Oklahoma Academic Standards for Mathematics
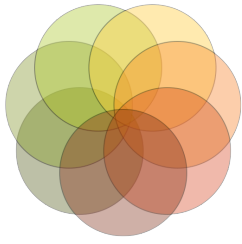
DRAFT
July 1, 2015

Acknowledgements

The Oklahoma Academic Standards for Mathematics 2015 is the result of the contributions of many mathematics teachers and mathematics educators from across the state. We believe the draft of this document reflects a balanced synthesis of the work of all members of the Oklahoma Academic Standards for Mathematics Writing Committee.
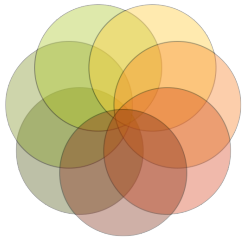
Oklahoma Academic Standards for Mathematics Writing Committee

Introduction

The Oklahoma Academic Standards for Mathematics 2015 specify what students should know and be able to do as learners of mathematics at the end of each grade level or course. Students are held responsible for learning standards listed at earlier grade levels as well as their current grade level. Following each of the standards are **Sample Problems or Classroom Activities (Forthcoming)** that clarify the standards and help teachers interpret them appropriately.

Throughout this document, the standards are written to allow time for study of additional material at every grade level. The order of the standards at any grade level is not meant to imply a sequence of topics and should be considered flexible for the organization of any course. The document provides standards for PK-7, Pre-Algebra, Algebra I, Geometry, Algebra II with Algebra I as the pre-requisite for both Geometry and Algebra II.

Development of the Oklahoma Academic Standards for Mathematics

The Oklahoma Academic Standards for Mathematics writing team drew on the work of the National Council of Teachers of Mathematics (NCTM) standards documents; the National Research Council's report *Adding It Up*, the Oklahoma Priority Academic Standards (PASS), and other states' standards documents and curriculum framework guides (e.g., Minnesota, Virginia, and Massachusetts). Please see the reference list at the end of this document for a more complete list of all resources consulted.

Vision and Guiding Principles

These standards envision all students in Oklahoma will become mathematically proficient and literate through a strong mathematics program that emphasizes and engages them in problem solving, communicating, reasoning and proof, making connections, and using representations. Mathematically proficient and literate students can confidently and effectively use mathematics concepts, computation skills, and numbers to problem-solve, reason and analyze information. Developing mathematical proficiency and literacy for Oklahoma students depends in large part on a clear, comprehensive, coherent, and developmentally appropriate set of standards to guide curricular decisions. The understanding and implementation of these standards throughout PK-12 mathematics experience for students is based on the following guiding principles:

Guiding Principle 1: Excellence in mathematics education requires equity--high expectations and strong support for all students.

All students, regardless of their personal characteristics, backgrounds, or physical challenges, must have opportunities to study—and support to learn—mathematics. Equity does not mean that every student

should receive identical instruction; instead, it demands that reasonable and appropriate accommodations be made as needed to promote access and attainment for all students.

Guiding Principle 2: Mathematical ideas should be explored in ways that stimulate curiosity, create enjoyment of mathematics, and develop depth of understanding.

Students need to understand mathematics deeply and use it effectively. To achieve mathematical understanding, students should be actively engaged in doing meaningful mathematics, discussing mathematical ideas, and applying mathematics in interesting, thought provoking situations. Student understanding is further developed through ongoing reflection about cognitively demanding and worthwhile tasks.

Tasks should challenge and engage students in mathematics in multiple ways. Short- and long-term investigations that connect procedures and skills with conceptual understanding are integral components of an effective mathematics program. Activities should build upon curiosity and prior knowledge, and enable students to solve progressively deeper, broader, and more sophisticated problems. Mathematical tasks reflecting significant mathematics should generate active classroom talk, promote the development of conjectures, and lead to an understanding of the necessity for mathematical reasoning.

Guiding Principle 3: An effective mathematics program focuses on problem solving and requires teachers who have a deep knowledge of mathematics as a discipline.

Mathematical problem solving is the hallmark of an effective mathematics program. Skill in mathematical problem solving requires practice with a variety of mathematical problems as well as a firm grasp of mathematical techniques and their underlying principles. Students who possess a deeper knowledge of mathematics can then use mathematics in a flexible way to attack various problems and devise different ways of solving any particular problem. Mathematical problem solving calls for reflective thinking, persistence, learning from the ideas of others, and going back over one's own work with a critical eye. Success in solving mathematical problems helps to create an abiding interest in mathematics.

Guiding Principle 4: Technology is essential in teaching and learning mathematics.

Technology enhances the mathematics curriculum in many ways. Technology enables students to communicate ideas within the classroom or to search for needed information. It can be especially helpful in assisting students with special needs in regular and special classrooms, at home, and in the community. Technology changes what mathematics is to be learned and when and how it is learned. Tools such as measuring instruments, manipulatives (such as base ten blocks and fraction pieces), scientific and graphing calculators, and computers with appropriate software, if properly used, contribute to a rich learning environment for developing and applying mathematical concepts. Appropriate use of calculators is essential; calculators should not be used as a replacement for basic understanding and skills. Although the use of a graphing calculator can help middle and secondary students to visualize properties of functions and their graphs, graphing calculators should be used to enhance their understanding and skills rather than replace them.

Standards Overview

The Oklahoma Academic Standards for Mathematics are developed around both content and process strands. The four main content strands, Algebraic Reasoning and Algebra, Number and Operations, Geometry and Measurement, and Data and Probability organize the content standards throughout PK-7 and Pre-Algebra. The standards for Algebra I, Algebra II, and Geometry are fundamentally organized around these strands as well. The process and content standards work in concert to create clear, concise and rigorous mathematics standards and expectations for Oklahoma students. Both content and process stands are described below.

Algebraic Reasoning and Algebra Strand: All students should be able to reason algebraically and learn algebra. This strand provides focus for the PK-7 and Pre-Algebra standards around the notion that algebra is more than moving symbols around. It is about understanding patterns, relations and functions, representing and analyzing mathematical situations and structures using algebraic symbols, using mathematical models to represent and understanding quantitative relationships, and analyzing change in various contexts. Understanding change is fundamental to algebraic reasoning and understanding the concept of function with depth. It is also fundamental to understanding many real-world problems and ideas presented in the news.

Number and Operations Strand: A focus on number and operations is the cornerstone of a strong mathematics program. Developing students' fluency with number and operations throughout their PK-12 mathematics experience requires a balance and connection between conceptual understanding and computational proficiency. This strand provides focus on the importance of students' understanding of numbers, ways of representing numbers, relationships among numbers, relationships among number systems, and meanings of operations and how they relate to one another. Further, it requires that students should be able to compute fluently and make reasonable estimates.

Geometry and Measurement Strand: All students should gain experience using a variety of visual and coordinate representations to analyze problems and solve mathematics and learn how to use appropriate units and tools for measuring. This strand provides focus for the PK-7 and Geometry standards around the notion that geometry and measurement help students understand and represent ideas and solve problems they will encounter in their daily lives. A focus on geometry should enable students to analyze characteristics of two- and three-dimensional objects, develop arguments based on geometric relationships, describe spatial relationships using coordinate geometry and other representational systems, apply transformations and symmetry to analyze mathematical situations, and utilize visualization, spatial reasoning and geometric modeling to solve problems. A focus on measurement should enable students to understand measureable attributes of objects and the units, systems, and processes of measurement, and apply appropriate techniques, tools, and formulas to determine measurements.

Data and Probability Strand: An increased emphasis on understanding data should span all grade levels. The idea that making sense of data and probability has become a part of our daily lives provides support for the importance of this strand throughout a students' Pk-12 mathematics experience. A focus on data and probability should enable all students to formulate questions that can be addressed with data, and collect, organize, and display relevant data to answer them, select and use appropriate statistical methods to analyze data, develop and evaluate inferences and predictions that are based on data, and understand and

apply basic concepts of probability. The study of data is also an opportunity to apply the basic skills of computing with numbers while the study of probability provides application and use of fractions in daily life.

Mathematical Actions & Processes
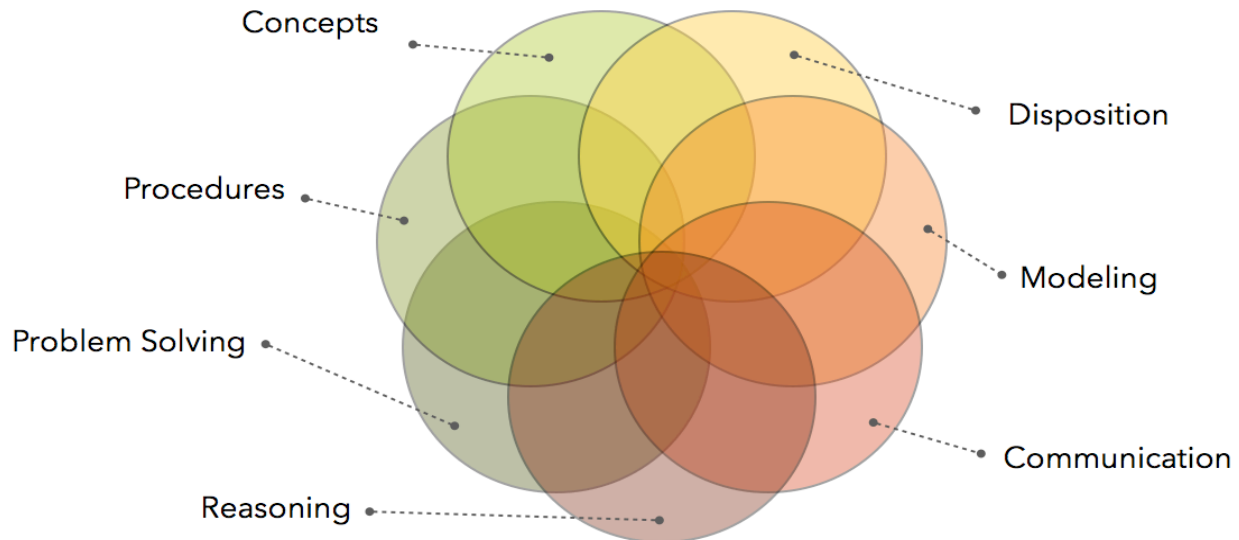
Throughout their Pk-12 education experience, mathematically literate students will:

Develop a Deep and Flexible *Conceptual* Understanding

Pursue a deep and flexible conceptual understanding of mathematical concepts, operations, and relations while making mathematical and real-world connections.

Develop Accurate and Appropriate *Procedural* Fluency

Pursue efficient procedures for various computations and repeated processes based on a strong sense of numbers. They will develop a sophisticated understanding of the development and application of algorithms and procedures.

Develop Strategies for *Problem Solving*

Analyze the parts of complex mathematical tasks and identify entry points to begin the search for a solution. They will select from a variety of problem solving strategies and use corresponding multiple

representations (verbal, physical, symbolic, pictorial, graphical, tabular) when appropriate. They will pursue solutions to various tasks from real-world situations and applications that are often interdisciplinary in nature. They will find methods to verify their answers in context and will always question the reasonableness of solutions.

Develop Mathematical *Reasoning*

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

Develop a Productive Mathematical *Disposition*

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

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

Make predictions and conjectures and draw conclusions throughout the problem solving process based on patterns and the repeated structures in mathematics. They will create, identify, and extend patterns as a strategy for solving and making sense of problems.

Develop the Ability to *Communicate* Mathematically

Develop the ability to communicate mathematically. They will discuss, write, read, interpret and translate ideas and concepts mathematically. As they progress, students' ability to communicate mathematically will include their increased use of mathematical language and terms and analysis of mathematical definitions.
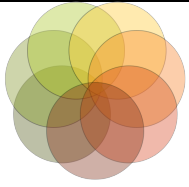
Oklahoma Academic Standards for Mathematics
Pre-Kindergarten

The Pre-kindergarten standards place emphasis on developing the concept of number by counting; recognizing numerals, 0-9; sorting and grouping sets of objects; recognizing and describing simple repeating patterns; and recognizing shapes and sizes of figures and objects. Students will investigate the attributes of objects and sort and organize them based on those attributes.

Problem solving has been integrated throughout the content strands. The development of problem solving skills should be a major goal of the mathematics program at every grade level. Experience with the process of problem solving will need to be integrated early and continuously into each student's mathematics education. Students must be helped to develop a wide range of skills and strategies for solving a variety of problem types.

While learning mathematics, students should be actively engaged, using concrete materials and appropriate technologies such as calculators and computers. However, facility in the use of technology should not be regarded as a substitute for a student's understanding of quantitative concepts and relationships or for proficiency and fluency with basic computations.
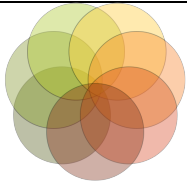
Mathematics has its own language, and the acquisition of specialized vocabulary and language patterns is crucial to a student's understanding, appreciation of, disposition for the subject. Students should be encouraged to correctly use the concepts, skills, symbols, and vocabulary identified in the following set of standards.

Algebraic Reasoning and Algebra

PK.A.1. Apply mathematical actions and processes to recognize, create, complete, and extend patterns.
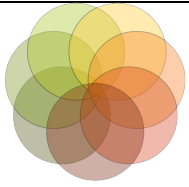
Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**PK.A.1.1** Sort and group up to 5 objects into a set and explain verbally what the objects have in common (e.g., color, size, shape). **PK.A.1.2** Recognize, duplicate, extend, and create repeating patterns in various formats (e.g., manipulatives, sound, movement).

Sample Problems or Classroom Activities

FORTHCOMING

Number and Operations

PK.N.1. Apply mathematical actions and processes to know number names and count in sequence.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Solving Diverse Problems • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**PK.N.1.1** Count aloud in sequence to 30. **PK.N.1.2** Recognize and name written numerals 0-9. **PK.N.1.3** Recognize that zero represents the count of no objects.

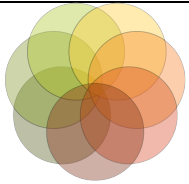**Sample Problems or Classroom Activities**

FORTHCOMING

Number and Operations

PK.N.2. Apply mathematical actions and processes to count to tell the number of objects.

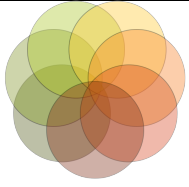| Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Solving Diverse Problems • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**PK.N.2.1** Identify the number of objects, up to 10, in a horizontal row. **PK.N.2.2** Begin to make use of one-to-one correspondence in counting objects and matching groups of objects. **PK.N.2.3** Understand the last numeral spoken, when counting aloud, tells how many total objects are in a set. **PK.N.2.4** Count up to 5 items in a scattered configuration; not in a horizontal row.

Sample Problems or Classroom Activities

FORTHCOMING

Number and Operations

PK.N.3. Apply mathematical actions and processes to compare numbers.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Solving Diverse Problems • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**PK.N.3.1** Compare two sets of 1-5 objects using comparative language such as "more" or "less".

Sample Problems or Classroom Activities
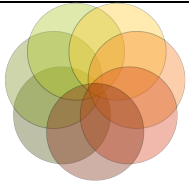
FORTHCOMING

Geometry and Measurement

PK.GM1. Apply mathematical actions and processes to analyze, compare, create and compose shapes.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Solving Diverse Problems • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**PK.GM.1.1** Identify common shapes by pointing to the shape when given the name (e.g., circle, square, rectangle and triangle). **PK.GM.1.2** Use smaller shapes to form a larger shape when there is an outline to follow (create a larger square using 4 small squares).

