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ABSTRACT

This technical guide to the South Dakota Mathematics Standards serves as a critical model for educators and school districts in effectively implementing the standards. This guide features the goals, indicators, benchmarks, and grade level standards for South Dakota. It is organized by grade level clusters according to benchmark levels K-2, 3-5, 6-8, and 9-12. (ASK)

TECHNICAL GUIDE FOR IMPLEMENTING CONTENT STANDARDS

MATHEMATICS

December 1998

A TECHNICAL GUIDE FOR IMPLEMENTING SOUTH DAKOTA MATHEMATICS STANDARDS

THE PURPOSE OF THE TECHNICAL GUIDE

The Technical Guide to the South Dakota Mathematics Standards serves as a critical purpose for educators and school districts. First of all, it is essential that educational dialogue based upon this document take place in each and every school district in South Dakota. The expectations inherent in the document will never be fully realized unless teachers are provided meaningful dialogue about the communications, ideas, concepts, and skills outlined by this document and the ongoing implications for assessment and instruction aligned with the standards.

In addition, to this professional dialogue about assessment and instruction, school districts will need to use this document to address technology issues. Educators must determine how technology can and should be used to help provide the rich learning environments and experiences that are demanded by the expectations in this document and what district technology decisions should be made to meet those demands.

THE ORGANIZATION OF THE TECHNICAL GUIDE

This Technical Guide to the Standards includes the Goals, Indicators, Benchmarks, and Grade Level Standards. It is organized in grade level clusters according to benchmark levels: K-2, 3-5, 6-8, and 9-12. This format is provided as a framework for school districts to use as they study and implement the state standards, design local district and classroom assessments, and align curriculum materials, resources, and technology to the standards. The technical section is formatted in the benchmark clusters so that teacher teams or individual teachers can easily reference the math standards at adjacent grade levels. For example, the first grade teacher could easily survey the classroom learning objectives in both the kindergarten and the second grade.

- **Goal:** The six broad, conceptual goals (content area/discipline standards) are the K-12 strands/strings which define the essence of the discipline of mathematics. Because the goals are the "end results" of what we would expect after thirteen years of mathematics study in South Dakota schools, they are worded the same at each grade level. This is done to provide consistency in K-12 curricular focus and alignment. It should also be noted that although algebra, geometry, and statistics have traditionally been thought of as "courses", in this document, they refer to mathematical strands which should be addressed throughout a K-12 program.

- **Indicators:** The indicators further define the goals and set the framework for mathematics. The indicators remain the same at all instructional levels (K-2, 3-5, 6-8, 9-12), thereby providing an ongoing and constant focus for the standards. The indicators also provide the targets and anchors for broad district-level, program evaluation.

- **Benchmarks**: The benchmarks articulate what the goal and indicator represent at the different developmental levels: K-2, 3-5, 6-8, and 9-12. They provide the targets for student performance and are an essential and critical component for local school districts to use in designing district and classroom assessments aligned with the goals, indicators, and grade level standards.

- **Grade Level Standards:** These statements represent the classroom learning objectives or activities which should be provided at each grade level to help students reach the expectations articulated in the benchmarks, indicators, and goals. These are presented in single grade levels except at the 9-12 level. Currently in South Dakota, state statute requires that high school students take at least a minimum of two units (years) of mathematics to graduate, but does not mandate the specific "courses" that all students must have. It is the responsibility of each school district to "organize" the 9-12 grade level standards into the courses they offer at the 9-12 level. At the K-8 levels, districts may choose to move some grade level standards from one grade to another within the benchmark clusters if they feel it strengthens their local curriculum delivery. In other words, if a district's middle school teachers feel a standard is more appropriate for their students at the sixth grade than at the seventh grade (or vice versa), they may make those adjustments in the 6-8 standards.

Since education is often describe as a "journey through learning," that analogy helps clarify the components which makeup a set of standards. The goals represent the final/ultimate destination--where all students should "arrive" after the required years of mathematics study in K-12 South Dakota schools. The indicators provide targets and guideposts throughout the journey. The benchmarks serve as mile markers and weigh stations along the way and the grade level standards represent the turns, hills, traffic signs, and the white lines along the road.

Goals

1. **Students will use the language of algebra to explore, describe, represent, and analyze number expressions and relations that represent variable quantities.**

2. **Students will use the language of geometry to discover, analyze, and communicate geometric concepts, properties, and relationships.**

3. **Students will apply systems of measurement and use appropriate measurement tools to describe and analyze the world around them.**

4. **Students will develop and use number sense to investigate the characteristics of numbers in a variety of forms and modes of operation.**

5. **Students will discover, analyze, extend, and create patterns, relations, or functions to model mathematical ideas in a variety of forms**

6. **Students will apply statistical methods to analyze data and explore probability for making decisions and predictions.**

Goals and Rationales

In this 1998 South Dakota Content Standards document, the format has been organized into six overall K-12 goals which represent the discipline of mathematics. Each of the six goals is listed below, accompanied by a rationale. The rationales are brief descriptions of the goal and its importance for our students as they prepare for adulthood.

GOAL 1: ALGEBRA

Students will use the language of algebra to explore, describe, represent, and analyze number expressions and relations that represent variable quantities.

RATIONALE:

Algebra is a language of mathematics based on symbols used to communicate concepts, relationships, and abstract ideas. Algebra is a tool that is used to model real situations and answer questions about situations. This often leads to the development of concepts at an abstract level. The changing role of technology and societal needs requires that more emphasis be placed on algebraic thinking, generalizations, and algebra as a problem solving tool and less emphasis on the manipulation of symbols. The use of algebra begins in the primary grades and should be sequentially developed throughout the elementary, middle, and secondary grades.

GOAL 2: GEOMETRY

Students will use the language of geometry to discover, analyze, and communicate geometric concepts, properties, and relationships.

RATIONALE:

Geometry is a language of mathematics that is used to communicate the properties of and relationships between objects. Experiences related to the recognition, visualization, representation, and transformation of geometric shapes and their properties from real-life experiences long before they computed. Mathematicians continue this process today as powerful models of our world are developed. Students spatial capabilities often exceed their numerical skills and tapping these strengths can improve number understandings and skills as well as pique as interest in mathematics. Geometry is connected to every strand in the mathematics curriculum and therefore should not be restricted to a formal deductive study.

GOAL 3: MEASUREMENT

Students will apply systems of measurement and use appropriate measurement tools to describe and analyze the world around them.

RATIONALE:

Measurement is a dimension, quantity, or capacity determined by comparison to a standard unit. The study of measurement provides useful and practical applications of mathematics and involves making connections within mathematics and across the curriculum. Students develop their understanding of measurement and systems of measurement through experiences that enable them to use a variety of techniques, tools, and units of measurement to describe, analyze, and answer quantifiable questions and phenomena.

GOAL 4: NUMBER SENSE

Students will develop and use number sense to investigate the characteristics and relationships of numbers in a variety of forms and modes of operations.

RATIONALE:

Number sense is the ability to interpret and use numbers in counting and measurement situations and to sense the reasonableness of results. Numbers are an important part of daily lives. We use numbers every day; therefore, it is important to understand the many kinds and uses of numbers. Number sense is "common sense" about numbers. A person's ability to perform numerical calculations does not guarantee the acquisition of number sense. Number sense is gained through opportunities to explore number relationships and opportunities to make decisions regarding strategies to follow in solving problems.

GOAL 5: PATTERN, RELATIONS, and FUNCTIONS

Students will discover, analyze, extend, and create patterns, relations, or functions to model mathematical ideas in a variety of forms.

RATIONALE:

The study of patterns, relations, and functions help learners to recognize and generalize patterns and to identify and clarify functional relationships. A pattern is an arrangement of objects or symbols in which relationships can be established. A relationship is a correspondence between two values and a function is a relation in which the first value has exactly one second value. Students who are able to identify and classify patterns and funcitonal relationships are prepared to use pattern-based thinking to understand and represent mathematical and other real-world phenomena both in and out of school.

GOAL 6: STATISTICS and PROBABILITY

Students will apply statistical methods to analyze data and explore probability in making decisions and predictions.

