator, or computer) to solve the problem
- Determine from real-world problems whether an estimated or exact sum or difference is acceptable

#### **GRADE 3**

- Given a real-world problem-solving situation, use the correct operation (addition, subtraction, or multiplication) and appropriate method (mental arithmetic, estimation, paper-and-pencil, calculator, or computer) to solve the problem
- Determine from real-world problems whether an estimated or exact sum, difference, or product is acceptable

#### **GRADE 4**

- Given a real-world problem-solving situation, use the correct operation (addition, subtraction, multiplication or division) and appropriate method (mental arithmetic, estimation, paper-and-pencil, calculator, or computer) to solve the problem
- Determine from real-world problems whether an estimated or exact sum, difference, product or quotient is acceptable



***6.1 Explaining how ratios, proportions, and percents can be used to solve real-world problems.***

**GRADE 5**

- Use appropriate notations of ratio such as  $a/b$ ,  $a$  to  $b$ , and  $a:b$
- Using concrete materials, determine commonly-used percentages (e.g., 25% and 50%) in real-world problems

**GRADE 6**

- Demonstrate the equivalence of fractions, decimals, and percents
- Using concrete materials, determine commonly-used percentages in real-world problems

**GRADE 7**

- Demonstrate equivalence of fractions, decimals, and percents using proportions
- Solve real-world problems using appropriate and convenient forms of fractions, decimals, and percents

**GRADE 8**

- Compute percent of increase or decrease in real-world problems
- Apply proportional reasoning in problem-solving situations (for example, scale, similarity, percentage, unit pricing, simple interest, and rate)

***6.2 Constructing, using and explaining procedures to compute and estimate with whole numbers, fractions, decimals and integers.***

**GRADE 5**

- Demonstrate order of operations with whole numbers
- Demonstrate with proficiency multiplication of whole numbers of three digits by two digits and three digits by three digits
- Demonstrate with proficiency division of whole numbers with a two-digit divisor
- Demonstrate equivalencies and simplification of proper fractions
- Using paper-and-pencil, demonstrate with proficiency addition and subtraction of proper fractions and mixed numerals with common denominators and without regrouping
- Using concrete materials, demonstrate addition and subtraction of mixed numerals with common denominators with regrouping
- Using concrete materials, demonstrate addition and subtraction of proper fractions with unlike denominators
- Demonstrate the inverse relationship of addition and subtraction of proper fractions and mixed numerals with common denominators
- Demonstrate how the value of a fraction changes as the denominator increases
- Demonstrate with proficiency addition and subtraction of decimals

- Demonstrate the inverse relationship of addition and subtraction of decimals
- Make change from any dollar denomination

### **GRADE 6**

- Demonstrate order of operations including exponents with whole numbers
- Choose the appropriate representation of the remainder in a division problem
- Demonstrate equivalencies of mixed numerals and improper fractions
- Simplify fractions
- Using paper-and-pencil, demonstrate with proficiency addition and subtraction of fractions including mixed numerals
- Demonstrate multiplication and division of a proper fraction and a whole number or a mixed numeral
- Demonstrate multiplication and division of proper fractions
- Demonstrate the meaning of multiplication and division of decimals by whole numbers

### **GRADE 7**

- Demonstrate order of operations with positive rational numbers and integers
- Choose the appropriate representation of the remainder in a division problem
- Demonstrate, by modeling, the inverse relationship of multiplication and division of common proper fractions
- Using paper-and-pencil, demonstrate with proficiency computation of fractions
- Using paper-and-pencil, demonstrate with proficiency the four basic operation of decimals
- Demonstrate the inverse relationship of multiplication and division of decimals
- Demonstrate the meaning of the four basic operations of integers
- Using paper-and-pencil, demonstrate proficiency in computation of integers
- Demonstrate the inverse relationship of addition and subtraction of integers
- Demonstrate the inverse relationship of multiplication and division of integers
- Demonstrate multiplication of integers as repeated addition
- Using paper-and-pencil, solve real-world problems involving percents

### **GRADE 8**

- Demonstrate order of operations with rational numbers
- Demonstrate the meaning of the four basic operations of rational numbers
- Using paper-and-pencil, demonstrate with proficiency computation of rational numbers
- Demonstrate the inverse relationship of addition and subtraction of rational numbers
- Demonstrate the inverse relationship of multiplication and division of rational numbers
- Demonstrate multiplication of rational numbers as repeated addition
- Using paper-and-pencil, solve real-world problems involving percents

***6.3 Developing, applying and explaining a variety of different estimation strategies in problem-solving situations, and explaining why and estimate may be acceptable in place of an exact answer.***

**GRADE 5**

- Determine from real-world problems whether an estimated or exact answer is acceptable
- Use estimation techniques before performing operations

**GRADE 6**

- Determine from real-world problems whether an estimated or exact answer is acceptable
- Use estimation techniques before performing operations

**GRADE 7**

- Determine from real-world problems whether an estimated or exact answer is acceptable
- Use estimation techniques before performing operations

**GRADE 8**

- Determine from real-world problems whether an estimated or exact answer is acceptable
- Use estimation techniques before performing operations

***6.4 Selecting and using appropriate methods for computing with commonly-used fractions and decimals, percents, and integers in problem-solving situations from among mental arithmetic, estimation, paper-and-pencil, calculator, and computer methods, and determining whether the results are reasonable.***

**GRADE 5**

- Determine whether information given in a problem-solving situation is sufficient, insufficient, or extraneous
- Given a real-world problem-solving situation, use the correct operation and appropriate method (mental arithmetic, estimation, paper-and-pencil, calculator, or computer) to solve the problem
- Given a math sentence using the four operations with whole numbers, create and illustrate a real-world problem
- In a problem-solving situation, determine whether the results are reasonable and justify those results with correct computations

**GRADE 6**

- Determine whether information given in a problem-solving situation is sufficient, insufficient, or extraneous

- Given a real-world problem-solving situation, use the correct operation and appropriate method (mental arithmetic, estimation, paper-and-pencil, calculator, or computer) to solve the problem
- Given a math sentence with sums and differences of common fractions and decimals, create and illustrate a real-world problem
- In a problem-solving situation, determine whether the results are reasonable and justify those results with correct computations

### **GRADE 7**

- Determine whether information given in a problem-solving situation is sufficient, insufficient, or extraneous
- Given a real-world problem-solving situation, use the correct operation and appropriate method (mental arithmetic, estimation, paper-and-pencil, calculator, or computer) to solve the problem
- Given a math sentence using the four operations with positive rational numbers and integers, create and illustrate a real-world problem
- In a problem-solving situation, determine whether the results are reasonable and justify those results with correct computations

### **GRADE 8**

- Determine whether information given in a problem-solving situation is sufficient, insufficient, or extraneous
- Given a real-world problem-solving situation, use the correct operation and appropriate method (mental arithmetic, estimation, paper-and-pencil, calculator, or computer) to solve the problem
- Given a math sentence using the four operations with rational numbers, create and illustrate a real-world problem
- In a problem-solving situation, determine whether the results are reasonable and justify those results with correct computations