Sample Problems or Classroom Activities

FORTHCOMING

Geometry and Measurement

PK.GM.2. Apply mathematical process standards to describe and compare measureable attributes.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Solving Diverse Problems • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**PK.GM.2.1** Identify measurable attributes of objects, such as length or weight. Describe them using age appropriate vocabulary (e.g., little, big, long, short, tall, heavy, and light). **PK.GM.2.2** Directly compares two objects with a common measurable attribute using words such as longer/ shorter (horizontal); heavier/ lighter; or taller/ shorter (vertical). **PK.GM.2.3** Compare 2 objects by size (e.g., tall/taller). **PK.GM.2.4** Sort objects into sets by one or more attributes.

Sample Problems or Classroom Activities

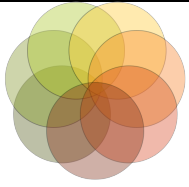FORTHCOMING

Oklahoma Academic Standards for Mathematics
Kindergarten

The kindergarten standards place emphasis on developing the concept of number by counting; subitizing, combining, sorting, and comparing sets of objects; recognizing and describing simple repeating patterns; and recognizing shapes and sizes of figures and objects. Students will investigate nonstandard measurement, collect data, and create graphs. The foundation for fractions will begin by distributing sets of objects equally into smaller groups.

Problem solving has been integrated throughout the content strands. The development of problem solving skills should be a major goal of the mathematics program at every grade level. Experience with the process of problem solving will need to be integrated early and continuously into each student's mathematics education. Students must be helped to develop a wide range of skills and strategies for solving a variety of problem types.

While learning mathematics, students should be actively engaged, using concrete materials and appropriate technologies such as calculators and computers. However, facility in the use of technology should not be regarded as a substitute for a student's understanding of quantitative concepts and relationships or for proficiency and fluency with basic computations.

Mathematics has its own language, and the acquisition of specialized vocabulary and language patterns is crucial to a student's understanding, appreciation of, disposition for the subject. Students should be encouraged to correctly use the concepts, skills, symbols, and vocabulary identified in the following set of standards.
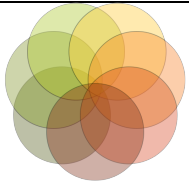
Algebraic Reasoning and Algebra

K.A.1. Apply mathematical actions and processes to recognize, create, complete, and extend patterns.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**K.A.1.1** Sort and group up to 10 objects into a set and explain verbally what the objects have in common (e.g., color, size, shape). **K.A.1.2** Recognize, create, complete, and extend repeating, shrinking and growing patterns using shape, color, size, quantity, sounds and movements.

**Sample Problems or Classroom Activities**

FORTHCOMING

Algebraic Reasoning and Algebra

K.A.2 Apply mathematical actions and processes standards to use objects and pictures to develop fluency with addition and subtraction (up to 10) to represent and solve real-world and mathematical problems.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**K.A.2.1** Compose and decompose numbers up to 10 with objects and pictures to develop the concept of fluidity of numbers and lay the foundation for addition and subtraction (e.g., making ten, number bonds).

Sample Problems or Classroom Activities
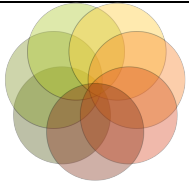
FORTHCOMING
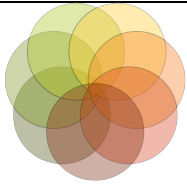
Number and Operations

K.N.1. Apply mathematical actions and processes to understand the relationship between quantities and whole numbers.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**K.N.1.1** Count aloud in sequence to 100. **K.N.1.2** Recognize that a number can be used to represent how many objects are in a set or to represent the position of an object in a sequence up to 10. **K.N.1.3** Recognize without counting (subitizing*) the quantity of a small group of objects in organized and random arrangements up to 10 (e.g. dot patterns). **K.N.1.4** Count forward, with and without objects, from any given number up to 10. **K.N.1.5** Read, write and represent whole numbers from 0 to at least 10. Representations may include numerals, pictures, real objects and picture graphs, spoken words, and manipulatives. **K.N.1.6** Find a number that is 1 more or 1 less than a given number. **K.N.1.7** Compare and order whole numbers, with and without objects, from 0 to 10. *Subitizing is defined as instantly recognizing the quantity of a set without having to count. "subitizing" is not a vocabulary word, not for student discussion at this age.

Sample Problems or Classroom Activities

FORTHCOMING
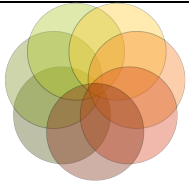
Number and Operations

K.N.2. Apply mathematical actions and processes to understand the relationship between whole numbers and fractions through fair share.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**K.N.2.1** Distribute equally a set of objects into at least two smaller sets.

**Sample Problems or Classroom Activities**

FORTHCOMING

Number and Operations

K.N.3. Apply mathematical actions and processes to identify coins in order to recognize the need for monetary transactions.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**K.N.3.1** Identify U.S. coins by name, including pennies, nickels, dimes, and quarters.

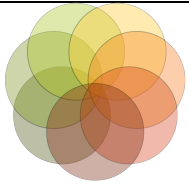**Sample Problems or Classroom Activities**

FORTHCOMING
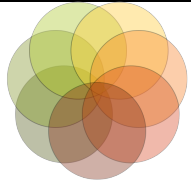
Geometry and Measurement

K.GM.1. Apply mathematical actions and processes to recognize and sort basic two- and three-dimensional shapes; use them to model real-world objects.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**K.GM.1.1** Recognize basic two- and three-dimensional shapes such as squares, circles, triangles, rectangles, trapezoids, hexagons, cubes, cones, cylinders and spheres. **K.GM.1.2** Identify attributes of two-dimensional shapes using informal and formal geometric language interchangeably.

Sample Problems or Classroom Activities
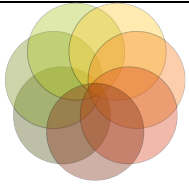
FORTHCOMING

Geometry and Measurement

K.GM.2. Apply mathematical actions and processes to compare and order objects according to location and measurable attributes.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**K.GM.2.1** Use words to compare objects according to length, size, weight and position. **K.GM.2.2** Order up to 6 objects using measurable attributes, such as length and weight (e.g. tall/taller/tallest). **K.GM.2.3** Use smaller shapes to form a larger shape when there is a model or outline to follow (e.g. Create a larger square using 4 small squares).

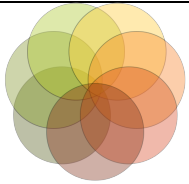**Sample Problems or Classroom Activities**

FORTHCOMING

Geometry and Measurement

K.GM.3. Apply mathematical actions and processes to tell time.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**K.GM.3.1** Develop an awareness of simple time concepts within his/her daily life (e.g. yesterday, today, tomorrow; morning, afternoon, night).

Sample Problems or Classroom Activities

FORTHCOMING

Data and Probability

K.DP.1. Apply mathematical actions and processes to collect and organize data to make it useful for interpreting information.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**K.DP.1.1** Collect and analyze information about objects and events in the environment. **K.DP.1.2** Use data to create real-object, picture graphs and Venn diagrams. **K.DP.1.3** Draw conclusions from real-object and picture graphs.

Sample Problems or Classroom Activities

FORTHCOMING
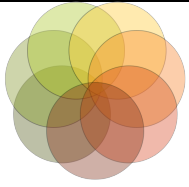
Oklahoma Academic Standards for Mathematics
1st Grade

The first-grade standards place emphasis on counting, sorting, and comparing sets of up to 120 objects; recognizing and describing simple repeating and growing patterns; and analyze attributes of two and three dimensional solids to develop general ideas about their properties geometric figures. Students' understanding of number will be expanded modeling and explaining strategies used to solved addition and subtraction problems up to 20; using Measuring tools to measure the length of objects in order to reinforce the continuous nature of linear measurement; and collecting, organizing and interpreting data. Fractional concepts will be expanded by partitioning regular polygons into equal pieces.

Problem solving has been integrated throughout the content strands. The development of problem solving skills should be a major goal of the mathematics program at every grade level. Experience with the process of problem solving will need to be integrated early and continuously into each student's mathematics education. Students must be helped to develop a wide range of skills and strategies for solving a variety of problem types.

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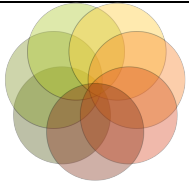
Algebraic Reasoning and Algebra

1.A.1. Apply mathematical actions and processes to recognize, create, complete, and extend patterns.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**1.A.1.1** Create and extend repeating or growing patterns using objects, pictures, numbers and rules. **1.A.1.2** Recognize, create, complete, and extend repeating, shrinking and growing patterns with numbers or geometric shapes in a variety of contexts (e.g., addition charts, skip counting, calendars, hundreds charts, number lines, real world situations such as art and architecture).

Sample Problems or Classroom Activities

FORTHCOMING

Algebraic Reasoning and Algebra

1.A.2 Apply mathematical actions and processes standards to use number sentences to develop fluency with addition and subtraction (up to 20) to represent and solve real-world and mathematical problems; create real-world situations corresponding to number sentences.
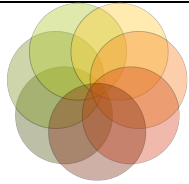
Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**1.A.2.1** Represent and create real-world situations involving basic addition and subtraction, using objects and number sentences. (e.g., making ten, compatible numbers, number bonds).

Sample Problems or Classroom Activities

Example for 1. A.2.1

A student can see a stack of 7 cubes and know that a stack of 4 cubes and 3 cubes has the same number of cubes and create a pictorial model of the relationship.

MORE FORTHCOMING

Number and Operations

1.N.1. Apply mathematical actions and processes to count, compare and represent whole numbers up to 100, with an emphasis on groups of tens and ones.

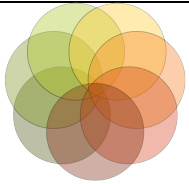| Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**1.N.1.1** Recognize without counting (subitizing*) the quantity of structured arrangements (e.g., ten frames, arrays, dot patterns). **1.N.1.2** Use concrete model to describe whole numbers between 10 and 100 in terms of tens and ones. **1.N.1.3** Read, write and represent whole numbers up to 100. Representations may include numerals, addition and subtraction, pictures, tally marks, number lines and manipulatives, such as bundles of sticks and base 10 blocks. **1.N.1.4** Count forward, with and without objects, from any given number up to 100 by 1s, 2s, 5s and/or 10s. **1.N.1.5** Find a number that is 10 more or 10 less than a given number (e.g., Using a hundred chart, find the number that is 10 more than 27). **1.N.1.6** Compare and order whole numbers, with and without objects, including open number lines, up to 100. **1.N.1.7** Create an open number line and use knowledge of number relationships to locate the position of a given whole number on that open number line up to 20. **1.N.1.8** Use objects to model and use words to describe the relative size of numbers, such as more than, less than, and equal to. Explore equivalence

	through the use of balance scales.
	*Subitizing is defined as instantly recognizing the quantity of a set without having to count. "subitizing" is not a vocabulary word, not for student discussion at this age.

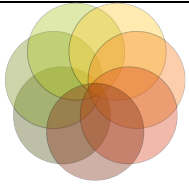**Sample Problems or Classroom Activities**

FORTHCOMING

Number and Operations

1.N.2. Apply mathematical actions and processes to solve addition and subtraction problems up to 20 in real-world and mathematical contexts.
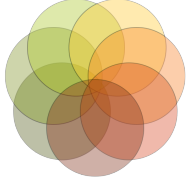
Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**1.N.2.1** Model and explain strategies used to solve addition and subtraction problems up to 20 using a variety of strategies (e.g., spoken words, objects, pictorial models, number lines, number sentences, compose and decompose numbers, making 10, doubles plus one, part part-whole). **1.N.2.2** Apply basic fact strategies to add and subtract within 20 including making ten, decomposing a number leading to a ten, doubles plus one. **1.N.2.3** Determine if equations involving addition and subtraction are true.

Sample Problems or Classroom Activities

FORTHCOMING

Number and Operations

1.N.3. Apply mathematical actions and processes to explore the foundational ideas of fractions.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**1.N.3.1** Partition a regular polygon using physical models into equal pieces (e.g., halves, thirds, fourths).

Sample Problems or Classroom Activities
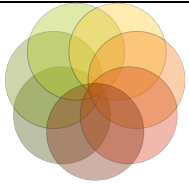
FORTHCOMING

Number and Operations

1.N.4. Apply mathematical actions and processes to identify coins, their values, and the relationships among them in order to recognize the need for monetary transactions.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**1.N.4.1** Identify U.S. coins, including pennies, nickels, dimes, and quarters, by value and describe the relationships among them. **1.N.4.2** Write a number with the cent symbol to describe the value of a coin. **1.N.4.3** Use relationships to count by ones, fives, and tens to determine the value of a collection of pennies, nickels, and/or dimes.

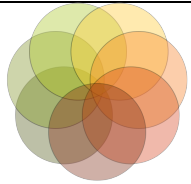**Sample Problems or Classroom Activities**

FORTHCOMING

Geometry and Measurement

1.GM.1. Apply mathematical actions and processes standards to analyze attributes of two- and three - dimensional shapes to create new shapes.

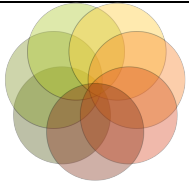| Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**1.GM.1.1** Use smaller shapes to form a larger shape (compose and decompose) two- dimensional shapes such as triangles, squares, rectangles, and circles, and three-dimensional shapes such as rectangular prisms and cylinders.

Sample Problems or Classroom Activities

FORTHCOMING

Geometry and Measurement

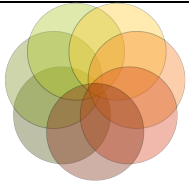**1.GM.2. Apply mathematical actions and processes to select and use units to describe length and time.**

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**1.GM.2.1** Use nonstandard and standard measuring tools to measure the length of objects to reinforce the continuous nature of linear measurement. **1.GM.2.2** Illustrate that the length of an object is the number of same-size units of length that, when laid end-to-end with no gaps or overlaps, reach from one end of the object to the other. **1.GM.2.3** Measure the same object/distance with units of two different lengths and describe how and why the measurements differ. **1.GM.2.4** Describe a length to the nearest whole unit using a number and a unit.

Sample Problems or Classroom Activities

FORTHCOMING

Geometry and Measurement

1.GM.3. Apply mathematical actions and processes to tell time.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**1.GM.3.1** Tell time to the hour and half-hour (analog and digital).

Sample Problems or Classroom Activities

FORTHCOMING

Data and Probability

1.D.1. Apply mathematical actions and processes to organize data to make it useful for interpreting information and solving problems.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**1.D.1.1** Collect, sort, and organize data in up to three categories using models/representations (e.g., tally marks, tables). **1.D.1.2** Use data to create picture and bar-type graphs, to demonstrate one to one correspondence. **1.D.1.3** Draw conclusions from picture and bar-type graphs.

Sample Problems or Classroom Activities

FORTHCOMING

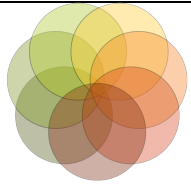# Oklahoma Academic Standards for Mathematics
2^(nd) Grade

The second-grade standards extend the study of number and spatial sense to include three-digit whole numbers and solid geometric figures. Students will be asked to demonstrate fluency with basic addition and related subtraction facts. Place value will play an important role in developing, modeling and using addition and subtraction with multi digit numbers. Students will begin to understand and use U.S. Customary and metric units of measure; and create and interpret picture and bar graphs using the data to write and solve addition and subtraction problems. Students will work with a variety of patterns and will develop knowledge of equality by identifying missing numbers in addition and subtraction Number sentences or equations.

Problem solving has been integrated throughout the content strands. The development of problem solving skills should be a major goal of the mathematics program at every grade level. Experience with the process of problem solving will need to be integrated early and continuously into each student's mathematics education. Students must be helped to develop a wide range of skills and strategies for solving a variety of problem types.

While learning mathematics, students should be actively engaged, using concrete materials and appropriate technologies such as calculators and computers. However, facility in the use of technology should not be regarded as a substitute for a student's understanding of quantitative concepts and relationships or for proficiency and fluency with basic computations.