RATIONALE:

Statistics is a mathematical tool used to analyze data. Collected data are processed and the interpretations of the data become translated into usable knowledge as decisions are based upon the interpretations. Probability is the mathematics of chance and the study of random events. Statistics is closely linked to probability as statistical data are often used to predict the likelihood of outcomes or future events. Understanding statistics and probability is essential in the modern world as consumers of print and electronic media must be able to judge the meaningfulness and appropriateness of the information presented and interpreted in the media.

Goals and Indicators

1. **Students will use the language of algebra to explore, describe, represent, and analyze number expressions and relations that represent variable quantities.**

Indicators:

- Analyze procedures to transform algebraic expressions.
- Use a variety of algebraic concepts and methods to solve problems.
- Analyze and describe situations that involve one or more variables.

2. **Students will use the language of geometry to discover, analyze, and communicate geometric concepts, properties, and relationships.**

Indicators:

- Apply deductive and inductive reasoning to analyze geometric properties to solve problems.
- Analyze geometric figures from a variety of perspectives.

3. **Students will apply systems of measurement and use appropriate measurement tools to describe and analyze the world around them.**

Indicators:

- Use various units of measure within a system of measurement.
- Apply measurement concepts in practical applications.

4. **Students will develop and use number sense to investigate the characteristics of numbers in a variety of forms and modes of operation.**

Indicators:

- Analyze the structural characteristics of the real number system and its various subsystems.
- Apply number operations with real numbers and other number systems.
- Develop conjectures, predictions, or estimations to solve problems and verify or justify the results.
- Analyze the concepts of value, magnitude, and relative magnitude of real numbers.

5. **Students will discover, analyze, extend, and create patterns, relations, or functions to model mathematical ideas in a variety of forms.**

Indicators:

- Analyze and describe the properties and behaviors of relations, functions, and their inverses.
- Apply relations and functions to complex problem solving situations.
- Analyze the applications of the concept of mathematical limit.

6. **Students will apply statistical methods to analyze data and explore probability for making decisions and predictions.**

Indicators:

- Use various statistical models to gather data, study problems, and draw conclusions.
- Apply the laws of probability to predict events/outcomes and solve problems.

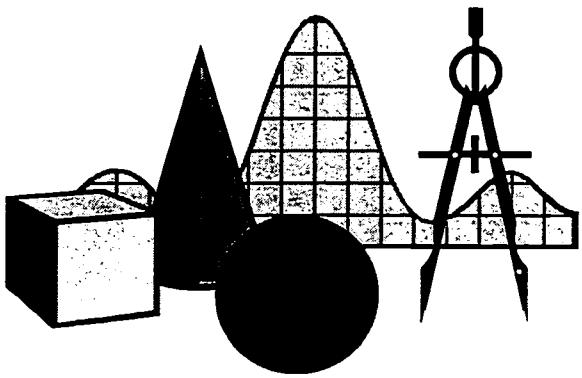

NOTES

SOUTH DAKOTA

MATHEMATICS

K - 2

CONTENT STANDARDS



GOALS
INDICATORS
BENCHMARKS
STANDARDS

SOUTH DAKOTA MATHEMATICS STANDARDS
K-2

Goal 1 – ALGEBRA

Students will use the language of algebra to explore, describe, represent, and analyze number expressions and relations that represent variable quantities.

Indicator 1: Analyze procedures to transform algebraic expressions.

K - 2 Benchmarks:

a. identify equalities and inequalities.
b. explore elements of sets.
c. write mathematical statements to show relationships.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Kindergarten	First Grade	Second Grade
1. compare collections of objects to determine more, less, and equal. 2. recognize and create a variety of sets and patterns using symbols and objects.	1. use the concepts of equal to, greater than, and less than to compare numbers and sets. 2. extend a variety of patterns and generalize relationships using symbols and objects. 3. identify number sentences that represent the commutative property of addition.	1. identify number sentences that represent the inverse operation of given number sentences. 2. apply the addition properties of zero and one in problem situations. 3. describe the inverse relationship between addition and subtraction, write related equations, and solve, e.g., 35 + _ = 47, 47 - 35 = _.

SOUTH DAKOTA MATHEMATICS STANDARDS
K-2

Goal 1 – ALGEBRA

Students will use the language of algebra to explore, describe, represent, and analyze number expressions and relations that represent variable quantities.

Indicator 2: Use a variety of algebraic concepts and methods to solve problems.

K - 2 Benchmarks:

a. create algebraic expressions that represent problem situations.
b. recognize various representations of a number sentence.
c. use the number line to solve problems involving positive and negative quantities.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Kindergarten	First Grade	Second Grade
1. recognize that addition or subtraction is used to solve problems. 2. recognize and interpret + and - symbols. 3. use symbols to represent known and unknown quantities.	1. use +, -, and = symbols to write number sentences and solve problems. 2. understand that symbols can be used to represent unknown quantities in mathematical sentences. 3. describe problem situations that require addition. 4. describe problem situations that require subtraction.	1. describe techniques used in adding and subtracting numbers, e.g., 18 + 8 is the same as 18 + 2 + 6. 2. identify relevant and irrelevant information in the statements of problem situations. 3. identify problem situations that match or do not match a given number sentence. 4. solve addition and subtraction problems using number lines.

SOUTH DAKOTA MATHEMATICS STANDARDS
K–2

Goal 1 - ALGEBRA
Students will use the language of algebra to explore, describe, represent, and analyze number expressions and relations that represent variable quantities.

Indicator 3: Analyze and describe situations that involve one or more variables.

K - 2 Benchmarks:

a. identify the variables in open sentences.
b. explore various representations of a given number.
c. describe processes used to find answers to open sentences.

GRADE LEVEL STANDARDS
THE STUDENT WILL:

Kindergarten	First Grade	Second Grade
1. use informal methods to solve everyday problems. 2. explore and model possible addition and subtraction combinations for a given number.	1. use informal methods to solve everyday problems requiring more than one operation. 2. given a set of objects, determine all the ways to divide a sets of objects into equal groups. 3. determine all possible addition and subtraction combinations for a given number.	1. use informal methods to solve everyday problems requiring open sentences with one unknown. 2. use properties of addition and subtraction to devise algorithms or check results. 3. solve addition and subtraction problems using data from simple charts, picture graphs, and number sentences, e.g., find the answer for $4 + X = ?$ when $X = 2$.

SOUTH DAKOTA MATHEMATICS STANDARDS
K - 2

Goal 2 - GEOMETRY

Students will use the language of geometry to discover, analyze, and communicate geometric concepts, properties, and relationships.

Indicator 1: Apply deductive and inductive reasoning to analyze geometric properties to solve problems.

K - 2 Benchmarks:

a. identify characteristics of two- and three-dimensional shapes.
b. use geometric properties to identify shapes.
c. investigate relationships between various geometric shapes.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Kindergarten	First Grade	Second Grade
1. identify and draw plane geometric figures, e.g., square, rectangle, circle, triangle. 2. identify and describe solid figures, e.g., cube, sphere. 3. compare and sort plane figures based on observable attributes.	1. identify, describe, and draw plane figures according to number of sides, corners, and square corners, e.g., octagon, pentagon, hexagon, polygon, trapezoid. 2. identify and describe solid figures including cubes, cylinders, pyramids, and spheres. 3. identify and describe examples of plane and solid figures in the environment.	1. identify and describe solid figures according to faces, edges, bases, and corners. 2. classify plane figures using sides and vertices. 3. compare plane and solid figures, e.g., circle/sphere, square/cube, triangle/pyramid, rectangle/rectangular solid. 4. compare plane figures to determine if objects are similar or congruent.

SOUTH DAKOTA MATHEMATICS STANDARDS
K - 2

Goal 2 - GEOMETRY

Students will use the language of geometry to discover, analyze, and communicate geometric concepts, properties, and relationships.

Indicator 2: Analyze geometric figures from a variety of perspectives.

K - 2 Benchmarks:

a. explore concepts of perspective using geometric shapes and figures.
b. describe spatial arrangements or positions of shapes and figures.
c. explore ways to arrange and/or transform geometric shapes.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Kindergarten	First Grade	Second Grade
1. identify and describe geometric objects in the environment and describe their position, e.g., next to, top, bottom. 2. explore various geometric patterns.	1. describe proximity of objects in space, e.g., near, far, up, down, below, beside. 2. explore concepts of perspective. 3. determine ways in which shapes can be divided into equal pieces.	1. identify geometric figures regardless of position and orientation in space. 2. use objects to perform geometric transformations including flips, slides, and turns. 3. identify lines of symmetry in a variety of shapes and figures.