Mathematics has its own language, and the acquisition of specialized vocabulary and language patterns is crucial to a student's understanding, appreciation of, disposition for the subject. Students should be encouraged to correctly use the concepts, skills, symbols, and vocabulary identified in the following set of standards.
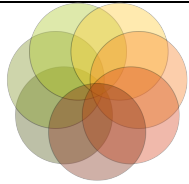
Algebraic Reasoning and Algebra

2.A.1. Apply mathematical actions and processes to recognize, create, describe, and use patterns and rules to solve real-world and mathematical problems.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**2.A1.1** Recognize, create, describe, and extend repeating, growing, and shrinking patterns involving numbers in a variety of contexts (e.g., repeated addition or subtraction, skip counting, arrays of objects). **2.A1.2** Recognize and describe repeating patterns involving geometric shapes in a variety of contexts.

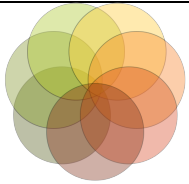**Sample Problems or Classroom Activities**

FORTHCOMING

Algebraic Reasoning and Algebra

2.A.2. Apply mathematical actions and processes to use number sentences involving addition, subtraction and unknowns to represent and solve real-world and mathematical problems; create real-world situations corresponding to number sentences.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**2.A.2.1** Use objects and number lines and create real-world situations to represent number sentences. **2.A.2.2** Use number sense and properties (commutative and identity) of addition and subtraction to find values for the unknowns that make the number sentences true. (Introduction to properties, but not mastery of vocabulary).

Sample Problems or Classroom Activities
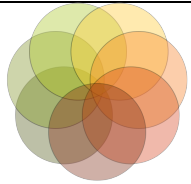
FORTHCOMING

Number and Operations

2.N.1. Apply mathematical actions and processes to compare and represent whole numbers up to 1000 with an emphasis on place value and equality.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**2.N.1.1** Read, write, discuss, and represent whole numbers up to 1000. Representations may include numerals, words, pictures, tally marks, number lines and manipulatives. **2.N.1.2** Create an open number line and use knowledge of number relationships to locate the position of a given whole number on that open number line up to 100. **2.N.1.3** Use place value to describe whole numbers between 10 and 1000 in terms of hundreds, tens and ones. Know that 100 is 10 tens, and 1000 is 10 hundreds. **2.N.1.4** Find 10 more or 10 less than a given three-digit number. Find 100 more or 100 less than a given three-digit number. **2.N.1.5** Recognize when to round numbers to the nearest 10 and 100. Emphasis on understanding how to round instead of memorizing the rules for rounding. **2.N.1.6** Use place value to compare and order whole numbers up to 1000 using comparative language, numbers, and symbols (e.g., 425 > 276, 73 < 107, page 351 comes after 350, 753 is between 700 and 800).

Sample Problems or Classroom Activities

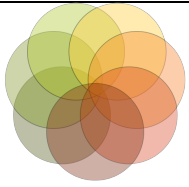FORTHCOMING

Number and Operations

2.N.2. Apply mathematical actions and processes to add and subtract one- and two-digit numbers in real-world and mathematical problems.

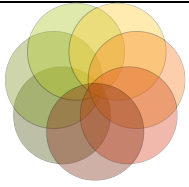| Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**2.N.2.1** Use strategies to generate addition and subtraction facts including making tens, fact families, doubles plus or minus one, counting on, counting back, and the commutative and associative properties. Use the relationship between addition and subtraction to generate basic facts. **2.N.2.2** Demonstrate fluency with basic addition facts and related subtraction facts up to 20. **2.N.2.3** Use strategies to estimate sums and differences up to 100 (e.g., compose, decompose and regroup numbers, use knowledge of 10 to estimate quantities and sums [two numbers less than 10 cannot add up to more than 20]). **2.N.2.4** Use mental strategies and algorithms based on knowledge of place value and equality to add and subtract two-digit numbers. Strategies may include decomposition, expanded notation, and partial sums and differences. **2.N.2.5** Solve real-world and mathematical addition and subtraction problems involving whole numbers up to 2 digits. **2.N.2.6** Use concrete models and structured arrangements, such as repeated addition, arrays and ten frames to develop understanding of multiplication.

Sample Problems or Classroom Activities

FORTHCOMING

Number and Operations

2.N.3. Apply mathematical actions and processes to explore the foundational ideas of fractions.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**2.N.3.1** Identify the parts of a set and/or area that represent fractions for halves, thirds and fourths. **2.N.3.2** Construct equal sized portions through fair sharing including length and set area models for halves, thirds, and fourths.

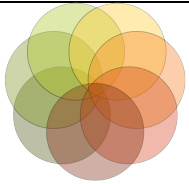**Sample Problems or Classroom Activities**

FORTHCOMING

Number and Operations

2.N.4. Apply mathematical actions and processes to determine the value of coins in order to solve monetary transactions.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**2.N.4.1** Determine the value of a collection(s) of coins up to one dollar (e.g., given 2 dimes and 1 quarter, recognize you have 45¢; person 1 has 15¢ and person 2 has 25¢, together they have 40¢). Limited to: whole numbers. **2.N.4.2** Select a combination of coins to represent a given amount of money up to one dollar.

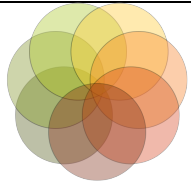**Sample Problems or Classroom Activities**

FORTHCOMING

Geometry and Measurement

2.GM.1. Apply mathematical actions and processes standards to analyze attributes of two- and three-dimensional figures develop generalizations about their properties.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**2.GM.1.1** Describe, compare, and classify two- and three-dimensional figures according to their geometric attributes including developing appropriate vocabulary for faces, and the number of sides, edges and vertices. **2.GM.1.2** Identify and name basic two- and three-dimensional shapes, such as squares, circles, triangles, rectangles, trapezoids, hexagons, cubes, rectangular prisms, cones, cylinders and spheres (architecture, technology, art).

Sample Problems or Classroom Activities

FORTHCOMING

Geometry and Measurement

2.GM.2. Apply mathematical actions and processes to understand length as a measurable attribute; use tools to measure length.
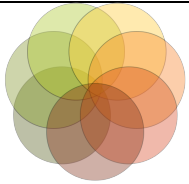
Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Solving Diverse Problems • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**2.GM.2.1** Explain the relationship between the size of the unit of measurement and the number of units needed to measure the length of an object. **2.GM.2.2** Explain of the relationship between length and the numbers on a ruler by using a ruler to measure lengths to the nearest centimeter or inch.

Sample Problems or Classroom Activities

Example for 2.GM.2.1:

To help students understand that it takes more centimeters to measure the length of a table than it does meters because centimeters are smaller than meters, students can be engaged in an activity where some groups measure a table, for example, in meters while other groups measure the same table in centimeters. Each group can present their results and the class can discuss the difference in findings. Following the group discussion, students should be asked to write about why it required fewer meters than centimeters to measure the length of the table when meters are longer than centimeters. This relationship seems proportionally counterintuitive for many students so they may need several concrete experiences measuring with several units to fully understand and be able to explain with confidence that the smaller the unit, the more will be needed to measure the length of any object.
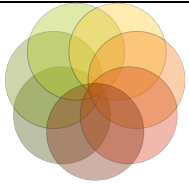
MORE FORTHCOMING

Geometry and Measurement

2.GM.3. Apply mathematical actions and processes to tell time.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**2.GM.3.1** Tell time to the quarter-hour and distinguish between a.m. and p.m. (analog and digital)

Sample Problems or Classroom Activities

FORTHCOMING

Data and Probability

2.D1. Apply mathematical actions and processes to organize data to make it useful for interpreting information and solving problems..

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**2.D1.1** Explain that the length of a bar in a bar graph or the number of objects in a picture graph represents the number of data points for a given category. **2.D1.2** Organize a collection of data with up to four categories using pictographs and bar graphs with intervals of one or more. **2.D1.3** Write and solve one-step word problems involving addition or subtraction using data represented within pictographs and bar graphs with intervals of one. **2.D1.4** Draw conclusions and make predictions from information in a graph.

Sample Problems or Classroom Activities

FORTHCOMING
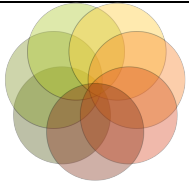
Oklahoma Academic Standards for Mathematics
3rd Grade

In the third grade students will demonstrate fluency with addition and subtraction facts up to 20, multiply multi digit numbers, understand and apply place value, and build on the foundation of fractions by reading, writing, recognizing in different contexts, order and comparing fractions with like denominators. Students will use standard units (U.S. Customary and metric) to measure temperature, length, liquid volume, and weight and identify relevant properties of shapes and lines, and find the perimeter of polygons. Students will investigate and describe the identity and commutative properties for addition and multiplication.

Problem solving has been integrated throughout the content strands. The development of problem solving skills should be a major goal of the mathematics program at every grade level. Experience with the process of problem solving will need to be integrated early and continuously into each student's mathematics education. Students must be helped to develop a wide range of skills and strategies for solving a variety of problem types.

While learning mathematics, students should be actively engaged, using concrete materials and appropriate technologies such as calculators and computers. However, facility in the use of technology should not be regarded as a substitute for a student's understanding of quantitative concepts and relationships or for proficiency and fluency with basic computations.

Mathematics has its own language, and the acquisition of specialized vocabulary and language patterns is crucial to a student's understanding, appreciation of, disposition for the subject. Students should be encouraged to correctly use the concepts, skills, symbols, and vocabulary identified in the following set of standards.
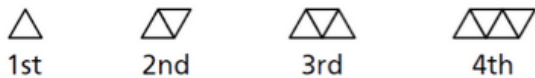
Algebraic Reasoning and Algebra

3.A.1. Apply mathematical actions and processes to use single-operation input-output rules to represent patterns and relationships and to solve real-world and mathematical problems.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**3.A.1.1** Create, describe, and extend patterns involving addition, subtraction or multiplication to solve problems in a variety of contexts (e.g., skip counting, arrays of objects, function machine, hundreds chart). **3.A.1.2** Describe the rule for a pattern from an input/output table or function machine involving addition, subtraction or multiplication. **3.A.1.3** Construct and explore models of growing patterns and construct the next steps.

Sample Problems or Classroom Activities

Example for 3.A.1.3

1st   2nd   3rd   4th
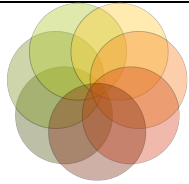
What is the next stage?

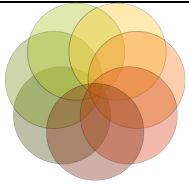*How many triangles will there be in the 10th stage?*

Do you notice any patterns?

MORE FORTHCOMING

Algebraic Reasoning and Algebra

3.A.2. Apply mathematical actions and processes to use number sentences involving multiplication and unknowns to represent and solve real-world and mathematical problems; create real-world situations corresponding to number sentences.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**3.A.2.1** Find unknowns represented by symbols in arithmetic problems by solving open sentences (equations) and other problems involving addition, subtraction, and multiplication. Create real-world situations to represent number sentences. **3.A.2.2** Recognize, represent and apply the number properties (commutative and identity properties of addition and multiplication) using models and manipulatives. (Introduction to properties, but not mastery of vocabulary).

Sample Problems or Classroom Activities

FORTHCOMING

Number and Operations

3.N.1. Apply mathematical actions and processes to compare and represent whole numbers up to 100,000 with an emphasis on place value and equality.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**3.N.1.1** Read, write, discuss, and represent whole numbers up to 100,000. Representations may include numerals, expressions with operations, words, pictures, number lines, and manipulatives. **3.N.1.2** Use place value to describe whole numbers between 1000 and 100,000 in terms of ten thousands, thousands, hundreds, tens and one, including expanded form. **3.N.1.3** Find 10,000 more or 10,000 less than a given five-digit number. Find 1000 more or 1000 less than a given four- or five-digit. Find 100 more or 100 less than a given four- or five-digit number. **3.N.1.4** Recognize when to round numbers to the nearest 10,000, 1000, 100 and 10 and/or use compatible numbers to estimate sums and differences. Emphasis on understanding why and how to round rather than memorization of the rules for rounding. **3.N.1.5** Use place value to compare and order whole numbers up to 100,000, using comparative language, numbers, and symbols (e.g., 15,023 < 25,156; 2345 is between 2000 and 3000).

Sample Problems or Classroom Activities

FORTHCOMING
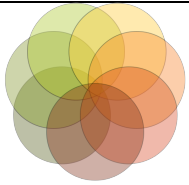
Number and Operations

3.N.2. Apply mathematical actions and processes to add and subtract multi-digit whole numbers; represent multiplication and division in various ways; solve real-world and mathematical problems using arithmetic.

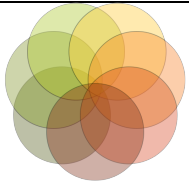| Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**3.N.2.1** Demonstrate fluency in addition and subtraction facts up to 100. **3.N.2.2** Add and subtract multi-digit numbers, using efficient and generalizable procedures and strategies based on knowledge of place value, which may include standard algorithms. **3.N.2.3** Use addition and subtraction to solve real-world and mathematical problems involving whole numbers. Use various strategies, including the relationship between addition and subtraction, the use of technology, and the context of the problem to assess the reasonableness of results. **3.N.2.4** Represent multiplication facts by using a variety of approaches, such as repeated addition, equal-sized groups, arrays, area models, equal jumps on a number line and skip counting. **3.N.2.5** Represent division facts by using a variety of

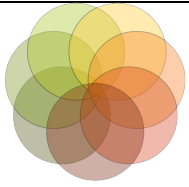|	approaches, such as repeated subtraction, equal sharing and forming equal groups.
	3.N.2.6 Recognize the relationship between multiplication and division to model and solve real world problems (e.g., partitioning, missing factors, arrays).
	3.N.2.7 Use strategies and algorithms based on knowledge of place value, equality and properties of addition and multiplication to multiply a two-digit number by a one-digit number. Strategies may include mental strategies, partial products, the standard algorithm, and the commutative, associative, and distributive properties.

Sample Problems or Classroom Activities

FORTHCOMING

Number and Operations

3.N.3. Apply mathematical actions and processes to understand meanings and uses of fractions in real-world and mathematical situations.
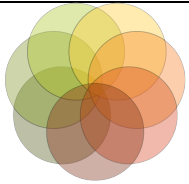
Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**3.N.3.1** Read and write fractions with words and symbols. **3.N.3.2** Construct fractions using set, area and length models. **3.N.3.3** Order and compare, including equivalent unit fractions and fractions with like denominators by using models, reasoning about their size and an understanding of the concept of numerator and denominator.

Sample Problems or Classroom Activities

FORTHCOMING

Number and Operations

3.N.4. Apply mathematical actions and processes to determine the value of coins in order to solve monetary transactions.
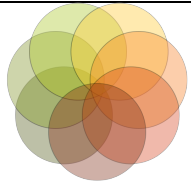
Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**3.N.4.1** Use addition to determine the value of a collection of coins or bills up to $20. (e.g. 45¢ + 30¢= 75¢, $11 + $9=$20). Limited to: whole numbers. **3.N.4.2** Select the fewest amount of coins for a given amount of money up to one dollar.

Sample Problems or Classroom Activities

FORTHCOMING

Geometry and Measurement

3.GM.1. Apply mathematical actions and processes to use geometric attributes to describe and create shapes in various contexts.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**3.GM.1.1** Identify parallel and perpendicular lines in various contexts.