SOUTH DAKOTA MATHEMATICS STANDARDS
K-2

Goal 3 - MEASUREMENT
Students will apply systems of measurement and use appropriate measurement tools to describe and analyze the world around them.

Indicator 1: Use various units of measure within a system of measurement.

K - 2 Benchmarks:

a. explore various types of measurement used.
b. recognize specific standard measurement units.
c. use non-standard units to explore measurement in unique situations.

GRADE LEVEL STANDARDS
THE STUDENT WILL:

Kindergarten	First Grade	Second Grade
1. explore and compare units of time, e.g., yesterday, today, tomorrow, days, hours, minutes, weeks, months, years, seasons. 2. identify coins and their value. 3. explore length, weight, and volume of objects using standard and non-standard units. 4. order a group of objects using measurable attributes.	1. measure time to the nearest quarter hour, half hour, and hour. 2. use specific units of measure to explore length, weight, volume, and temperature. 3. count and trade objects to explore the concept of equivalence, e.g., how many nickels equal a quarter. 4. compare and order a group of objects by measurable attributes.	1. measure time to the nearest five minute interval. 2. order events by time sequence; past, future, and equivalent periods of time. 3. use $, cent symbol, and decimal point appropriately when working with money. 4. select an appropriate standard or non-standard unit to measure various objects and substances. 5. predict whether the measure will be greater or smaller when a different unit is used, e.g., 3 dimes > a quarter.

SOUTH DAKOTA MATHEMATICS STANDARDS
K-2

Goal 3 - MEASUREMENT
Students will apply systems of measurement and use appropriate measurement tools to describe and analyze the world around them.

Indicator 2: Apply measurement concepts in practical applications.

K - 2 Benchmarks:

a. explore various tools that provide accurate measurements.
b. apply physical senses in making measurements and estimations of measurements.
c. explore the use of measurement in various situations.

GRADE LEVEL STANDARDS
THE STUDENT WILL:

Kindergarten	First Grade	Second Grade
1. explore various tools used in measurement. 2. compare objects or events using direct comparison according to a given attribute, e.g., length (longer/shorter), height (taller/shorter), volume (holds more/ holds less). 3. compare temperatures of different objects, e.g., hot water, cold water, ice cubes.	1. identify various tools used to solve measurement problems. 2. read scales of length, weight, and temperature for measurement. 3. observe and record temperatures taken at various times. 4. explore the concept of area and perimeter using squares, counting cubes, or base-ten blocks.	1. use appropriate tools and units of measure to solve problems. 2. use scales of length, weight, and volume within a measurement system. 3. record and compare various measurement situations, e.g., temperature to the nearest degree, precipitation to the nearest inch. 4. estimate and determine the area, perimeter, and volume of figures by covering them with squares, counting cubes, or base ten blocks.

SOUTH DAKOTA MATHEMATICS STANDARDS
K-2

Goal 4 - NUMBER SENSE
Students will develop and use number sense to investigate the characteristics of numbers in a variety of forms and modes of operation.

Indicator 1: Analyze the structural characteristics of the real number system and its various subsystems.

K - 2 Benchmarks:

a. explore the structure and applications of the rational number system.
b. use physical materials to understand the rational number system.
c. explore connections of the whole number system to the rational number system.

GRADE LEVEL STANDARDS
THE STUDENT WILL:

Kindergarten	First Grade	Second Grade
1. count and group numbers, objects, and simple events. 2. recognize patterns from counting by number groups, using concrete objects and a calculator, e.g., 2s, 5s, 10s. 3. represent numbers through the use of physical models, word names, and symbols. 4. identify ordinal positions of objects in a set, e.g., 1^{st}, 2^{nd}, 3^{rd}.	1. count by number groups, e.g., 2s, 3s, 5s, 10s. 2. count objects in a given set and write the corresponding numeral. 3. identify ordinal positions using an ordered set of objects, 1^{st} through 20^{th}. 4. classify and model numbers as even or odd.	1. count by number groups to 1000 or higher, e.g., 3s, 4s, 5s, 10s, 20s. 2. associate verbal names, written word names, and standard numerals with whole numbers less than 1000. 3. identify ordinal positions using ordered sets of objects. 4. explain concept of even and odd numbers. 5. explore the concept of mixed numbers.

SOUTH DAKOTA MATHEMATICS STANDARDS
K-2

Goal 4 - NUMBER SENSE
Students will develop and use number sense to investigate the characteristics of numbers in a variety of forms and modes of operation.

Indicator 2: Apply number operations with real numbers and other number systems.

K - 2 Benchmarks:

a. model operations of addition and subtraction using rational numbers.
b. construct meaning for whole numbers, common fractions, and decimals.
c. apply the number operations of addition and subtraction in problem-solving situations.

GRADE LEVEL STANDARDS
THE STUDENT WILL:

Kindergarten	First Grade	Second Grade
1. use objects to model addition and subtraction. 2. determine the number of objects in a set when one object is added or subtracted. 3. demonstrate and describe that a whole is composed of fractional parts using things encountered in daily experiences.	1. recall basic addition and subtraction facts through the 9s. 2. select the appropriate operation to solve specific problems involving whole numbers. 3. use fraction models to identify parts of a whole and parts of a group. 4. estimate and find the sum or difference of two whole numbers written in horizontal or vertical form.	1. solve two- and three-digit addition and subtraction problems. 2. estimate sums and/or differences of two whole numbers and find the answers using the appropriate methods of computing. 3. use models to explore addition and subtraction of fractions. 4. identify the correct usage of decimal point for decimals and money.

Goal 4 - NUMBER SENSE

Students will develop and use number sense to investigate the characteristics of numbers in a variety of forms and modes of operation.

Indicator 3: Develop conjectures, predictions, or estimations to solve problems and verify or justify the results.

K - 2 Benchmarks:

a. explore properties of the whole number system.
b. explore various problem-solving rules.
c. estimate and/or predict results of various calculations.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Kindergarten	First Grade	Second Grade
1. represent problem situations using concrete objects. 2. estimate answers to problems using comparative words, e.g., greater, fewer, more, less. 3. explain how to solve story and picture problems.	1. explore problem situations using concrete materials, drawings, or words. 2. explain or justify estimates to everyday quantity problems, e.g., how many jelly beans may be in the jar. 3. explain how one arrives at solutions to problems.	1. model problem situations in a variety of ways, e.g., concrete materials, tables, charts, drawings, words. 2. estimate sums and differences of whole numbers and determine if a given estimate is correct. 3. solve story problems involving multi-step operations. 4. explain the strategies used to arrive at a solution to a problem.

SOUTH DAKOTA MATHEMATICS STANDARDS
K-2

Goal 4 - NUMBER SENSE
Students will develop and use number sense to investigate the characteristics of numbers in a variety of forms and modes of operation.

Indicator 4: Analyze the concept of value, magnitude, and relative magnitude of real numbers.

K - 2 Benchmarks:

a. explore place value concepts using grouping and substitution.
b. describe the impact of adding and subtracting on the magnitude of numbers.
c. model order and value for commonly used fractions, decimals, and whole numbers.

GRADE LEVEL STANDARDS
THE STUDENT WILL:

Kindergarten	First Grade	Second Grade
1. explore place value by grouping objects by tens and ones. 2. order a set of numbers based on value. 3. use relationship vocabulary to describe value and magnitude of objects, e.g., bigger, smaller, more, less, same, equal.	1. use words, models, and expanded notation to represent two-digit numbers. 2. order and compare whole numbers up to 100. 3. compare and order common fractions using concrete materials, e.g., one-fourth to one-half of a cookie.	1. use words, models, and expanded notation to represent numbers with two or more digits. 2. compare and order fractions and decimals on a number line. 3. recognize relationships between common decimals and fractions, e.g., $\frac{1}{2} = 0.5$. 4. understand relative size of whole numbers.

Goal 5 - PATTERNS, RELATIONS, AND FUNCTIONS:

Students will discover, analyze, extend, and create patterns, relations, or functions to model mathematical ideas in a variety of forms.

Indicator 1: Analyze and describe the properties and behaviors of relations, functions, and their inverses.

K - 2 Benchmarks:

a. explore the relationship between two variables.
b. recognize and explain the constants of a relationship.
c. explore the properties of various relations.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Kindergarten	First Grade	Second Grade
1. sort and classify objects according to similar attributes, e.g., size, shape, or color. 2. identify common attributes found in different groupings.	1. sort and classify objects according to one or more attributes, e.g., color, size, shape, or thickness. 2. identify like and unlike attributes of objects in a given group.	1. determine common attributes in a given group and identify those objects that do not belong. 2. use data to explain relationships, e.g., plants grow taller with more hours of sunlight. 3. explain relationships present in a given set of data.

SOUTH DAKOTA MATHEMATICS STANDARDS
K-2

Goal 5 - PATTERNS, RELATIONS, AND FUNCTIONS

Students will discover, analyze, extend, and create patterns, relations, or functions to model mathematical ideas in a variety of forms.

Indicator 2: Apply relations and functions to complex problem solving situations.

K - 2 Benchmarks:

a. observe and describe patterns found in everyday events and experiences.
b. use tables and graphs to explore solutions to problems.
c. create rules to extend patterns and relationships.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Kindergarten	First Grade	Second Grade
1. explore effects of change on a pattern. 2. identify and extend repeating patterns found in common objects, sounds, and movements. 3. create repeating patterns.	1. recognize and extend basic number patterns using different forms of a hundreds chart. 2. describe or demonstrate the next element in repeating patterns, e.g., rhythm, color, shape, and number patterns. 3. find patterns or relations in data organized in tables or charts to determine what should come next.	1. find patterns and relationships in sequences of numbers, e.g., doubles in learning addition; given three numbers, find the next number in the sequence. 2. write and solve number sentences from problem situations that express relationships. 3. describe and represent patterns that are growing and/or repeating. 4. represent patterns geometrically and numerically.

Goal 5 - PATTERNS, RELATIONS, AND FUNCTIONS

Students will discover, analyze, extend, and create patterns, relations, or functions to model mathematical ideas in a variety of forms.

Indicator 3: Analyze the applications of the concept of mathematical limit.

K - 2 Benchmarks:

a. explore characteristics of bounded relationships.
b. use concrete models to represent continuous or discrete patterns or functions.
c. use concrete examples to demonstrate bounded relationships.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Kindergarten	First Grade	Second Grade
1. identify potential arrangements/combinations for sets of three objects.	1. explain ways to change an arrangement of objects. 2. explore the concept of discrete patterns, e.g., money.	1. identify examples of continuous patterns. 2. identify examples of discrete patterns. 3. explore bounded relationships, e.g., what is the largest possible sum of any two numbers from a given set.

SOUTH DAKOTA MATHEMATICS STANDARDS
K-2

Goal 6 - STATISTICS & PROBABILITY

Students will apply statistical methods to analyze data and explore probability for making decisions and predictions.

Indicator 1: Use various statistical models to gather data, study problems, and draw conclusions.

K - 2 Benchmarks:

a. use data gathered from the environment to create tallies, tables, and graphs of information.
b. compare and discuss relationships of categories for classified collections of objects.
c. make convincing arguments to support simple conclusions drawn from collected data.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Kindergarten	First Grade	Second Grade
1. describe ways to sort and/or group given sets of objects or data. 2. collect and record information using tallies, picture graphs, or other strategies. 3. describe and compare observable quantities of collected data, e.g., the flavor of ice cream most people liked.	1. gather and record data from various sources or situations including surveys and simple experiments. 2. organize data into tally charts, picture graphs, and bar graphs. 3. describe represented data in terms of most often, least often, and range.	1. represent data sets in more than one way, e.g., charts, line graphs, bar graphs. 2. identify features of data sets, e.g., range, median, and mode. 3. determine if data collected is relevant and/or appropriate. 4. form questions about and generate explanations of data given in tables and graphs.

SOUTH DAKOTA MATHEMATICS STANDARDS
K-2

Goal 6 - STATISTICS & PROBABILITY

Students will apply statistical methods to analyze data and explore probability for making decisions and predictions.

Indicator 2: Apply the laws of probability to predict events/outcomes and solve problems.

K - 2 Benchmarks:

a. gather and compare sets of data based on chance events.
b. explain consistency of results that occur in repeated experimental trials.
c. predict outcomes, draw simple conclusions, and report results based on collected data.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

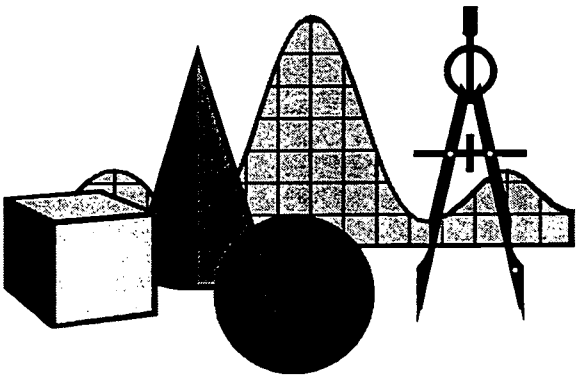
Kindergarten	First Grade	Second Grade
1. explore chance using game situations and spinners. 2. explore the concept of probability through the use of chance events, e.g., coin toss, dice, spinners.	1. use concept of chance to explore probability of actual events. 2. predict possible outcomes of probability experiments, e.g., tossing a die or a coin. 3. generate data from probability experiments using spinners, tiles, or dice. 4. explain how some events are more likely to occur than others.	1. use concepts of chance and certainty to discuss the probability of actual events. 2. list all possible outcomes of probability experiments. 3. determine if common events are certain, likely, unlikely, or impossible. 4. use spinners, tiles, and dice to predict which event is more likely to occur if an experiment is repeated.

SOUTH DAKOTA

MATHEMATICS

3 - 5

CONTENT STANDARDS



GOALS
INDICATORS
BENCHMARKS
STANDARDS

Goal 1 - ALGEBRA

Students will use the language of algebra to explore, describe, represent, and analyze number expressions and relations that represent variable quantities.

Indicator 1: Analyze procedures to transform algebraic expressions.

3 - 5 Benchmarks:

a. explore properties of equality and inequality.
b. explore various relationships among elements of a set.
c. create equivalent algebraic statements using inverse operations and order of operations.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Third Grade	Fourth Grade	Fifth Grade:
1. solve problems involving numeric equations or inequalities. 2. explain the relationship between repeated addition and multiplication. 3. recognize and use the commutative and associative properties of multiplication, e.g., if $6 \times 7 = 42$, then what is 7×6? 4. use appropriate terms in mathematical explanations, e.g., multiple, factor, product. 5. identify special properties of 0 and 1 with respect to arithmetic operations.	1. relate the concepts of addition, subtraction, multiplication, and division to one another, e.g., use of the associative, commutative, and distributive properties. 2. use appropriate terms in mathematical explanations, e.g., divisor, dividend, quotient. 3. explore how to simplify numerical expressions involving addition, subtraction, multiplication, division, and parentheses. 4. create mathematical sentences that are true using three given numbers.	1. demonstrate and explain use of associative, commutative, and distributive properties. 2. simplify numerical expressions involving addition, subtraction, multiplication, division, and parentheses, e.g., m = [3x(2-7)-8]. 3. use variables, expressions, equations, and inequalities to solve problems. 4. create equivalent number sentences that use the inverse operation.

SOUTH DAKOTA MATHEMATICS STANDARDS
3-5

Goal 1 - ALGEBRA
Students will use the language of algebra to explore, describe, represent, and analyze number expressions and relations that represent variable quantities.

Indicator 2: Use a variety of algebraic concepts and methods to solve problems.

3 - 5 Benchmarks:

a. use algebraic expressions to represent problems.
b. create various representations for the same number sentence.
c. use graphic representations to solve problems involving positive and negative quantities.

GRADE LEVEL STANDARDS
THE STUDENT WILL:

Third Grade	Fourth Grade	Fifth Grade
1. represent given problem situations using diagrams, models, and symbolic expressions. 2. select appropriate operational and relational symbols to make expressions true, e.g., 4 _ 3 = 12. 3. use concrete materials to model and solve equations.	1. use tables to model and solve equations. 2. use the number line as a method to solve problems. 3. describe given problem situations in multiple ways. 4. use variables as place holders in number sentences, e.g., m + w = 6; 3 * K = 12. 5. write and solve number sentences that represent word problems.	1. use information taken from a graph or equation to answer questions about a problem situation or create a "story". 2. solve one-step linear equations, e.g.,2x=10, x+4=5. 3. use graphing techniques on a number line to model absolute value and arithmetic operations with integers. 4. analyze tables and graphs to identify properties and relationships.