Sample Problems or Classroom Activities

FORTHCOMING

Geometry and Measurement

3.GM.2. Apply mathematical actions and processes to understand perimeter as a measurable attribute of real-world and mathematical objects. Use various tools to measure distances.
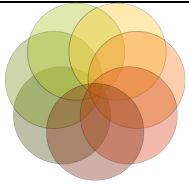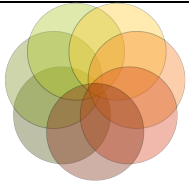
Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**3.GM.2.1** Choose an appropriate measurement instrument (e.g., ruler, yard/meter, measuring tape) and measure the length of objects to the nearest whole or half unit. **3.GM2.2** Establish personal benchmarks for metric units and estimate the measures of a variety of objects (e.g., mass: the mass of a raisin is about 1 gram, length: the width of a finger is about 1 centimeter). **3.GM.2.3** Find the perimeter of a polygon. **3.GM.2.4** Use an analog thermometer to determine temperature to the nearest degree in Fahrenheit and Celsius.

Sample Problems or Classroom Activities

FORTHCOMING

Geometry and Measurement

3.GM.3. Apply mathematical actions and processes to tell time.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**3.GM.3.1** Read and write time to the nearest minute (analog and digital). **3.GM.3.2** Determine the solutions to problems involving addition and subtraction of time intervals in minutes using pictorial models or tools up to one hour (e.g.15-minute event plus a 30-minute event equals 45 minutes).

Sample Problems or Classroom Activities

FORTHCOMING

Data and Probability

3.D1. Apply mathematical actions and processes to organize data to make it useful for interpreting information and solving problems.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**3.D1.1** Summarize a data set with multiple categories using a frequency table, line plot, pictograph, and/or bar graph with scaled intervals. **3.D1.2** Solve one- and two-step problems using categorical data represented with a frequency table, dot plot, pictograph, and/or bar graph with scaled intervals.

Sample Problems or Classroom Activities

FORTHCOMING

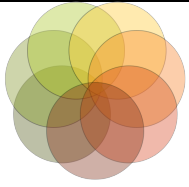# Oklahoma Academic Standards for Mathematics
4th Grade

The fourth-grade standards place emphasis on multiplication and division with whole numbers and solving problems involving addition and subtraction of fractions by finding common multiples and factors using concrete or pictorial models. Students will be fluent in the basic multiplication and division facts as they become proficient in multiplying larger numbers. Students also will refine their estimation skills for computations and measurements. Students will identify classify and construct, triangles and quadrilaterals, and predict, identify, and describe slides, flips, turns and lines of symmetry. Concrete materials and two-dimensional representations will be used to solve problems involving area, patterns, and equivalence of fractions and decimals. Students will establish personal benchmarks for measurements, choose appropriate measurement tools and solve problems involving measurements in a variety of situations.

Problem solving has been integrated throughout the content strands. The development of problem solving skills should be a major goal of the mathematics program at every grade level. Experience with the process of problem solving will need to be integrated early and continuously into each student's mathematics education. Students must be helped to develop a wide range of skills and strategies for solving a variety of problem types.

While learning mathematics, students should be actively engaged, using concrete materials and appropriate technologies such as calculators and computers. However, facility in the use of technology should not be regarded as a substitute for a student's understanding of quantitative concepts and relationships or for proficiency and fluency with basic computations.

Mathematics has its own language, and the acquisition of specialized vocabulary and language patterns is crucial to a student's understanding, appreciation of, disposition for the subject. Students should be encouraged to correctly use the concepts, skills, symbols, and vocabulary identified in the following set of standards.
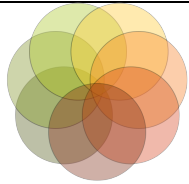
Algebraic Reasoning and Algebra

4.A.1. Apply mathematical actions and processes to use single-operation input-output rules, tables and charts to represent patterns and relationships and to solve real-world and mathematical problems.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**4.A1.1** Create, describe, and extend a wide variety of patterns involving numbers, using tables, charts and/or rules (e.g., determine the rule from a table or "function machine", extend number patterns). Record the inputs and outputs in a chart or table. **4.A1.2** Describe the rule for a pattern from a input/output table or function machine involving addition, subtraction, multiplication, or division. **4.A1.3** Create, describe, and extend a wide variety of patterns involving geometric shapes and define the rule of the pattern.

Sample Problems or Classroom Activities

FORTHCOMING

Algebraic Reasoning and Algebra

4.A.2. Apply mathematical actions and processes to use multiplication, division with unknowns to create number sentences representing a given problem situation using a number sentence.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**4.A.2.1** Use number sense, properties of multiplication (commutative, identity, and associative) and the relationship between multiplication and division to find values for the unknowns represented by letters and symbols that make number sentences true. (Introduction to properties, but not mastery of vocabulary). **4.A.2.2** Solve for unknowns in one-step arithmetic problems by solving open sentences (equations) and other problems involving addition, subtraction, multiplication, or division with whole numbers. Use real-world situations to represent number sentences.

Sample Problems or Classroom Activities

Example for 4.A.2.1

$4 \times 12 = \quad \times 4$
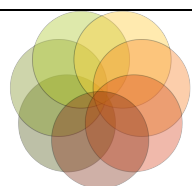$6 \times ? = 6$
$2 \times (3 \times 4) = (2 \times 3) \times$

Example for 4.A.2.2

Find the value of the unknown in the following number sentences to make them true.

$4 \times y = 12$
$c + 9 = 17$

Number and Operations

4.N.1 Apply mathematical actions and processes to multiply multi-digit numbers; solve real-world and mathematical problems using arithmetic.

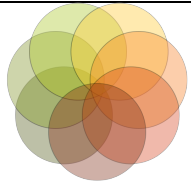| Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Solving Diverse Problems • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**4.N.1.1** Demonstrate fluency with multiplication and division facts up to 12 x 12. **4.N.1.2** Use an understanding of place value to multiply or divide a number by 10, 100 and 1000. **4.N.1.3** Multiply 3-digit by 1-digit or a 2-digit by 2-digit whole numbers, using efficient and generalizable procedures and strategies, based on knowledge of place value, including standard algorithms. **4.N.1.4** Estimate products of 3-digit by 1-digit or a 2-digit by 2-digit whole numbers by using rounding, benchmarks and place value to assess the reasonableness of results. Explore larger numbers using technology to investigate patterns. **4.N.1.5** Solve multi-step real world and mathematical problems requiring the use of

	addition, subtraction and multiplication of multi-digit whole numbers. Use various strategies, including the relationship between operations, the use of appropriate technology, and the context of the problem to assess the reasonableness of results. **4.N.1.6** Use strategies and algorithms based on knowledge of place value, equality and properties of operations to divide 3-digit by 1-digit whole numbers. Strategies may include mental strategies, partial quotients, the commutative, associative, and distributive properties and repeated subtraction.
Sample Problems or Classroom Activities FORTHCOMING	

Number and Operations

4.N.2. Apply mathematical actions and processes to represent and compare fractions and decimals in real-world and mathematical situations; use place value to understand how decimals represent quantities.
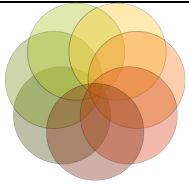
Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**4.N.2.1** Represent equivalent fractions using fraction models (e.g., parts of a set, fraction circles, fraction strips, number lines and other manipulatives). **4.N.2.2** Use benchmark fractions to locate additional fractions on a number line. Use models to order and compare whole numbers and fractions less than and greater than one. **4.N.2.3** Decompose a fraction in more than one way into a sum of fractions with the same denominator using concrete and pictorial models and recording results with symbolic representations (e.g., 3/4 = 1/4 + 1/4 + 1/4). **4.N.2.4** Use fraction models to add and subtract fractions with like denominators in real world and mathematical situations. Develop a rule for addition and subtraction of fractions with like denominators. **4.N.2.5** Represent tenths and hundredths with concrete models, making connections between fractions and decimals. **4.N.2.6** Model, read and write decimals up to at least the hundredths place in a variety of context including money. **4.N.2.7** Compare and order decimals and whole numbers using place value, a number line and models such as grids and base 10 blocks.

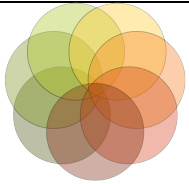|	**4.N.2.8** Rename and compare benchmark fractions and decimals in real-world and mathematical situations; use place value to understand how decimals represent quantities, including money (e.g., half of a dollar is $0.50; ¼ is the same as 0.25).
Sample Problems or Classroom Activities FORTHCOMING	

Number and Operations

4.N.3. Apply mathematical actions and processes to determine the value of coins in order to solve monetary transactions.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Solving Diverse Problems • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**4.N.3.1** Given a total cost and amount paid, find the change required in a variety of ways.

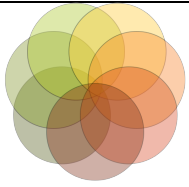**Sample Problems or Classroom Activities**

FORTHCOMING

Geometry and Measurement

4.GM.1. Apply mathematical actions and processes to name, describe, classify and construct polygons.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**4.GM.1.1** Describe, classify and construct triangles, including equilateral, right, obtuse and acute triangles. Recognize triangles in various contexts. **4.GM.1.2** Describe, classify and construct quadrilaterals, including squares, rectangles, trapezoids, rhombuses, parallelograms and kites. Recognize quadrilaterals in various contexts.

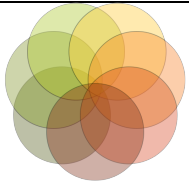**Sample Problems or Classroom Activities**

FORTHCOMING

Geometry and Measurement

4.GM.2. Apply mathematical actions and processes to transformations and use symmetry to analyze mathematical situations.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**4.GM.2.1** Predict and describe the results of sliding, flipping and turning 2-dimensional shapes. **4.GM.2.2** Identify and describe the line(s) of symmetry in 2-dimensional shapes.

Sample Problems or Classroom Activities

FORTHCOMING

Geometry and Measurement

4.GM.3. Apply mathematical actions and processes to understand angle and area as measurable attributes of real world and mathematical objects. Use various tools to measure angles and areas.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**4.GM.3.1** Measure angles in geometric figures and real world objects with a protractor or angle ruler. **4.GM.3.2** Find the area of a two-dimensional figure by counting the total number of same size square units that cover a shape without gaps or overlaps. **4.GM.3.3** Develop and use formulas to determine the area of rectangles. Justify why length and width are multiplied to find the area of a rectangle by breaking the rectangle into one unit by one unit squares and viewing these as grouped into rows and columns. **4.GM.3.4** Find the area of polygons that can be decomposed into rectangles. **4.GM.3.5** Choose an appropriate instrument (e.g., ruler, yard/meter stick, tape measure) and measure the length of an object to the nearest whole centimeter or quarter-inch. **Clarification:** Anything smaller than a centimeter should be measured in millimeters. No need to "fraction" centimeters. **4.GM.3.6** Solve problems that deal with measurements of length, intervals of time, when to use liquid volumes, when to use mass, temperatures above zero and money using addition, subtraction, multiplication, or division as appropriate. **Clarification:** Focus should be on why and when to use the tools in addition to how to use the tools.

Sample Problems or Classroom Activities

FORTHCOMING
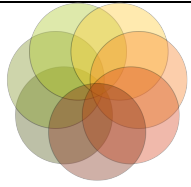
Data and Probability

4.D1. Apply mathematical actions and processes to solve problems by collecting, organizing, displaying, and interpreting data.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**4.D1.1** Represent data on a frequency table or dot plot marked with whole numbers and fractions using appropriate titles, labels and units. **4.D1.2** Use tables, bar graphs, timelines and Venn diagrams to display data sets. The data may include benchmark fractions or decimals. **4.D1.3** Solve one- and two-step problems using data in whole number, decimal, and fraction form in a frequency table and dot plot.

Sample Problems or Classroom Activities

FORTHCOMING
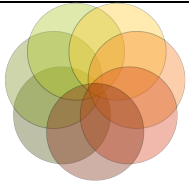
Oklahoma Academic Standards for Mathematics
5th Grade

The fifth-grade standards place emphasis on number sense with whole numbers, fractions, and decimals. This focus involves three main ideas: whole number division, the notion of decimal and their connections with fractions, and addition and subtraction of fractions. Students will develop proficiency in the use of fractions and decimals to solve problems. Solving real-world and mathematical problems is a common theme across the number and operation strand. Additionally, students will work with many foundational algebraic ideas, including exploring patterns of change using patterns, tables, graphs and rules along with evaluating expressions and solving equations involving variables when values of the variables are given. Students will describe, classify, and draw representations of three-dimensional figures. They will also determine the area of triangles and quadrilaterals. Finally, students will display and interpret data including finding the mean, median and range of a set of numbers.

Problem solving has been integrated throughout the content strands. The development of problem solving skills should be a major goal of the mathematics program at every grade level. Experience with the process of problem solving will need to be integrated early and continuously into each student's mathematics education. Students must be helped to develop a wide range of skills and strategies for solving a variety of problem types.

While learning mathematics, students should be actively engaged, using concrete materials and appropriate technologies such as calculators and computers. However, facility in the use of technology should not be regarded as a substitute for a student's understanding of quantitative concepts and relationships or for proficiency and fluency with basic computations.

Mathematics has its own language, and the acquisition of specialized vocabulary and language patterns is crucial to a student's understanding, appreciation of, disposition for the subject. Students should be encouraged to correctly use the concepts, skills, symbols, and vocabulary identified in the following set of standards.
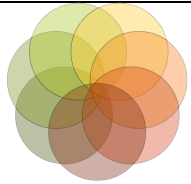
Algebraic Reasoning and Algebra

5.A.1 Apply mathematical actions and processes to create and use patterns, tables, graphs and rules to describe patterns to solve real-world and mathematical problems.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**5.A.1.1** Create and use rules and tables to describe patterns of change and make predictions and generalizations about real-world and mathematical problems. **5.A.1.2** Use a rule or table to represent ordered pairs of positive integers and graph these ordered pairs on a coordinate system.

Sample Problems or Classroom Activities

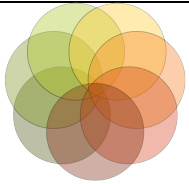FORTHCOMING

Algebraic Reasoning and Algebra

5.A.2 Apply mathematical actions and processes to understand and interpret expressions, equations, and inequalities involving variables and whole numbers, and use them to represent and solve real-world and mathematical problems.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**5.A.2.1** Apply the commutative, associative, and distributive properties and order of operations to generate equivalent numerical expressions and to solve problems involving whole numbers. **5.A.2.2** Determine whether an equation or inequality involving a variable is true or false for a given value of the variable. **5.A.2.3** Evaluate expressions and solve equations involving variables when values for the variables are given.

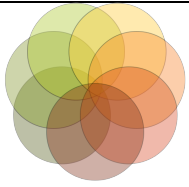**Sample Problems or Classroom Activities**

FORTHCOMING

Number and Operations

5.N.1 Apply mathematical actions and processes to divide multi-digit numbers and solve real-world and mathematical problems using arithmetic.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**5.N.1.1** Estimate solutions to division problems in order to assess the reasonableness of results. **5.N.1.2** Divide multi-digit numbers, using efficient and generalizable procedures, based on knowledge of place value, including standard algorithms. Recognize that quotients can be represented in a variety of ways, including a whole number with a remainder, a fraction or mixed number, or a decimal and consider the context in which a problem is situated to select and interpret the most useful form of the quotient for the solution. **5.N.1.3** Solve real-world and mathematical problems requiring addition, subtraction, multiplication and division of multi-digit whole numbers. Use various strategies, including the inverse relationships between operations, the use of technology, and the context of the problem to assess the reasonableness of results.