Goal 1 - ALGEBRA

Students will use the language of algebra to explore, describe, represent, and analyze number expressions and relations that represent variable quantities.

Indicator 3: Analyze and describe situations that involve one or more variables.

3 - 5 Benchmarks:

a. determine solution sets for simple open sentences.
b. model relationships between sets of numbers.
c. explore how changing one variable can cause a change in another.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Third Grade	Fourth Grade	Fifth Grade
1. explain the relationship between multiplication and division to compute and check results, e.g., 3 x 7 = 21, so 21 ÷ 7 = _. 2. determine various multiplication and division sentences for a given number. 3. investigate and describe the concept of variable.	1. use multiple methods, such as physical models and graphs to solve real-world problems involving equations and inequalities. 2. explain the process used to simplify a three-step problem. 3. use models to explain how changing one variable causes a change in another, e.g., area, perimeter.	1. represent situations and number patterns with concrete materials, tables, graphs, verbal rules, and algebraic notation. 2. interpret and use formulas to answer questions about quantities and their relationships, e.g., A = bh. 3. use variables to represent given verbal quantities in problem situations. 4. solve open sentences using the four basic operations.

Goal 2 - GEOMETRY

Students will use the language of geometry to discover, analyze, and communicate geometric concepts, properties, and relationships.

Indicator 1: Apply deductive and inductive reasoning to analyze geometric properties to solve problems.

3 - 5 Benchmarks:

a. describe properties of geometric figures using geometric terms.
b. classify objects using geometric properties.
c. use geometric properties to solve problems.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Third grade	Fourth grade	Fifth grade
1. analyze and classify plane and solid geometric figures using relevant properties, e.g., number of corners, square corners, shape of faces, and edges. 2. identify and draw representations of line segments and angles using rulers or straightedges. 3. use geometric properties of two-dimensional shapes to solve problems.	1. investigate, describe, and identify the relationships between and among points, lines, line segments, and rays. 2. determine if sides of plane figures, faces of solid objects, or edges of solid objects are the same size, parallel, or perpendicular. 3. use appropriate geometric language to write descriptions of figures or pictures composed of geometric figures. 4. apply a variety of strategies and geometric properties of two-dimensional shapes to solve problems.	1. use geometric properties and terms to describe, sort, and classify geometric objects. 2. state and use properties of squares, rectangles, isosceles and equilateral triangles, circles, and regular polygons to solve problems. 3. demonstrate that the ratio of the circumference to the diameter of a circle is constant. 4. represent and apply a variety of strategies and geometric properties and formulas for two- and three-dimensional shapes to solve problems.

Goal 2 - GEOMETRY

Students will use the language of geometry to discover, analyze, and communicate geometric concepts, properties, and relationships.

Indicator 2: Analyze geometric figures from a variety of perspectives.

3 - 5 Benchmarks:

a. use perspective to create or identify geometric shapes and figures.
b. visualize and illustrate ways objects can be oriented in space.
c. determine methods to transform objects.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Third grade	Fourth grade	Fifth grade
1. predict, illustrate, and verify which figures could result from a flip, slide, or turn of a given figure. 2. demonstrate relationships between and among figures using symmetry, similarity, and congruence. 3. rearrange geometric components of a given figure to create new patterns.	1. analyze geometric figures using size, shape, orientation, congruence, and similarity. 2. interpret or create scales on maps and drawings. 3. visualize and represent two-dimensional views of three-dimensional objects which are made from rectangular solids. 4. combine or take apart three-dimensional solids to construct new objects.	1. create three-dimensional figures from two-dimensional drawings. 2. use two-dimensional coordinate grids to find locations and represent points and simple figures. 3. determine ways to transform images of objects. 4. recognize and describe bilateral and rotational symmetry in two- and three-dimensional figures.

Goal 3 - MEASUREMENT

Students will apply systems of measurement and use appropriate measurement tools to describe and analyze the world around them.

Indicator 1: Use various units of measure within a system of measurement.

3 - 5 Benchmarks:

a. identify the referents used in different measurement scales.
b. investigate appropriateness of scales selected for measurement situations.
c. investigate scales that can be used in unique measurement situations.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Third Grade	Fourth Grade	Fifth Grade
1. measure time within fractions of a second, e.g., stop watch. 2. describe time using the concepts of how long until, the duration of an event, and equivalent periods. 3. count, compare, make change, and solve problems using a collection of coins and bills. 4. explore unit relationships within a system of measurement, e.g., four quarts = a gallon.	1. measure time using fractions, e.g., fractions of an hour, fractions of a year. 2. solve problems involving money, e.g., use of proper notation, unit conversions, and making change. 3. select and use the most appropriate units for given measurement situations. 4. carry out unit conversions within a system of measurement, e.g., inches, feet, yards. 5. explore the use of formulas that assist in measurement situations, e.g., area.	1. identify equivalent periods of time and solve problems, e.g., relationships among days, months, and years; hours and minutes, A.M. and P.M. 2. solve problems involving money, e.g., use of proper notation, unit conversions, and making change. 3. use and convert measurement units, e.g., inches to feet. 4. use formulas in measurement situations, e.g., perimeter, area. 5. use degrees as a unit of measure for angles. 6. explain equivalent fractions in measurement.

Goal 3 - MEASUREMENT

Students will apply systems of measurement and use appropriate measurement tools to describe and analyze the world around them.

Indicator 2: Apply measurement concepts in practical applications.

3 - 5 Benchmarks:

a. use various tools to make accurate measurements.
b. apply measurement tools that assist the physical senses in making measurements.
c. investigate the effectiveness of specific measurement systems.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Third Grade	Fourth Grade	Fifth Grade
1. determine the appropriate tools and units of measure for problem solving. 2. estimate and measure length to the nearest $\frac{1}{4}$ inch or the nearest centimeter. 3. measure and compare objects using measurable attributes. 4. estimate and measure perimeter, area, and volume of irregular objects.	1. use scales of length, temperature, volume, and weight for problem solving. 2. measure length to the nearest eighth inch or to the nearest millimeter. 3. estimate and measure liquid volume in a variety of ways, e.g., cups, pints, quarts, gallons, milliliters, and liters. 4. develop strategies to make measurement estimates.	1. use appropriate tools to measure length, weight, temperature, volume, and area. 2. develop strategies to estimate conversions between Fahrenheit and Celsius. 3. develop strategies to determine formulas used to find various measurements, e.g., perimeter, area, or volume of objects. 4. solve measurement problems involving change in a measurable attribute. 5. use and evaluate strategies to make measurement estimates.

Goal 4 - NUMBER SENSE

Students will develop and use number sense to investigate the characteristics of numbers in a variety of forms and modes of operation.

Indicator 1: Analyze the structural characteristics of the real number system and its various subsystems.

3 - 5 Benchmarks:

a. examine the structure of the rational number system and investigate its appropriate applications and limitations.
b. use physical materials and real-life experiences to understand the rational number system.
c. model the connections of subsystems in the rational number system.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Third Grade	Fourth Grade	Fifth Grade
1. explore basic number theory concepts with whole numbers, e.g., primes, composites, factors, multiples. 2. name, represent, and write fractions and decimals. 3. demonstrate that a mixed number is a whole number plus a fraction.	1. find multiples and factors of numbers to 400. 2. identify and explain the meaning of square numbers and cube numbers. 3. interpret negative integers, e.g., temperature, number line. 4. demonstrate that the value of a fraction is not changed when the numerator and denominator are multiplied by the same number.	1. apply basic number theory concepts to the rational number system. 2. represent numbers in a variety of equivalent forms. 3. use place-value concepts of grouping based upon powers of ten within the decimal number system. 4. write terminating decimals as fractions and explain why they represent the same value. 5. extend properties that work with positive numbers to negative numbers.

Goal 4 - NUMBER SENSE

Students will develop and use number sense to investigate the characteristics of numbers in a variety of forms and modes of operation.

Indicator 2: Apply number operations with real numbers and other number systems.

3 - 5 Benchmarks:

a. model the operations of addition, subtraction, multiplication, and division on rational numbers..
b. represent numbers in a variety of equivalent ways.
c. apply number operations in problem solving situations.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Third Grade	Fourth Grade	Fifth Grade
1. add and subtract multi-digit whole numbers using various computational methods. 2. recall multiplication and division facts through the nines. 3. add and subtract with fractions and decimals.	1. apply multiplication and division facts through the 12s. 2. find the products of multi-digit factors. 3. find the quotient of two whole numbers. 4. use the four operations with fractions and decimals. 5. solve addition and subtraction problems using negative numbers.	1. use the inverse relationship of multiplication and division to explain the effects of division. 2. determine least common multiple and greatest common factor of two or more whole numbers. 3. compute with rational numbers using the four arithmetic operations, e.g., $\frac{1}{4} \div \frac{1}{2} = \_$, $3.2 \times 1.5 = \_$. 4. explain how the relationship between multiplication and division of whole numbers extends to the rational number system.

Goal 4 - NUMBER SENSE

Students will develop and use number sense to investigate the characteristics of numbers in a variety of forms and modes of operation.

Indicator 3: Develop conjectures, predictions, or estimations to solve problems and verify or justify the results.

3 - 5 Benchmarks:

a. explore the properties of the rational number system.
b. apply various problem solving rules.
c. use estimation to test reasonableness of calculations.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Third Grade	Fourth Grade	Fifth Grade
1. solve problems using addition, subtraction, and multiplication. 2. use estimation in problems with whole numbers. 3. identify similarities within different problem-solving situations involving addition and subtraction.	1. use and justify estimations in problems with whole numbers, fractions, decimals, and money. 2. identify the appropriate arithmetic operations in multi-step problem situations. 3. identify similarities within different problem-solving situations involving multiplication and division.	1. use and evaluate different estimation strategies to justify solutions for problems involving rational numbers. 2. determine reasonableness of calculations in problem situations. 3. select and use appropriate arithmetic operations for multi-step problem situations. 4. solve problems using non-routine strategies. 5. create and test rules that can be applied in unfamiliar problem-solving situations.

Goal 4 - NUMBER SENSE

Students will develop and use number sense to investigate the characteristics of numbers in a variety of forms and modes of operation.

Indicator 4: Analyze the concept of value, magnitude, and relative magnitude of real numbers.

3 - 5 Benchmarks:

a. model the concept of magnitude using concrete materials.
b. explore the effect of operations on magnitudes.
c. describe order and value relationships of common decimals, fractions, and whole numbers.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Third Grade	Fourth Grade	Fifth Grade
1. order and compare whole numbers using appropriate words and symbols, e.g., < , greater than. 2. compare numerical value of fractions having like and unlike denominators. 3. compare decimals expressed as tenths and hundredths. 4. recognize that fractions and decimals are parts of a whole.	1. use a number line to compare numerical value of fractions or mixed numbers. 2. read, write, order, and compare numbers from .001 to over 1,000,000. 3. associate verbal names, written word names, and the appropriate symbols in mathematical sentences. 4. describe the relative size of large numbers using various models and/or everyday representations. 5. use and interpret negative numbers in simple contexts.	1. estimate, determine, and interpret the meaning of very large numbers, e.g., 'What day was it 10,000,000 seconds ago?" 2. read, write, and interpret whole number powers of 10, e.g., $10^4 = 10,000$. 3. understand relative size of whole numbers, commonly used fractions, decimals, and percents. 4. read, write, order, and compare numbers from .0001 to over 1,000,000,000. 5. use the number line to compare the numerical value of rational numbers.

Goal 5 - PATTERNS, RELATIONS, AND FUNCTIONS

Students will discover, analyze, extend, and create patterns, relations, or functions to model mathematical ideas in a variety of forms.

Indicator 1: Analyze and describe the properties and behaviors of relations, functions, and their inverses.

3 - 5 Benchmarks:

a. explore relationships between and among different variables.
b. recognize the effects of change in coefficients on graphs of relations.
c. identify the general properties and behaviors of a set of relations.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Third Grade	Fourth Grade	Fifth Grade
1. investigate the concept of a variable. 2. determine total costs as a function of the number of units and the per unit cost.	1. describe the concept of a variable. 2. use the understanding that an equality relationship between two quantities remains the same as long as the same change is made to both quantities. 3. determine per unit cost based on number of units and the total cost.	1. solve problems involving variables of speed, unit cost, or unit weight. 2. analyze how change in one variable causes a change in another, e.g., holding area constant and changing length and width.

Goal 5 - PATTERNS, RELATIONS, AND FUNCTIONS

Students will discover, analyze, extend, and create patterns, relations, or functions to model mathematical ideas in a variety of forms.

Indicator 2: Apply relations and functions to complex problem solving situations.

3 - 5 Benchmarks:

a. describe and reproduce patterns from real experiences.
b. use tables, graphs, and open sentences to explain solutions to problems.
c. apply pattern and relationship rules to solve problems.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Third Grade	Fourth Grade	Fifth Grade
1. use number patterns and relationships to learn basic facts, e.g., nines tables. 2. solve problems involving a function relationship and graph the resulting ordered pairs of whole numbers on a grid, e.g., (height, age). 3. extend linear patterns by their rules, e.g., the number of legs on *n* horses can be calculated by counting by fours.	1. solve problems involving pattern identification and completion of patterns. 2. describe a rule for simple patterns. 3. analyze given patterns formed using concrete objects and pictures in order to create patterns with the same attributes.	1. write open sentences using variables to represent a given mathematical relationship. 2. use a constant function to construct tables of input and output numbers and express the relationship as an open sentence. 3. describe and explain how one quantity determines another quantity in a functional relationship based on a linear pattern. 4. use information from a graph or equation to answer questions about a problem situation or to create a "story".

Goal 5 - PATTERNS, RELATIONS, AND FUNCTIONS

Students will discover, analyze, extend, and create patterns, relations, or functions to model mathematical ideas in a variety of forms.

Indicator 3: Analyze the applications of the concept of mathematical limit.

3 - 5 Benchmarks:

a. explain characteristics of bounded relationships.
b. create pictorial or numeric models to represent continuous or discrete patterns or functions.
c. use pictorial examples to demonstrate bounded relationships.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Third Grade	Fourth Grade	Fifth Grade
1. explain ways to change an arrangement of objects. 2. explore discrete and continuous patterns.	1. determine all combinations or arrangements of a limited number of objects. 2. explain if there is a limit to what can be done in a given situation, e.g., sharing 10 candy bars among 20 people. What is the maximum amount a given person could have?	1. explain how there can be a bounded relation. 2. create examples of continuous patterns or functions. 3. create examples of discrete patterns or functions.

Goal 6 - STATISTICS & PROBABILITY

Students will apply statistical methods to analyze data and explore probability for making decisions and predictions.

Indicator 1: Use various statistical models to gather data, study problems, and draw conclusions.

3 - 5 Benchmarks:

a. investigate the different uses of various sampling techniques.
b. determine mode, median, and mean for various sets of data.
c. make and support inferences through data collection.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Third Grade	Fourth Grade	Fifth Grade
1. represent data in line plots, bar graphs, tables, or tally charts using appropriate form and scales for the data. 2. determine range and mode(s) of sets of data. 3. ask and answer relevant questions from data represented in charts, tables, and graphs.	1. develop survey questions and systematically collect appropriate data. 2. use appropriate scales to represent data in various forms. 3. interpret and analyze data from graphical representations and draw justifiable conclusions. 4. use mode, mean, median, and range to describe results and support predictions.	1. collect, organize, and display data in a variety of forms. 2. use statistical data about life situations to make predictions and justify reasoning. 3. analyze data to determine the appropriate uses of the measures of central tendency. 4. compare data sets of different sizes to determine reliability.

Goal 6 - STATISTICS & PROBABILITY

Students will apply statistical methods to analyze data and explore probability for making decisions and predictions.

Indicator 2: Apply the laws of probability to predict events/outcomes and solve problems.