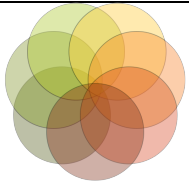**Sample Problems or Classroom Activities**

FORTHCOMING

Number and Operations

5.N.2 **Apply mathematical actions and processes to read, write, represent and compare fractions and decimals; recognize and write equivalent fractions; convert between fractions and decimals; use fractions and decimals in real-world and mathematical situations.**

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**5.N.2.1** Represent decimal fractions (e.g. 1/10, 1/100) using a variety of models (e.g, 10 by 10 grids, rational number wheel, base-ten blocks, meter stick) and make connections between fractions and decimals (e.g., the visual for 1/10 is the same as for 0.1). **5.N.2.2** Model, read and write decimals using place value to describe decimal numbers from at least millions to thousandths. **5.N.2.3** Compare and order fractions and decimals, including mixed numbers and improper fractions, and locate on a number line. **5.N.2.4** Recognize and generate equivalent decimals, fractions, mixed numbers and improper fractions in various contexts.

**Sample Problems or Classroom Activities**

FORTHCOMING

Numbers and Operations

5.N.3 Apply mathematical actions and processes to add and subtract fractions, mixed numbers and decimals to solve real-world and mathematical problems.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**5.N.3.1** Estimate sums and differences of fractions and decimals to assess the reasonableness of the results. **5.N.3.2** Using the meanings of fractions, meanings of whole number addition and subtraction, and inverse relationships to model addition and subtraction of fractions and decimals using a variety of representations (e.g., fraction strips, area models, number lines, Cuisenaire rods). **5.N. 3.3** Add and subtract fractions and decimals, using efficient and generalizable procedures, including standard algorithms in order to solve real world and mathematical problems including those involving money, measurement, geometry, and data. **5.N.3.4** Find 0.1 more than a number and 0.1 less than a number. Find 0.01 more than a number and 0.01 less than a number. Find 0.001 more than a number and 0.001 less than a number.

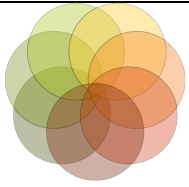**Sample Problems or Classroom Activities**

FORTHCOMING
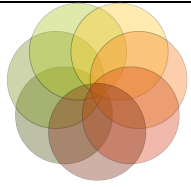
Geometry and Measurement

5.GM.1 Apply mathematical actions and processes to describe, classify, and draw representations of three-dimensional figures.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**5.GM.1.1** Describe and classify three-dimensional figures including cubes, rectangular prisms and pyramids by the number of edges, faces or vertices as well as the types of faces. **5.GM.1.2** Recognize and draw a net for a three-dimensional figure (e.g., cubes, rectangular prisms, pyramids).

**Sample Problems or Classroom Activities**

FORTHCOMING

Geometry and Measurement

5.GM.2 Apply mathematical actions and processes to determine the area of triangles and parallelograms.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**5.GM.2.1** Develop and use formulas to determine the area of triangles and parallelograms. **5.GM.2.2** Find the area of polygons that can be decomposed into triangles.

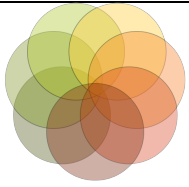**Sample Problems or Classroom Activities**

FORTHCOMING
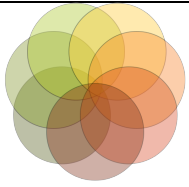
Geometry and Measurement

5.GM.3. Apply mathematical actions and processes to understand angle and length as measurable attributes of real world and mathematical objects. Use various tools to measure angles and lengths.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**5.GM.3.1** Compare angles according to size. Classify angles as acute, right, and obtuse. **5.GM.3.2** Choose an appropriate instrument (e.g., ruler, yard/meter stick, tape measure) and measure the length of an object to the nearest whole centimeter or 1/16-inch.

Sample Problems or Classroom Activities

FORTHCOMING

Data and Probability

5.D.1 Apply mathematical actions and processes to display and interpret data; determine mean, median and range..

Mathematical Actions and Processes	Mathematical Standard
- Develop a Deep and Flexible Conceptual Understanding - Develop Accurate and Appropriate Procedural Fluency - Develop Strategies for Problem Solving - Develop Mathematical Reasoning - Develop a Productive Mathematical Disposition - Develop the Ability to Make Conjectures, Model, and Generalize - Develop the Ability to Communicate Mathematically	**5.D.1.1** Know and use the definitions of the mean, median, mode, and range of a set of data. Understand that the mean is a "leveling out" of data. **5.D.1.2** Create and analyze double-bar graphs and line graphs by applying understanding of whole numbers, fractions and decimals. Know how to create spreadsheet tables and graphs to display data.

Sample Problems or Classroom Activities

FORTHCOMING

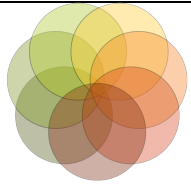# Oklahoma Academic Standards for Mathematics
6th Grade

The sixth-grade standards transition from an emphasis on whole number arithmetic in the elementary grades to an increased emphasis on algebra and geometry with some data analysis and probability. Students will read, write, represent, compare, and explore the connections between fractions, decimals, percents, and ratios. They will write positive integers as a product of factors. Students will develop mathematical proficiency with multiplication and division of fractions and solve real-world problems. Solving real-world and mathematical problems is a common theme across the number and operation strand. As a part of the algebra strand, students will recognize and represent relationships between varying quantities as well as solve real-world and mathematical problems using patterns, tables, graphs and rules. Students will model, write, solve, and graph one-step equations with one variable using number sense, the properties of operations and the properties of equality. Students will develop formulas and use them to calculate the area of quadrilaterals and be able to explain why a particular formula is used and why it works. They will begin to explore and use relationships between angles in geometric figures and choose appropriate units of measurements to solve real-world and mathematical problems. Students will display and interpret data and use probabilities to solve real-world and mathematical problems.

Problem solving has been integrated throughout the content strands. The development of problem solving skills should be a major goal of the mathematics program at every grade level. Experience with the process of problem solving will need to be integrated early and continuously into each student's mathematics education. Students must be helped to develop a wide range of skills and strategies for solving a variety of problem types.

While learning mathematics, students should be actively engaged, using concrete materials and appropriate technologies such as calculators and computers. However, facility in the use of technology should not be regarded as a substitute for a student's understanding of quantitative concepts and relationships or for proficiency and fluency with basic computations.

Mathematics has its own language, and the acquisition of specialized vocabulary and language patterns is crucial to a student's understanding, appreciation of, disposition for the subject. Students should be encouraged to correctly use the concepts, skills, symbols, and vocabulary identified in the following set of standards.

Algebraic Reasoning and Algebra

6.A.1 Apply mathematical actions and processes to recognize and represent relationships between varying quantities; translate from one representation to another; use patterns, tables, graphs and rules to solve real-world and mathematical problems.

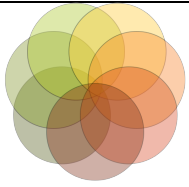| Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**6.A.1.1** Create and use rules, tables, and graphs to describe patterns of change and make predictions and generalizations about real-world and mathematical problems. **6.A.1.2** Use variables in various contexts including whether an equation or inequality involving a variable is true or false for a given value of the variable. **6.A.1.3** Translate between any two of these representations.

Sample Problems or Classroom Activities

Example for 6.A.1.3 - *Using table below, recognize and graph on the x-y coordinate plane the points (2, 3) and (1, 2).*

x	y
2	3
1	2

Use y = 2x or y = x + 2 (limit to one operation) to generate a table and then graph.
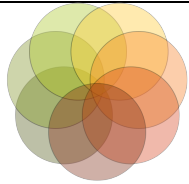
MORE FORTHCOMING

Algebraic Reasoning and Algebra

6.A.2 Apply mathematical actions and processes to use properties of arithmetic to generate equivalent numerical expressions and evaluate expressions involving positive rational numbers.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**6.A.2.1** Apply the associative, commutative and distributive properties and order of operations to generate equivalent expressions and to solve problems involving positive rational numbers.

Sample Problems or Classroom Activities

FORTHCOMING

Algebraic Reasoning and Algebra

6.A.3 Apply mathematical actions and processes to understand and interpret equations and inequalities involving variables and positive rational numbers. Use equations and inequalities to represent real-world and mathematical problems; use the idea of maintaining equality to solve equations. Interpret solutions in the original context.
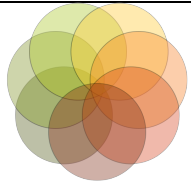
Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**6.A.3.1** Represent real-world or mathematical situations using equations and inequalities involving variables and positive rational numbers. **6.A.3.2** Solve equations involving positive rational numbers using number sense, properties of arithmetic and the idea of maintaining equality on both sides of the equation. Interpret a solution in the original context and assess the reasonableness of results. **6.A.3.3** Model, write, solve, and graph one-step equations with one variable using number sense, the properties of operations, and the properties of equality (e.g., $1/3x = 9$).

Sample Problems or Classroom Activities

Resource note for 6.A.3.2: Use a balance to model an equation and show how subtracting a number from one side requires subtracting the same amount from the other side. Hands on equations and balance tasks can help students move from the concrete to the pictorial to the abstract.

The app "SolveMe Mobiles" for tablet and the Balance Task app found on the NCTM Illuminations website will be helpful for students working to understand solving equations.

MORE FORTHCOMING

Number and Operations

6.N.1 Apply mathematical actions and processes to read, write, represent and compare positive rational numbers expressed as fractions, decimals, percents and ratios; write positive integers as products of factors; use these representations in real-world and mathematical situations.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**6.N.1.1** Locate positive rational numbers on a number line. **6.N.1.2** Compare positive rational numbers represented in various forms using the symbols <, >, and =. **6.N.1.3** Explain that a percent represents parts out of 100 and ratios to 100 (e.g., 75% corresponds to the ratio 75 to 100 which is equivalent to a ratio of 3 to 4) and select among these representations to solve real-world or mathematical situations. **6.N.1.4** Factor whole numbers; express a whole number as a product of prime factors with exponents. **6.N.1.5** Determine greatest common factors and least common multiples. Use common factors and common multiples to calculate with fractions and find equivalent fractions.

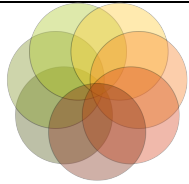**Sample Problems or Classroom Activities**

FORTHCOMING
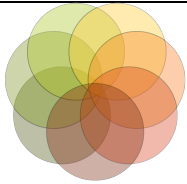
Number and Operations

6.N.2 Apply mathematical actions and processes to understand the concept of ratio and its relationship to fractions and percents and to the multiplication and division of whole numbers. Use ratios to solve real-world and mathematical problems.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**6.N.2.1** Identify and use ratios to compare quantities and use scaling up to solve problems. Show that percents can be written as several ratios and that comparing quantities using ratios is not the same as comparing quantities using subtraction. **6.N.2.2** Determine the unit rate for ratios of quantities with different units.

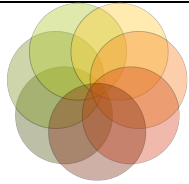**Sample Problems or Classroom Activities**

FORTHCOMING

Number and Operations

6.N.3 Apply mathematical actions and processes to multiply and divide decimals, fractions and mixed numbers; solve real-world and mathematical problems using arithmetic with positive rational numbers.

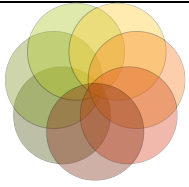| Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**6.N.3.1** Estimate solutions to problems with whole numbers, decimals, fractions, and mixed numbers and use the estimates to assess the reasonableness of results in the context of the problem. **6.N.3.2** Using the meanings of fractions, meanings of whole number multiplication and division, and inverse relationships to model multiplication and division of fractions and decimals using a variety of representations (e.g., fraction strips, area models, number lines, Cuisenaire rods). **6.N.3.3** Multiply and divide fractions and decimals, using efficient and generalizable procedures, including standard algorithms. **6.N.3.4** Solve real-world and mathematical problems including those involving money, measurement, geometry, and data requiring arithmetic with decimals, fractions and mixed numbers.

Sample Problems or Classroom Activities

FORTHCOMING

Geometry and Measurement

6.GM.1 Apply mathematical actions and processes to calculate perimeter and area of two- dimensional figures to solve real-world and mathematical problems.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**6.GM.1.1** Develop and use formulas for the area of quadrilaterals (e.g., squares, rectangles, rhombi, parallelograms, trapezoids, kites) using a variety of methods including the formula.

Sample Problems or Classroom Activities

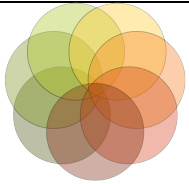FORTHCOMING

Geometry and Measurement

6.GM.2 Apply mathematical actions and processes to understand and use relationships between angles in geometric figures.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**6.GM.2.1** Solve problems using the relationships between the angles formed by intersecting lines, including vertical, supplementary, and complementary angles. **6.GM.2.2** Determine missing angle measures in a triangle using the fact that the sum of the interior angles of a triangle is 180˚. Use models of triangles to illustrate this fact.

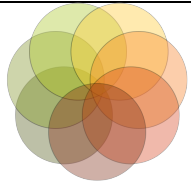**Sample Problems or Classroom Activities**

FORTHCOMING

Geometry and Measurement

6.GM.3 Apply mathematical actions and processes to choose appropriate units of measurement and use ratios to convert within measurement systems to solve real-world and mathematical problems.
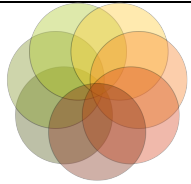
Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**6.GM.3.1** Solve problems in various contexts involving conversion of weights, capacities, geometric measurements and times within measurement systems using appropriate units.

Sample Problems or Classroom Activities

FORTHCOMING

Data and Probability

6.D.1 Apply mathematical actions and processes to display and interpret data, including box and whisker plots.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**6.D.1.1** For a given set of data, explain and defend which measure of central tendency (mean, median, and mode) would provide the most descriptive information. **6.D.1.2** Create and analyze box and whisker plots exploring how each segment contains ¼ of the data.

Sample Problems or Classroom Activities

FORTHCOMING

Data and Probability

6.D.2 Apply mathematical actions and processes to use probabilities to solve real-world and mathematical problems: represent probabilities using fractions, decimals, and percents.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**6.D.2.1** Determine the sample space (set of possible outcomes) for a given experiment and determine which members of the sample space are related to certain events. Sample space may be determined by the use of tree diagrams, tables or pictorial representations. **6.D.2.2** Perform experiments for situations in which the probabilities are known, compare the resulting relative frequencies with the known probabilities; know that there may be differences.

Sample Problems or Classroom Activities

Example 6.D.2.2

Repeatedly draw colored chips with replacement from a bag with an unknown mixture of chips, record relative frequencies, and use the results to make predictions about the contents of the bag.

MORE FORTHCOMING

Oklahoma Academic Standards for Mathematics
7th Grade

The seventh-grade standards continue the transition from an emphasis placed on whole number arithmetic in the elementary grades to an increased emphasis on algebra and geometry with some data analysis and probability. Students who complete seventh grade are prepared to study pre-algebra in eighth grade. Topics in grade seven include integer concepts and computation, proportional reasoning, and two-step linear equations. There is also a continued emphasis on multiple representations of functions. Students will apply the properties of real numbers to solve both equations and inequalities. Students will display and interpret meaningful data in a variety of ways. They will also begin to use proportional reasoning to draw conclusions and make predictions about relative frequencies of outcomes based on probability.

Problem solving has been integrated throughout the content strands. The development of problem solving skills should be a major goal of the mathematics program at every grade level. Experience with the process of problem solving will need to be integrated early and continuously into each student's mathematics education. Students must be helped to develop a wide range of skills and strategies for solving a variety of problem types.

While learning mathematics, students should be actively engaged, using concrete materials and appropriate technologies such as calculators and computers. However, facility in the use of technology should not be regarded as a substitute for a student's understanding of quantitative concepts and relationships or for proficiency and fluency with basic computations.
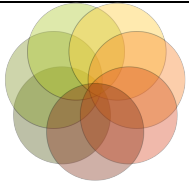
Mathematics has its own language, and the acquisition of specialized vocabulary and language patterns is crucial to a student's understanding, appreciation of, disposition for the subject. Students should be encouraged to correctly use the concepts, skills, symbols, and vocabulary identified in the following set of standards.

Algebraic Reasoning and Algebra

7.A.1 Apply mathematical actions and processes to create and use patterns, tables, graphs and rules to solve real-world and mathematical problems.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**7.A.1.1** Create and use rules, tables, spreadsheets and graphs to describe patterns of change and make predictions and generalizations about real-world and mathematical problems; translate between any two of these representations.

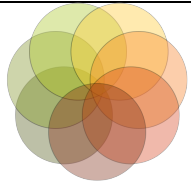**Sample Problems or Classroom Activities**

FORTHCOMING

Algebraic Reasoning and Algebra

7.A.2 Apply mathematical actions and processes to use number sense, the properties of operations, and algebraic reasoning to identify, simplify, and solve simple linear equations and inequalities.

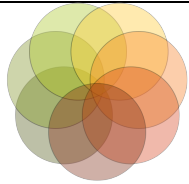| Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**7.A.2.1** Write and solve two-step linear equations with one variable using number sense, the properties of operations, and the properties of equality. **7.A.2.2** Model, write, solve, and graph one-step linear inequalities with one variable.

Sample Problems or Classroom Activities

FORTHCOMING

Algebraic Reasoning and Algebra

7.A.3 Apply mathematical actions and processes to use ratios to solve real-world and mathematical problems.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**7.A.3.1** Apply the relationship between ratios, equivalent fractions and percents to solve problems in various contexts, including those involving mixtures and concentrations. **7.A.3.2** Use scaling up, scale factor, and unit rate reasoning to solve ratio and rate problems.

Sample Problems or Classroom Activities

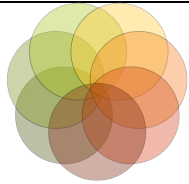FORTHCOMING

Algebraic Reasoning and Algebra

7.A.4 Apply mathematical actions and processes to use order of operations and algebraic properties to generate equivalent numerical and algebraic expressions containing positive and negative rational numbers and grouping symbols; evaluate such expressions.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**7.A.4.1** Use properties of algebra to generate equivalent numerical and algebraic expressions containing rational numbers, grouping symbols and whole number exponents. Properties of algebra include associative, commutative and distributive laws. **7.A.4.2** Apply understanding of order of operations and grouping symbols when using calculators and other technologies.

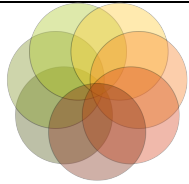**Sample Problems or Classroom Activities**

FORTHCOMING

Algebraic Reasoning and Algebra

7.A.5 Apply mathematical actions and processes to represent real-world and mathematical situations using equations with variables. Solve equations symbolically, using the properties of equality. Also solve equations graphically and numerically. Interpret solutions in the original context.

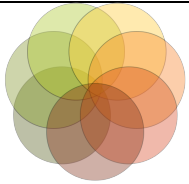| Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**7.A.5.1** Represent relationships in various contexts with equations involving variables and positive and negative rational numbers. Use the properties of equality to solve for the value of a variable. Interpret the solution in the original context. **7.A.5.2** Solve equations resulting from proportional relationships in various contexts.

Sample Problems or Classroom Activities

FORTHCOMING

Number and Operations

7.N.1 Apply mathematical actions and processes to read, write, represent and compare positive and negative rational numbers, expressed as integers, fractions and decimals.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**7.N.1.1** Know that every rational number can be written as the ratio of two integers or as a terminating or repeating decimal. Recognize that π is not rational, but that it can be approximated by rational numbers such as $\frac{22}{7}$ and 3.14. **7. N.1.2** Locate positive and negative rational numbers on a number line and understand the concept of opposites. **7.N.1.3** Compare and order positive and negative rational numbers expressed in various forms using the symbols <, >, =, ≤, and ≥.

Sample Problems or Classroom Activities

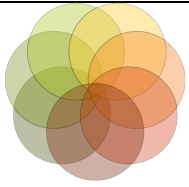FORTHCOMING

Number and Operations

7.N.2 Apply mathematical actions and processes to calculate with positive and negative rational numbers, and rational numbers with whole number exponents, to solve real-world and mathematical problems.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**7.N.2.1** Use real-world contexts and the inverse relationship between addition and subtraction to explain why the procedures of arithmetic with negative rational numbers make sense. **7.N.2.2** Model addition, subtraction, multiplication and division of positive and negative integers using a variety of representations (e.g., two-color counters, number lines). **7.N.2.3** Add, subtract, multiply and divide positive and negative rational numbers that are integers, fractions and terminating decimals; use efficient and generalizable procedures, including standard algorithms. **7.N.2.4** Raise integers to whole number exponents. **7.N.2.5** Solve real-world and mathematical problems involving calculations with positive and negative rational numbers and positive integer exponents. **7.N.2.6** Demonstrate an understanding of the relationship between the absolute value of a rational number and distance on a number line. Use the symbol for absolute value. **7.N.2.7** Calculate the percent of a number and determine what percent one number is of another number to solve problems in various contexts (e.g., sales tax, markup, discount, percent error, tip).

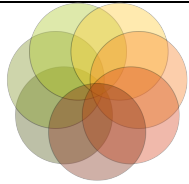**Sample Problems or Classroom Activities**

FORTHCOMING

Geometry and Measurement

7.GM.1 Apply mathematical actions and processes to analyze the effect of change of scale, translations and reflections on the attributes of two-dimensional figures.

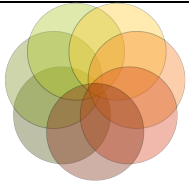| Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**7.GM.1.1** Describe the properties of similarity, compare geometric figures for similarity, and determine scale factors. **7.GM.1.2** Apply scale factors, length ratios and area ratios to determine side lengths and areas of similar geometric figures. **7.GM.1.3** Use proportions and ratios to solve problems involving scale drawings and conversions of measurement units. **7.GM.1.4** Graph and describe translations and reflections of figures on a coordinate grid and determine the coordinates of the vertices of the figure after the transformation.
Sample Problems or Classroom Activities	

FORTHCOMING

Geometry and Measurement

7.GM.2 Apply mathematical actions and processes to use reasoning with proportions and ratios to determine measurements, justify formulas, and solve real-world and mathematical problems involving circles and related geometric figures.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**7.GM.2.1** Demonstrate an understanding of the proportional relationship between the diameter and circumference of a circle and that the unit rate (constant of proportionality) is π and can be approximated by rational numbers such as $\frac{22}{7}$ and 3.14. **7.GM.2.2** Calculate the circumference and area of circles to solve problems in various contexts.

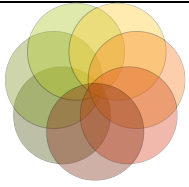**Sample Problems or Classroom Activities**

FORTHCOMING

Geometry and Measurement

7.GM.3 Apply mathematical actions and processes to develop and understand the concept of surface area and volume of three-dimensional figures.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**7.GM.3.1** Develop the concept that the volume of a three-dimensional figure can be found by counting the total number of same-sized cubic units that fill a shape without gaps or overlaps and that surface area of a three-dimensional figure can be found by wrapping the figure with same-sized cubic units without gaps or overlap. **7.GM.3.2** Use various tools and strategies to measure the volume and surface area of rectangular prisms. Use cubic units to label volume measurements.

Sample Problems or Classroom Activities

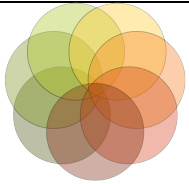FORTHCOMING

Data and Probability

7.D.1 Apply mathematical actions and processes to display and interpret data in a variety of ways, including circle graphs and histograms.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**7.D.1.1** Design simple experiments, collect data and calculate measures of central tendency (mean, median, and mode) and spread (range). Use these quantities to draw conclusions about the data collected and make predictions. **7.D.1.2** Use reasoning with proportions to display and interpret data in circle graphs (pie charts) and histograms. Choose the appropriate data display and know how to create the display using a spreadsheet or other graphing technology.

Sample Problems or Classroom Activities

FORTHCOMING

Data and Probability

7.D.2 Apply mathematical actions and processes to calculate probabilities and reason about probabilities using proportions to solve real-world and mathematical problems.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**7.D.2.1** Determine the probability of an event using the ratio between the size of the event and the size of the sample space; represent probabilities as percents, fractions and decimals between 0 and 1 inclusive. Understand that probabilities measure likelihood. **7.D.2.2** Use proportional reasoning to draw conclusions about and predict relative frequencies of outcomes based on probabilities.

Sample Problems or Classroom Activities

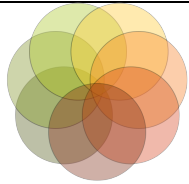FORTHCOMING

Oklahoma Academic Standards for Mathematics
Pre-Algebra

The pre-algebra standards prepare students for success in Algebra I. Students will gain proficiency in computation with rational numbers and deepen their understanding of functions. Students will recognize linear functions in real-world and mathematical situations including distinguishing between multiple representations of linear and nonlinear functions. They will represent relations and functions in multiple way including tables, graphs, and rules. Students will solve multi-step equations and inequalities symbolically and graphically. Students will verify and apply the Pythagorean Theorem, as well as calculate the surface area and volume of rectangular prisms and right circular cylinders. They will solve problems involving parallel and perpendicular lines. Finally, students will use measures of center, spread and lines of best fit to draw conclusions and make predictions, and interpret data using scatterplots.

Problem solving has been integrated throughout the content strands. The development of problem solving skills should be a major goal of the mathematics program at every grade level. Experience with the process of problem solving will need to be integrated early and continuously into each student's mathematics education. Students must be helped to develop a wide range of skills and strategies for solving a variety of problem types.

While learning mathematics, students should be actively engaged, using concrete materials and appropriate technologies such as calculators and computers. However, facility in the use of technology should not be regarded as a substitute for a student's understanding of quantitative concepts and relationships or for proficiency and fluency with basic computations.

Mathematics has its own language, and the acquisition of specialized vocabulary and language patterns is crucial to a student's understanding, appreciation of, disposition for the subject. Students should be encouraged to correctly use the concepts, skills, symbols, and vocabulary identified in the following set of standards.
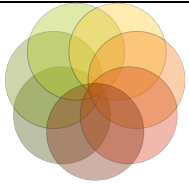
Algebraic Reasoning and Algebra

PA.A.1 Apply mathematical actions and processes to understand the concept of function in real-world and mathematical situations, and distinguish between linear and nonlinear functions.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**PA.A.1.1** Identify that a function is a relationship between an independent variable and a dependent variable in which the value of the independent variable determines the value of the dependent variable. Use functional notation, such as $f(x)$, to represent such relationships. **PA.A.1.2** Use linear functions to represent relationships in which changing the input variable by some amount leads to a change in the output variable that is a constant times that amount. **PA.A.1.3** Identify a function as linear if it can be expressed in the form $f(x)=mx+b$ or if its graph is a straight line.

Sample Problems or Classroom Activities

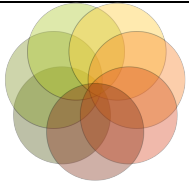FORTHCOMING

Algebraic Reasoning and Algebra

PA.A.2 Apply mathematical actions and processes to recognize linear functions in real-world and mathematical situations; represent linear functions and other functions with tables, verbal descriptions, symbols and graphs; solve problems involving these functions and explain results in the original context.

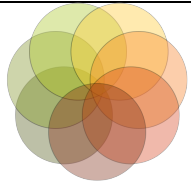| Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Solving Diverse Problems • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**PA.A.2.1** Represent linear functions with tables, verbal descriptions, symbols, equations and graphs; translate from one representation to another. **PA.A.2.2** Identify, describe, and analyze linear relationships between two variables (e.g., as the value of x increases on a table, do the values of y increase or decrease, identify a positive rate of change on a graph and compare it to a negative rate of change). **PA.A.2.3** Identify graphical properties of linear functions including slopes and intercepts. Know that the slope equals the rate of change, and that the y-intercept is zero when the function represents a proportional relationship. **PA.A.2.4** Predict the effect on the graph of a linear equation when the slope or y-intercept changes (e.g., make predictions from graphs, identify the slope or y-intercept in the equation y = mx + b and relate to a graph). Know how to use graphing technology to examine these effects. **PA.A.2.5** Using data generated from an arithmetic sequence (e.g., tables, graphs, and verbal descriptions), write a linear function representing the data.

Sample Problems or Classroom Activities

FORTHCOMING

Algebraic Reasoning and Algebra

PA.A.3 Apply mathematical actions and processes to generate equivalent numerical and algebraic expressions and use algebraic properties to evaluate expressions.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Solving Diverse Problems • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**PA.A.3.1** Evaluate algebraic expressions using a variety of methods including modeling and substitution. **PA.A.3.2** Justify steps in generating equivalent expressions by identifying the properties used, including the properties of algebra. Properties include the associative, commutative and distributive laws, and the order of operations, including grouping symbols.

Sample Problems or Classroom Activities

FORTHCOMING

Algebraic Reasoning and Algebra

PA.A.4 Apply mathematical actions and processes to represent real-world and mathematical situations using equations and inequalities involving linear expressions. Solve and graph equations and inequalities symbolically and graphically. Interpret solutions in the original context.

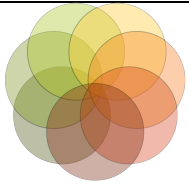| Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Solving Diverse Problems • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**PA.A.4.1** Model, write, and solve multi-step linear equations with one variable using a variety of methods to solve application problems. **PA.A.4.2** Graph and interpret the solution to one- and two-step linear equations on a number line with one variable and on a coordinate plane with two variables. **PA.A.4.3** Solve multi-step equations in one variable. Graph the solution on a number line. Justify the steps by identifying the properties of equalities used. **PA.A.4.4** Model, write, solve, and graph one- and two-step linear inequalities with one variable. **PA.A.4.5** Express linear equations in slope-intercept, point-slope and standard forms, and convert between these forms. Given sufficient information, find an equation of a line. **PA.A.4.6** Solve linear inequalities with one variable using properties of inequalities. Graph the solutions on a number line. **PA.A.4.7** Use the relationship between square roots and squares of a number to solve problems. **PA.A.4.8** Apply appropriate formulas to solve problems (e.g., d=rt, I=prt).

	PA.A.4.9 Represent and create real-world situations using equations and inequalities involving one variable.

Sample Problems or Classroom Activities

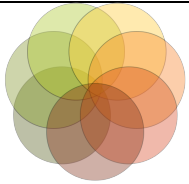FORTHCOMING

Number and Operations

PA.N.1 Apply mathematical actions and processes to read, write, compare, classify and represent real numbers, and use them to solve problems in various contexts.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Solving Diverse Problems • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**PA.N.1.1** Develop and apply the properties of positive and negative integer exponents to generate equivalent numerical expressions, including $a^0 = 1$. **PA.N.1.2** Express approximations of very large and very small numbers using scientific notation; understand how calculators display numbers in scientific notation. Multiply and divide numbers expressed in scientific notation, express the answer in scientific notation, using the correct number of significant digits when physical measurements are involved. **PA.N.1.3** Classify real numbers as rational or irrational. Recognize when a square root of a positive integer is not an integer, then it is irrational. Recognize that the sum of a rational number and an irrational number is irrational, and the product of a non-zero rational number and an irrational number is irrational. **PA.N.1.4** Compare real numbers; locate real numbers on a number line. Identify the square root of a perfect square to 169 or, if it is not a perfect square root, locate it as a real number between two consecutive positive integers.