3 - 5 Benchmarks:

a. compare sample data sets to group data.
b. explore the relationship between experimental and theoretical probabilities.
c. predict and report possible combinations and arrangements of probability in chance situations.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

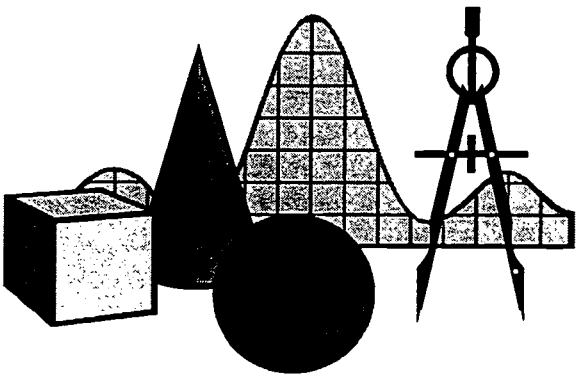
Third Grade	Fourth Grade	Fifth Grade
1. explore possible arrangements of a limited number of objects, e.g., how many ways can a blue, a red, and a green block be lined up? 2. explore what happens to results when data is pooled, e.g., each person contributes their results to a class data set. 3. use results of probability experiments to make predictions about future events. 4. describe events that are certain or impossible.	1. predict and represent possible outcomes for a simple probability situation in an organized manner, e.g., tables, grids, tree diagrams. 2. analyze outcomes of probability for both individual and group experiments and report the results. 3. explain why unlikely events may occur fairly often in very large samples. 4. determine the probability of simple events using a variety of materials, e.g., coins, spinners, dice, computer programs.	1. use models including tree diagrams to display possible outcomes and predict events. 2. classify probability of simple events as certain, likely, unlikely, or impossible. 3. explain how summary predictions about large collections of events are usually more accurate than summary predictions about just a few events. 4. use collected data to compare actual results to theoretical results, e.g., a hundred coin tosses predicted results verses actual results in a fair-coin toss.

SOUTH DAKOTA

MATHEMATICS

6 - 8

CONTENT STANDARDS



GOALS
INDICATORS
BENCHMARKS
STANDARDS

Goal 1 - ALGEBRA

Students will use the language of algebra to explore, describe, represent, and analyze number expressions and relations that represent variable quantities.

Indicator 1: Analyze procedures to transform algebraic expressions.

6 - 8 Benchmarks:

a. describe the properties of equality and inequality and indicate life-related applications.
b. determine common solution sets for algebraic statements.
c. transform various algebraic expressions.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Sixth Grade	Seventh Grade	Eighth Grade:
1. use order of operations to solve problems. 2. explore various properties of equality and inequality. 3. explain the significance of the equal sign and inequality symbols in algebraic sentences.	1. evaluate algebraic expressions for given replacement values of variables. 2. find and use generalizations about equalities and inequalities. 3. use associative, commutative, distributive and identity properties to create equivalent expressions.	1. apply properties of equalities and inequalities using algebraic techniques. 2. use equalities and inequalities to life-related situations. 3. use properties to justify the steps to expand, combine, or simplify polynomial expressions. 4. analyze products of binomials using area models, e.g., $(x + 3)(x - 2)$.

Goal 1 - ALGEBRA

Students will use the language of algebra to explore, describe, represent, and analyze number expressions and relations that represent variable quantities.

Indicator 2: Use a variety of algebraic concepts and methods to solve problems.

6 - 8 Benchmarks:

a. formulate an algebraic sentence from available data.
b. explain the process used in solving algebraic sentences.
c. use graphs to solve algebraic problems.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Sixth Grade	Seventh Grade	Eighth Grade
1. write and solve one-step linear equations involving inverse operations, fractions, and decimals. 2. identify and graph ordered pairs in a coordinate plane. 3. analyze tables and graphs to identify relationships between variables in algebraic sentences. 4. use graphic forms to solve problems involving numerical relationships including inequalities.	1. explore linear equations to identify generalizations. 2. use graphs to solve problems including ordered pairs and inequalities. 3. solve one-step linear equations using strategies involving inverse operations and integers. 4. solve inequalities in one variable using strategies involving inverse operations and integers.	1. analyze linear equations to create generalizations. 2. solve and graph equations and inequalities. 3. represent solutions to open sentences and inequalities graphically. 4. describe and represent relations from collected data using tables, graphs, and rules. 5. solve multi-step linear equations using strategies involving inverse operations and integers.

Goal 1 - ALGEBRA

Students will use the language of algebra to explore, describe, represent, and analyze number expressions and relations that represent variable quantities.

Indicator 3: Analyze and describe situations that involve one or more variables.

6 - 8 Benchmarks:

a. simulate life-related situations using algebraic statements.
b. investigate mathematical simulations to interpret the results of change, e.g., position, slope.
c. investigate equations which represent various characteristics of graphs.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Sixth Grade	Seventh Grade	Eighth Grade
1. use concrete materials and algebraic statements to represent problem situations. 2. solve problems involving rate of speed, unit cost, or unit weight. 3. use variables to represent given quantities in problem situations.	1. create algebraic statements representing patterns observed in life-related situations. 2. make predictions relating two variables using a rule or a graph. 3. use a scatterplot to determine line of best fit.	1. determine slope from a graph, ordered pairs, or an equation. 2. identify x and y intercepts from an equation or graph. 3. generalize the impact of coefficients and constants of linear equations. 4. identify various phenomena that represents different families of graphs. 5. solve word problems involving direct and inverse variation.

Goal 2 - GEOMETRY

Students will use the language of geometry to discover, analyze, and communicate geometric concepts, properties, and relationships.

Indicator 1: Apply deductive and inductive reasoning to analyze geometric properties to solve problems.

6 - 8 Benchmarks:

a. determine properties of geometric figures using inductive reasoning.
b. explain conjectures related to or associated with geometric figures.
c. apply geometric properties to investigate problem situations and produce solutions.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Sixth Grade	Seventh Grade	Eighth Grade
1. identify, classify, and describe the characteristics of plane figures, e.g., similarities and differences. 2. use given attributes to determine congruence of segments, angles, and polygons by direct comparison. 3. sketch, construct models, and classify rectangular prisms, cones, cylinders, and pyramids. 4. identify, describe, and classify angles. 5. explore problems involving regular and irregular shapes.	1. use deductive reasoning and inference to compare and contrast quadrilaterals. 2. identify, describe, and form polygons having up to ten sides. 3. identify and construct elements of geometric figures, e.g., altitudes, midpoints, bisectors, radii, diameters, and chords. 4. use geometric properties, formulas, and relationships to solve problems involving regular and irregular shapes. 5. present logical arguments about the properties of basic geometric figures.	1. use given assumptions to determine properties of figures and relationships between figures. 2. use visual perspectives to analyze geometric problems. 3. describe, classify, and construct plane and solid figures, e.g., prisms, pyramids, cylinders, and cones. 4. use the Pythagorean Theorem to solve problems. 5. use various geometric properties, formulas, and relationships to solve problems involving three-dimensional shapes.

Goal 2 - GEOMETRY

Students will use the language of geometry to discover, analyze, and communicate geometric concepts, properties, and relationships.

Indicator 2: Analyze geometric figures from a variety of perspectives.

6 - 8 Benchmarks:

a. develop representations that demonstrate various perspectives of geometric shapes and figures.
b. visualize and represent geometric figures from various orientations.
c. create and analyze transformations of geometric figures.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Sixth Grade	Seventh Grade	Eighth Grade
1. explore ways that shapes can be combined, subdivided, and changed using geometric concepts of symmetry, reflections, congruency, similarity, perpendicularity, and parallelism. 2. identify and plot ordered pairs in all four quadrants of the rectangular coordinate system. 3. explore ways to build three-dimensional figures from polygons. 4. develop two-dimensional representations that demonstrate various perspectives of three-dimensional objects.	1. demonstrate ways that shapes can be combined, subdivided, and changed using transformations, e.g., flips, slides, turns, and enlargements. 2. determine if geometric figures are similar and write proportions to express the relationships between corresponding parts of similar figures. 3. identify and construct two-dimensional patterns from three-dimensional models. 4. use the rectangular coordinate system to analyze connections between stretching, shrinking, and transforming figures. 5. explore and predict relationships within patterns, e.g., tessellations.	1. use given top, side, or bottom views of objects to construct three-dimensional models. 2. construct three-dimensional figures from two-dimensional views. 3. develop two-dimensional representations that demonstrate various perspectives of three-dimensional objects. 4. determine volume and surface area of three-dimensional models.

Goal 3 - MEASUREMENT

Students will apply systems of measurement and use appropriate measurement tools to describe and analyze the world around them.

Indicator 1: Use various units of measure within a system of measurement.