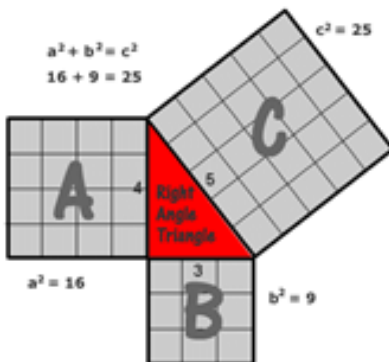**Sample Problems or Classroom Activities**

FORTHCOMING

Geometry and Measurement

PA.GM.1 Apply mathematical actions and processes to solve problems involving right triangles using the Pythagorean Theorem.
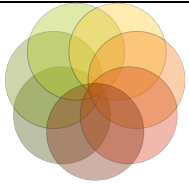
Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Solving Diverse Problems • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**PA.GM.1.1** Informally justify the Pythagorean Theorem using measurements, diagrams and computer software and use the Pythagorean Theorem to solve problems involving right triangles. **PA.GM.1.2** Determine the distance between two points on a horizontal or vertical line in a coordinate system. Use the Pythagorean Theorem to find the distance between any two points in a coordinate system.

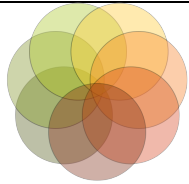## Sample Problems or Classroom Activities

Example for PA.GM.1.1

MORE FORTHCOMING

Geometry and Measurement

PA.GM.2 Apply mathematical actions and processes to solve problems involving parallel and perpendicular lines on a coordinate system.
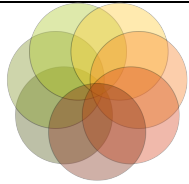
Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Solving Diverse Problems • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**PA.GM.2.1** Understand and apply the relationships between the slopes of parallel lines and between the slopes of perpendicular lines. Dynamic graphing software may be used to examine these relationships. **PA.GM.2.2** Given a line on a coordinate system and the coordinates of a point not on the line, find lines through that point that are parallel and perpendicular to the given line, symbolically and graphically.

Sample Problems or Classroom Activities

FORTHCOMING

Geometry and Measurement

PA.GM.3 Apply mathematical actions and processes to calculate surface area and volume of three-dimensional figures.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Solving Diverse Problems • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**PA.GM.3.1** Develop and use the formulas $V = \ell wh$ and $V = Bh$ to determine the volume of rectangular prisms. Justify why base area B and height h are multiplied to find the volume of a rectangular prism by breaking the prism into layers of unit cubes. **PA.GM.3.2** Develop and use the formulas $V = Bh$ and $V = \pi r^2 h$ to determine the volume of right cylinders. Justify why base area B and height h are multiplied to find the volume of a right cylinder by breaking the cylinder into an infinite number of layers of circles with radius r. **PA.GM.3.3** Calculate the surface area and volume of rectangular prisms and cylinders using appropriate units, such as cm² and cm³. Justify the formulas used. Justification may involve decomposition, nets or other models.

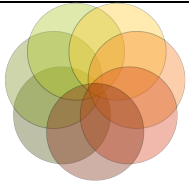**Sample Problems or Classroom Activities**

FORTHCOMING

Data and Probability

PA.D.1 Apply mathematical actions and processes to display and interpret data in a variety of ways, including using scatterplots and approximate lines of best fit. Use lines of best fit to draw conclusions about data.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Solving Diverse Problems • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**PA.D.1.1** Describe the impact that inserting or deleting a data point has on the mean and the median of a data set. Know how to create data displays using a spreadsheet and use a calculator to examine this impact. **PA.D.1.2** Collect, display and interpret data using scatterplots. Use the shape of the scatterplot to informally estimate a line of best fit and determine an equation for the line. Use appropriate titles, labels and units. Know how to use graphing technology to display scatterplots and corresponding lines of best fit. **PA.D.1.3** Use a line of best fit to make statements about approximate rate of change and to make predictions about values not in the original data set and assess the reasonableness of predictions using scatterplots by interpreting them in the original context.

Sample Problems or Classroom Activities

FORTHCOMING

Data and Probability

PA.D.2 Apply mathematical actions and processes to calculate experimental probabilities and reason about probabilities to solve real-world and mathematical problems.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Solving Diverse Problems • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**PA.D.2.1** Calculate experimental probabilities from experiments; represent them as percents, fractions and decimals between 0 and 1 inclusive. Use experimental probabilities to make predictions when actual probabilities are unknown.

Sample Problems or Classroom Activities

FORTHCOMING

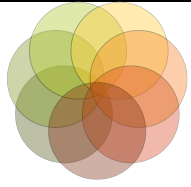# Oklahoma Academic Standards for Mathematics
Algebra I

The Algebra 1 standards are divided into four strands: Number and Operations, Algebraic Reasoning and Algebra, Data and Probability, and Functions. The Number and Operation strand highlights the understanding of irrational numbers in radical form. The Algebraic Reasoning and Algebra strand emphasizes the representation and solving of real world and mathematical situations using linear equations and inequalities, the ability to evaluate algebraic expressions and to generate equivalent expressions, and the analysis of change in various contexts by applying the concept of slope. The Data and Probability strand's focus is the displaying of data in various forms and comparing data as well as the calculation of probability by applying counting procedures, using Venn diagrams, and using experimental data. Finally the expectation of the Function strand is that students will determine if a relation is a function, use function notation, and interpret graphs of functions. The Algebra I course should be taught in such a way as to help students transition from the concrete to the abstract and to make connections with practical applications to attach meaning to the abstract concepts of algebra.

Problem solving has been integrated throughout the content strands. The development of problem solving skills should be a major goal of the mathematics program at every grade level. Experience with the process of problem solving will need to be integrated early and continuously into each student's mathematics education. Students must be helped to develop a wide range of skills and strategies for solving a variety of problem types.

While learning mathematics, students should be actively engaged, using concrete materials and appropriate technologies such as calculators and computers. However, facility in the use of technology should not be regarded as a substitute for a student's understanding of quantitative concepts and relationships or for proficiency and fluency with basic computations.

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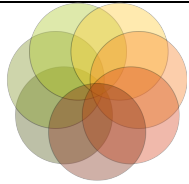
Number and Operations

A1.N.1 Apply mathematical actions and processes to understand irrational numbers in radical form.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**A1.N.1.1** Simplify radicals with or without variables. **A1.N.1.2** Add, subtract, and multiply radicals with or without variables, and divide radicals without variables.

Sample Problems or Classroom Activities

FORTHCOMING

Algebraic Reasoning and Algebra

A1.A.1 Apply mathematical actions and processes to represent real-world and mathematical situations using equations and inequalities involving linear expressions. Students will solve equations and inequalities symbolically and graphically and interpret solutions in the original context.

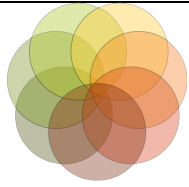| Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**A1.A.1.1** Solve equations symbolically and graphically. **A1.A.1.1a** Solve real-world problems by using first-degree equations (i.e. using monomial or binomial expressions as angle measures with vertical, complementary, supplementary angles, geometric formulas, science, or statistics). **A1.A.1.1b** Solve linear equations and absolute value equations by graphing, or using properties of equality. **A1.A.1.1c** Solve systems of linear equations by graphing, substitution, and elimination. **A1.A.1.2** Solve inequalities symbolically and graphically. **A1.A.1.2a** Match inequalities (with 1 or 2 variables) to a graph, table, or situation and vice versa. **A1.A.1.2b** Solve linear inequalities and absolute value inequalities by graphing or using properties of inequalities. **A1.A.1.2c** Solve systems of linear inequalities with two variables. **A1.A.1.2d** Represent relationships in various contexts with inequalities involving the absolute value of a linear expression. Solve these inequalities and graph the solutions on a number line.

Sample Problems or Classroom Activities

FORTHCOMING
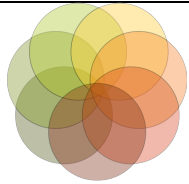
Algebraic Reasoning and Algebra

A1.A.2 Apply mathematical actions and processes to generate equivalent algebraic expressions and use algebraic properties to evaluate expressions with and without the use of technology.
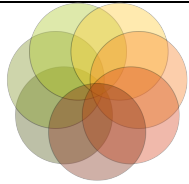
Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**A1.A.2.1** Solve literal equations involving several variables for one variable in terms of the others. **A1.A.2.2** Connect various representations of a linear equation (slope-intercept, point-slope, and standard forms) and manipulate to fit given context. **A1.A.2.3** Develop the equation of a line and graph linear relationships given the following: slope and y-intercept, slope and one-point on the line, two points on the line, x-intercept and y-intercept, a set of data points. **A1.A.2.4** Simplify and evaluate linear, absolute value, rational and radical expressions. **A1.A.2.5** Simplify polynomials by adding, subtracting or multiplying. **A1.A.2.6** Recognize, write and find the nth term of arithmetic sequences using proper notation.

Sample Problems or Classroom Activities

FORTHCOMING

Algebraic Reasoning and Algebra

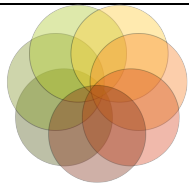**A1.A.3 Apply mathematical actions and processes to analyze mathematical change in various contexts.**

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**A1.A.3.1** Calculate the slope of a line using a graph, an equation, two points or a set of data points. **A1.A.3.2** Use the slope to differentiate between lines that are parallel, perpendicular, horizontal, or vertical. **A1.A.3.3** Interpret the slope and intercepts within the context of everyday life (e.g., telephone charges base on base rate [y-intercept] plus rate per minute [slope]). **A1.A.3.4** Relate a graph to a situation described qualitatively in terms of faster change or slower change.
Sample Problems or Classroom Activities	

FORTHCOMING

Functions

A1.F.1 Apply mathematical actions and processes to understand functions as descriptions of how related quantities vary together (covariation).
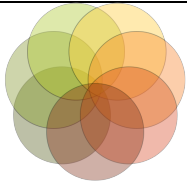
Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**A1.F.1.1** Distinguish between relations and functions using various methods including the vertical line test and the definition of a function. **A1.F.1.2** Identify dependent and independent variables, domain and range in terms of valid input and output, and in terms of function graphs. **A1.F.1.3** Write a linear function using function notation and explain its use in terms of a situational context. **A1.F.1.4** Read and interpret linear piecewise graphs (for example, absolute values), excluding step functions.
Sample Problems or Classroom Activities FORTHCOMING	

Functions

A1.F.2 Apply mathematical actions and processes to understand that families of functions are characterized by their type of rate of change.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**A1.F.2.1** Distinguish between linear and nonlinear data through tables, graphs, equations, and real-world situations. **A1.F.2.2** Recognize the parent graph of the functions f(x)=k, f(x)=x, f(x)=abs(x), and predict the effects of transformations symbolically and graphically on the parent graph using various methods and tools which may include graphing calculators.

Sample Problems or Classroom Activities

FORTHCOMING

Functions

A1.F.3 Apply mathematical actions and processes to understand functions can be combined arithmetically and in some cases will have an inverse.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**A1.F.3.1** Add, subtract, and multiply polynomial functions.

Sample Problems or Classroom Activities

FORTHCOMING

Functions

A1.F.4 Apply mathematical actions and processes to understand functions can be represented in multiple ways.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**A1.F.4.1** Evaluate a function using tables, equations and graphs and, when possible, interpret the results in terms of the situational context. **A1.F.4.2** Identify matching linear equations, graphs, tables, and situations.
Sample Problems or Classroom Activities FORTHCOMING		

Data and Probability
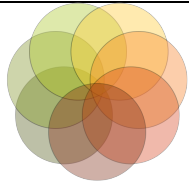
A1.D.1 Apply mathematical actions and processes to display and analyze data.

Mathematical Actions and Processes	Mathematical Standard
- Develop a Deep and Flexible Conceptual Understanding - Develop Accurate and Appropriate Procedural Fluency - Develop Strategies for Problem Solving - Develop Mathematical Reasoning - Develop a Productive Mathematical Disposition - Develop the Ability to Make Conjectures, Model, and Generalize - Develop the Ability to Communicate Mathematically	**A1.D.1.1** Describe a data set using data displays, describe and compare data sets using summary statistics, including measures of center, location and spread. Measures of center and location include mean, median, and percentile. Measures of spread include standard deviation, and range. Know how to use calculators, spreadsheets or other appropriate technology to display data and calculate summary statistics. **A1.D.1.2** Collect and use scatterplots to analyze patterns and describe linear relationships between two variables. Using graphing technology, determine regression lines and correlation coefficients; use regression lines to make predictions and correlation coefficients to assess the reliability of those predictions. **A1.D.1.3** Interpret graphs as being discrete or continuous based upon the context of the problem/situation.

Sample Problems or Classroom Activities

FORTHCOMING

Data and Probability

A1.D.2 Apply mathematical actions and processes to calculate probabilities and apply probability concepts.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**A1.D.2.1** Select and apply counting procedures, such as the multiplication and addition principles and tree diagrams, to determine the size of a sample space (the number of possible outcomes) and to calculate probabilities. **A1.D.2.2** Describe the concepts of intersections, unions and complements using Venn diagrams to evaluate probabilities. Understand the relationships between these concepts and the words AND, OR, NOT, as used in computerized searches and spreadsheets. **A1.D.2.3** Calculate experimental probabilities by performing simulations or experiments involving a probability model and using relative frequencies of outcomes. **A1.D.2.4** Apply probability concepts to real-world situations to make informed decisions.

Sample Problems or Classroom Activities

Example for A1.D.2.2

*Braums is testing out two new ice cream flavors, Pumpkin and Cotton Candy. A poll conducted by Braums showed that 32 customers liked Pumpkin, 58 customers liked Cotton Candy, 12 liked both flavors, and 22 liked neither flavor. What is the **probability** that one of those customers selected at random would like Cotton Candy?*
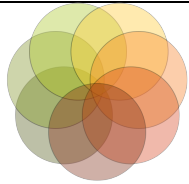
Oklahoma Academic Standards for Mathematics
Geometry

The study of geometry allows students to discover relationships of geometric figures through investigations of properties, lines, congruent and similar polygons, circles, three-dimensional objects, transformations, and right triangle trigonometry. This course emphasizes the use of logical reasoning skills in order to develop and justify mathematical arguments. Students use a variety of problem-solving techniques, including geometric models, proofs, and algebraic reasoning in order to develop an understanding of these standards. Calculators, computers, graphing utilities, dynamic geometry software, and other appropriate technology tools can be used to assist in teaching and learning.

Problem solving has been integrated throughout the content strands. The development of problem solving skills should be a major goal of the mathematics program at every grade level. Experience with the process of problem solving will need to be integrated early and continuously into each student's mathematics education. Students must be helped to develop a wide range of skills and strategies for solving a variety of problem types.

While learning mathematics, students should be actively engaged, using concrete materials and appropriate technologies such as calculators and computers. However, facility in the use of technology should not be regarded as a substitute for a student's understanding of quantitative concepts and relationships or for proficiency and fluency with basic computations.
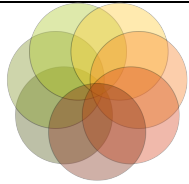
Mathematics has its own language, and the acquisition of specialized vocabulary and language patterns is crucial to a student's understanding, appreciation of, disposition for the subject. Students should be encouraged to correctly use the concepts, skills, symbols, and vocabulary identified in the following set of standards.

Geometry (Logic and Reasoning)

G.1 Apply mathematical actions and processes to use appropriate tools and logic to evaluate mathematical arguments.
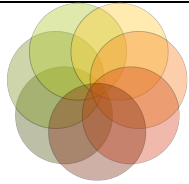
Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**G.1.1** Understand the roles of axioms, postulates, definitions, undefined terms and theorems in logical arguments. **G.1.2** Analyze and draw conclusions based on a set of conditions. Recognize the logical relationships between an "if…then" statement and its inverse, converse and contrapositive. **G.1.3** Assess the validity of a logical argument and give counterexamples to disprove a statement. **G.1.4** Construct logical arguments and write proofs of theorems and other results in geometry, including proofs by contradiction. Express proofs in a form that clearly justifies the reasoning, such as two-column proofs, paragraph proofs, flow charts or illustrations.

Sample Problems or Classroom Activities

FORTHCOMING

Geometry (Line and Angle Relationships)

G.2 Apply mathematical actions and process to discover and validate the relationships between lines and angles using theorems and postulates of parallel and perpendicular lines.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**G.2.1** Know and apply properties of parallel and perpendicular lines, including properties of angles formed by a transversal, to solve problems and determine if two lines are parallel, and logically justify results using algebraic and deductive proofs. **G.2.2** Know and apply properties of angles, including corresponding, exterior, interior, vertical, complementary and supplementary angles, to solve algebraic and geometric problems, discover unknowns, and logically justify results.

**Sample Problems or Classroom Activities**

FORTHCOMING

Geometry (2-Dimensional Shapes)

G.3 Apply mathematical actions and process to develop and evaluate mathematical arguments about polygons and transformed shapes.

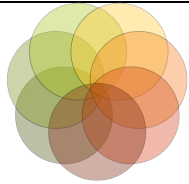| Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**G.3.1** Discover the Interior and Exterior Angle Sum Theorems, and use them to solve problems and logically justify results. **G.3.2** Discover the properties of quadrilaterals and use them to solve problems involving angles and side lengths, and logically justify results. **G.3.3** Discover the properties of polygons and use them to solve problems involving perimeter and area, and logically justify results. **G.3.4** Know and apply properties of congruent and similar figures to solve problems and logically justify results. **G.3.5** Use numeric, graphic and symbolic representations of transformations in two dimensions, such as reflections, translations, dilations and rotations about the origin by multiples of 90˚, to solve problems involving figures on a coordinate grid.

Sample Problems or Classroom Activities

FORTHCOMING
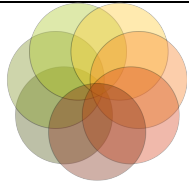
Geometry (Circles)

G.4 Apply mathematical actions and process to develop relationships and conduct investigations of circles involving lines and angles.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**G.4.1** Discover and use the properties of circles to solve problems involving circumference and area, and logically justify results. **G.4.2** Discover and use properties of circles and relationships among angles, arcs, and distances in a circle to define them, solve problems and logically justify results. **G.4.3** Extend the distance formula to develop the equation for the graph of a circle with radius r and center (h, k), $(x - h)^2 + (y - k)^2 = r^2$.

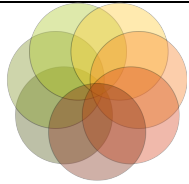**Sample Problems or Classroom Activities**

FORTHCOMING

Geometry (Elementary Trigonometry)

G.5 Apply mathematical actions and process to develop and verify mathematical relationships of right triangles and trigonometric ratios.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize Develop the Ability to Communicate Mathematically	**G.5.1** Apply the Pythagorean Theorem and its converse to solve problems and logically justify results, including Pythagorean Triples. **G.5.2** Explore and develop the distance formula based on the Pythagorean Theorem. **G.5.3** Discover, verify, and apply properties of right triangles, including properties of 45-45-90 and 30-60-90 triangles, to solve problems and logically justify results. **G.5.4** Understand how the properties of similar right triangles allow the trigonometric ratios to be defined, and determine the sine, cosine and tangent of an acute angle in a right triangle. **G.5.5** Apply the trigonometric ratios (sine, cosine and tangent) to solve problems, such as determining lengths in right triangles and in figures that can be decomposed into right triangles. Know how to use calculators or other appropriate technology to evaluate trigonometric ratios.

Sample Problems or Classroom Activities

FORTHCOMING

Geometry (3-Dimensional Shapes)

G.6 Apply mathematical actions and processes to develop and apply a variety of problem solving strategies to investigate 3-dimensional figures.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**G.6.1** Compose and decompose two- and three-dimensional figures; use decomposition to determine the perimeter, area, surface area and volume of various figures. **G.6.2** Determine the surface area and volume of prisms, cylinders, pyramids, cones and spheres. Use measuring devices or formulas as appropriate. **G.6.3** Use ratios of similar 3-dimensional figures to determine unknown values, such as angles, side lengths, perimeter or circumference of a face, area of a face, and volume. **G.6.4** Understand and apply the fact that dilations can be conveyed by the effect of a scale factor k on length, area and volume, multiplied by k, k^2 and k^3, respectively.

Sample Problems or Classroom Activities

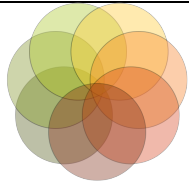FORTHCOMING

Oklahoma Academic Standards for Mathematics
Algebra II

The standards for Algebra 2 are divided into four strands: Number and Operations, Algebraic Reasoning and Algebra, Data and Probability, and Functions. The Number and Operation strand focuses on the understanding of rational exponents, complex numbers, and presenting and manipulating data in matrix form. The Algebraic Reasoning and Algebra strand emphasizes the representation and solving of real world and mathematical situations using linear, quadratic, exponential, and nth root equations and inequalities, the ability to represent and analyze mathematical situations symbolically, and the analysis of change in various contexts including various representations of a parabolic equation. The Data and Probability strand's focus is the displaying and analysis of data including the application of the normal curve and linear and non-linear regression models as well as the application of probability concepts. The Function strand explores various functions including quadratic, exponential, logarithmic, rational, polynomial, radical, and piecewise.

Problem solving has been integrated throughout the content strands. The development of problem solving skills should be a major goal of the mathematics program at every grade level. Experience with the process of problem solving will need to be integrated early and continuously into each student's mathematics education. Students must be helped to develop a wide range of skills and strategies for solving a variety of problem types.

While learning mathematics, students should be actively engaged, using concrete materials and appropriate technologies such as calculators and computers. However, facility in the use of technology should not be regarded as a substitute for a student's understanding of quantitative concepts and relationships or for proficiency and fluency with basic computations.
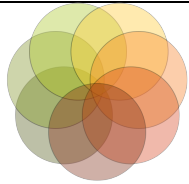
Mathematics has its own language, and the acquisition of specialized vocabulary and language patterns is crucial to a student's understanding, appreciation of, disposition for the subject. Students should be encouraged to correctly use the concepts, skills, symbols, and vocabulary identified in the following set of standards.

Number and Operations

A2.N.1 Apply mathematical actions and processes to understand and interpret expressions written with rational exponents.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**A2.N.1.1** Convert from radical notation to rational exponent and vice versa. **A2.N.1.2** Add, subtract, multiply, divide and simplify expressions containing rational exponents.

Sample Problems or Classroom Activities

FORTHCOMING

Number and Operations

A2.N.2 Apply mathematical actions and processes to understand and correctly represent complex numbers.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**A2.N.2.1** Simplify complex numbers. **A2.N.2.2** Add, subtract, multiply, divide complex numbers.

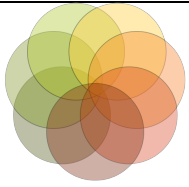## Sample Problems or Classroom Activities

Example for A2.N.2.2

Start in the green box. You may move horizontally or vertically (but not diagonally). As you traverse through the maze, continue adding the new box value to your total. The object is to find a path through the maze that will give a total of 4 - i as you reach the blue box. The total immediately preceding the blue box needs to be 4 – i.

|	$6 + 2i$	$2 + 3i$	$1 + i$
$2 + i$	$-4 - 2i$	$-7 - 6i$	$7 + 5i$
$1 - 4i$	$9 + 6i$	$8 + 3i$	

MORE FORTHCOMING

Number and Operations

A2.N.3 Apply mathematical actions and processes to represent, interpret, and manipulate data in matrix form.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**A2.N.3.1** Identify the order (dimension) of a matrix. **A2.N.3.2** Add and subtract matrices. **A2.N.3.3** Multiply a matrix by a scalar.

Sample Problems or Classroom Activities

FORTHCOMING
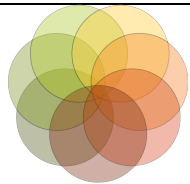
Algebraic Reasoning and Algebra

A2.A.1 Apply mathematical actions and processes to solve real-world and mathematical situations using equations and inequalities involving linear, quadratic, exponential, and nth root expressions and interpret the solutions in the original context.
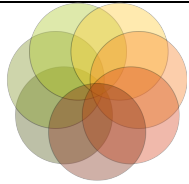
Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**A2.A.1.1** Solve quadratic equations using various methods including graphing, factoring, completing the square and the quadratic formula. **A2.A.1.2** Solve rational equations, consider domain restrictions and extraneous solutions. **A2.A.1.3** Solve equations that contain radical expressions, consider domain restrictions and extraneous solutions**.** **A2.A.1.4** Solve polynomial equations using various methods and tools which may include factoring, polynomial division, and synthetic division. **A2.A.1.5** Solve common and natural logarithmic equations using a variety of methods and tools. **A2.A.1.6** Solve systems of linear equations and inequalities using various methods and tools which may include substitution, elimination, matrices, graphing, and graphing calculators. **A2.A.1.7** Solve systems of equations containing one linear equation and one quadratic equation to solve problems. **A2.A.1.8** Assess the reasonableness of a solution in its given context and compare the solution to appropriate graphical or numerical estimates; interpret a solution in the context of the domain.

Sample Problems or Classroom Activities

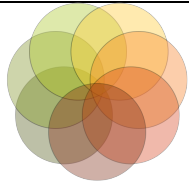FORTHCOMING

Algebraic Reasoning and Algebra

A2.A.2 Apply mathematical actions and processes to represent and analyze mathematical situations and structures using algebraic symbols. Students should be able to utilize flexible, accurate, efficient, and appropriate strategies to write equivalent forms of expressions and solve equations.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**A2.A.2.1** Factor polynomial and quadratics expressions involving common factors, trinomials, and differences of squares, using a variety of tools and strategies. **A2.A.2.2** Generate equivalent algebraic expressions involving polynomials and radicals; use algebraic properties to evaluate expressions. **A2.A.2.3** Connect various representations of a parabolic equation (vertex, factored, and standard forms) and manipulate to fit given context. **A2.A.2.4** Recognize and solve problems that can be modeled using finite geometric sequences and series, such as home mortgage and other compound interest examples. Know how to use spreadsheets and calculators to explore geometric sequences and series in various contexts. **A2.A.2.5** Use the properties of logarithms to expand and condense logarithmic expressions.

Sample Problems or Classroom Activities

FORTHCOMING

Functions

A2.F.1 Apply mathematical actions and processes to understand functions as descriptions of how related quantities vary together (covariation).

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**A2.F.1.1** Use algebraic, interval, and set notations to specify the domain and range of functions of various types. **A2.F.1.2** Graph a quadratic function and identify the x- and y- intercepts, maximum or minimum value, axis of symmetry, and vertex using various methods and tools which may include a graphing calculator. **A2.F.1.3** Model a situation that can be described by a quadratic function and use the model to answer questions about the situation. **A2.F.1.4** Graph exponential and logarithmic functions and identify asymptotes and x- and y- intercepts using various methods and tools which may include graphing calculators. Recognize exponential decay and growth graphically and symbolically. **A2.F.1.5** Model a situation that can be described by an exponential or logarithmic function and use the model to answer questions about the situation. **A2.F.1.6** Graph a polynomial function and identify the x- and y- intercepts, relative maximums and relative minimums, using various methods and tools which may include a graphing calculator. **A2.F.1.7** Model a situation that can be described by a polynomial function and use the model to answer questions about the situation.

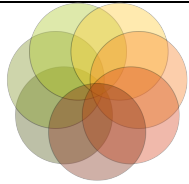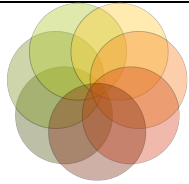|	
	A2.F.1.8 Graph a rational function and identify the x- and y- intercepts, vertical and horizontal asymptotes, using various methods and tools which may include a graphing calculator. **A2.F.1.9** Model a situation that can be described by a rational function and use the model to answer questions about the situation. **A2.F.1.10** Graph a radical function and identify the x- and y- intercepts using various methods and tools which may include a graphing calculator. **A2.F.1.11** Model a situation that can be described by a radical function and use the model to answer questions about the situation. **A2.F.1.12** Read, interpret, and model piecewise graphs, including step functions.
Sample Problems or Classroom Activities FORTHCOMING	

Functions

A2.F.3 Apply mathematical actions and processes to understand functions can be combined arithmetically and by composition and in some cases will have an inverse.

Mathematical Actions and Processes	Mathematical Standard
- Develop a Deep and Flexible Conceptual Understanding - Develop Accurate and Appropriate Procedural Fluency - Develop Strategies for Problem Solving - Develop Mathematical Reasoning - Develop a Productive Mathematical Disposition - Develop the Ability to Make Conjectures, Model, and Generalize - Develop the Ability to Communicate Mathematically	**A2.F.3.1** Add, subtract, multiply, and divide functions using function notation and recognize domain restrictions. **A2.F.3.2** Combine functions by composition and recognize that f(x) and g(x) are inverse functions if f(g(x))=g(f(x))=x. **A2.F.3.3** Find and graph the inverse of a function, if it exists, and know the graphs are symmetric about the line y=x. **A2.F.3.4** Apply the inverse relationship between exponential and logarithmic functions to convert from one form to another.

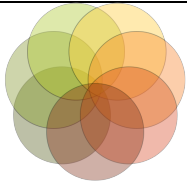**Sample Problems or Classroom Activities**

FORTHCOMING

Data and Probability

A2.D.1 Apply mathematical actions and processes to display and analyze data.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**A2.D.1.1** Use the mean and standard deviation of a data set to fit it to a normal distribution (bell-shaped curve) and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. **A2.D.1.2** Collect and use scatterplots to analyze patterns and describe linear, exponential or polynomial relationships between two variables. Using graphing technology, determine regression equation and correlation coefficients; use regression equations to make predictions and correlation coefficients to assess the reliability of those predictions. **A2.D.1.3** Based upon the context of the situation/problem recognize whether a discrete or continuous graphical representation is appropriate and then create the graph.

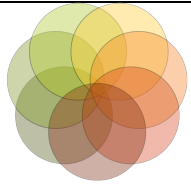**Sample Problems or Classroom Activities**

FORTHCOMING

Data and Probability

A2.D.2 Apply mathematical actions and processes to calculate probabilities and apply probability concepts.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**A2.D.2.1** Understand and use simple probability formulas involving intersections, unions and complements of events. **A2.D.2.2** Apply probability concepts such as intersections, unions and complements of events, and conditional probability and independence, to calculate probabilities and solve problems.

Sample Problems or Classroom Activities

FORTHCOMING

Data and Probability

A2.D.3 Apply mathematical actions and processes to analyze statistical thinking to draw inferences, make predictions and justify conclusions.

Mathematical Actions and Processes	Mathematical Standard
• Develop a Deep and Flexible Conceptual Understanding • Develop Accurate and Appropriate Procedural Fluency • Develop Strategies for Problem Solving • Develop Mathematical Reasoning • Develop a Productive Mathematical Disposition • Develop the Ability to Make Conjectures, Model, and Generalize • Develop the Ability to Communicate Mathematically	**A2.D.3.1** Evaluate reports based on data published in the media by identifying the source of the data, the design of the study, and the way the data are analyzed and displayed. Show how graphs and data can be distorted to support different points of view. Know how to use spreadsheet tables and graphs or graphing technology to recognize and analyze distortions in data displays. **A2.D.3.2** Identify and explain misleading uses of data; recognize when arguments based on data confuse correlation and causation.

Sample Problems or Classroom Activities

FORTHCOMING

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Appendix A

Mathematical Actions and Processes Expanded

FORTHCOMING

Appendix B

Support Materials and Resources

FORTHCOMING