6 - 8 Benchmarks:

a. describe the referents used in relating different measurement scales.
b. analyze the appropriateness of a scale selected for measurement situations.
c. apply a scale with referents that fit unique measurement situations.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Sixth Grade	Seventh Grade	Eighth Grade
1. use arbitrary referents to estimate and compare measurements, e.g., nose to extended fingertip is approximately one yard. 2. convert units of measure within a measurement system. 3. explore the use of formulas that assist in measurement situations, e.g., area. 4. select models of area that approximate referent values, e.g., a sheet of paper is about one square foot.	1. select, use, and explain methods for comparing measurements, e.g., miles per hour to feet per second. 2. create scale drawings to represent real-world situations. 3. develop and use standard formulas for perimeter, area, and circumference. 4. use proportions to convert between units of measure.	1. apply proportional reasoning to solve measurement problems. 2. design procedures for measuring various attributes of complex figures. 3. develop and use standard formulas for surface area and volume. 4. estimate and determine volume using standard and nonstandard units. 5. use degrees as a unit of measure for angles and circle problems. 6. develop rules to use when converting between different measurement systems.

Goal 3 - MEASUREMENT

Students will apply systems of measurement and use appropriate measurement tools to describe and analyze the world around them.

Indicator 2: Apply measurement concepts in practical applications.

6 - 8 Benchmarks:

a. choose measurement tools to achieve specific degrees of accuracy or precision.
b. select mathematical techniques that provide indirect measurement in specific situations.
c. apply units of measurement that are usable for specific situations or applications.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Sixth Grade	Seventh Grade	Eighth Grade
1. use the most appropriate tool to measure length, temperature, and angle in customary and metric systems. 2. examine measurement situations to determine necessary degree of accuracy. 3. use area formulas to solve problems. 4. apply units or combinations of units for various measurement situations.	1. use the most appropriate tool to measure mass, area, and angle in customary and metric systems. 2. analyze a variety of measurement situations to determine the necessary degree of accuracy and precision. 3. apply mathematical techniques to extend physical senses, e.g., using shadows to determine height of tree. 4. estimate areas of irregular areas by subdividing them into rectangles and triangles.	1. use the most appropriate tool to measure volume in customary and metric systems. 2. determine precision, accuracy, and measurement errors in a variety of situations. 3. apply mathematical techniques in situations that defy direct measurement, e.g., measuring the height of a tree, distance to the moon). 4. solve problems involving two- and three-dimensional measurement situations in everyday contexts. 5. use volume and surface area formulas to solve problems.

Goal 4 - NUMBER SENSE

Students will develop and use number sense to investigate the characteristics of numbers in a variety of forms and modes of operation.

Indicator 1: Analyze the structural characteristics of the real number system and its various subsystems.

6 - 8 Benchmarks:

a. investigate the structure, applications, and limitations of the rational number system.
b. use physical representations to demonstrate various number concepts.
c. determine the characteristics of subsystems in the real number system.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Sixth Grade	Seventh Grade	Eighth Grade
1. represent numbers in a variety of equivalent forms, e.g., fractions, decimals, percents. 2. use concepts about numbers to build number sequences, e.g., primes, factors, multiples. 3. describe relationships among sets of rational numbers.	1. represent numbers in a variety of equivalent forms, e.g., integers, exponents, scientific notation. 2. find common multiples and factors, e.g., least common multiple, greatest common factor. 3. explain the use of integers using examples from real-life situations.	1. represent numbers in a variety of equivalent forms, e.g., radicals, absolute value. 2. describe relationships between the subsets of the real number system. 3. explain the use of irrational numbers, e.g., pi. 4. use concrete representations of real numbers in daily situations.

Goal 4 - NUMBER SENSE

Students will develop and use number sense to investigate the characteristics of numbers in a variety of forms and modes of operation.

Indicator 2: Apply number operations with real numbers and other number systems.

6 - 8 Benchmarks:

a. apply computation strategies in the real number system.
b. represent real numbers in a variety of equivalent forms.
c. extend number operations to include roots and exponents.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Sixth Grade	Seventh Grade	Eighth Grade
1. solve problems involving arithmetic operations with fractions and mixed numbers. 2. select appropriate operations to solve problems involving rational numbers, ratios, proportions, and percents. 3. model addition and subtraction with integers.	1. describe and compare two sets of data using ratios including appropriate notation, e.g., a:b, a/b, a to b. 2. add, subtract, multiply, and divide rational numbers. 3. solve consumer application problems involving discount, markup, commission, profit, and simple compound interest. 4. model multiplication and division with integers.	1. simplify numerical expressions involving exponents. 2. use proportions to solve scale-model problems with fractions and decimals. 3. determine a relative position of a square root on a number line. 4. read, write, and compute within any subset of real numbers. 5. read, write, and explain exponential notation

Goal 4 - NUMBER SENSE

Students will develop and use number sense to investigate the characteristics of numbers in a variety of forms and modes of operation.

Indicator 3: Develop conjectures, predictions, or estimations to solve problems and verify or justify the results.

6 - 8 Benchmarks:

a. apply, test, and explain conjectures about properties of a number system.
b. create rules for various problem solving purposes.
c. determine the reasonableness of solutions to various problems derived from calculations.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Sixth Grade	Seventh Grade	Eighth Grade
1. use estimation strategies to help solve multi-step problems involving rational numbers. 2. identify similarities within different problem solving situations. 3. create and justify rules that can be applied in unfamiliar problem-solving situations. 4. test new rules against proven procedures.	1. use estimation strategies to make predictions and help solve multi-step problems involving rational numbers. 2. develop and apply properties of proportions to solve problems. 3. formulate rules to solve practical problems involving integers. 4. analyze and apply properties of operations with rational numbers to simplify expressions.	1. use estimation strategies to predict results and help solve multi-step problems involving real numbers. 2. formulate rules to solve practical problems involving real numbers. 3. use properties to justify steps when simplifying expressions. 4. create algorithms to determine solutions for equations and inequalities. 5. formulate counter-examples to disclaim given assertions.

Goal 4 - NUMBER SENSE

Students will develop and use number sense to investigate the characteristics of numbers in a variety of forms and modes of operation.

Indicator 4: Apply the concept of value, magnitude, and relative magnitude of real numbers.

6 - 8 Benchmarks:

a. express large and small numbers using appropriate notation.
b. describe the effect of operations on magnitudes.
c. explain real number relationships.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Sixth Grade	Seventh Grade	Eighth Grade
1. understand the magnitude of fractions, decimals, and percents. 2. associate mathematical symbols with word names for rational numbers. 3. explain the effects of operations on the magnitude of rational numbers. 4. identify, represent, compare, and order rational numbers and represent them on a number line.	1. understand the magnitude of integers and numbers expressed in scientific notation. 2. associate mathematical symbols with word names for irrational numbers. 3. explain the effects of operations on the magnitude of irrational numbers. 4. compare and order sets of numbers expressed in multiple forms.	1. explain the magnitude of radicals, numbers expressed with exponents, and the absolute values of numbers. 2. associate mathematical symbols with word names of real numbers. 3. explain the effects of operations on the magnitude of real numbers.

Goal 5 - PATTERNS, RELATIONS, AND FUNCTIONS

Students will discover, analyze, extend, and create patterns, relations, or functions to model mathematical ideas in a variety of forms.

Indicator 1: Analyze and describe the properties and behaviors of relations, functions, and their inverses.

6 - 8 Benchmarks:

a. investigate relationships between dependent and independent variables.
b. determine the effects of change in coefficients on graphs of functions or relations.
c. interpret the general properties and behaviors of a set of related functions.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Sixth Grade	Seventh Grade	Eighth Grade
1. explain functions using symbols and graphs. 2. recognize that rate is a measure of one quantity per unit value of another quantity. 3. solve simple problems involving rates, average speed, distance and time.	1. describe different ways in which variables are used. 2. model and solve multi-step problems involving rate, average speed, distance and time, or direct variation. 3. use graphs to distinguish between linear and nonlinear functions. 4. hypothesize relations or functions from patterns.	1. construct problems involving dependent and independent variables. 2. represent and interpret quantitative relationships graphically. 3. understand the relationship of solutions in one variable, the x-intercept of the related linear equation in two variables, and the related situations from which each arise. 4. create rules to explain the relationship between numbers when a change in the first variable affects the second variable.

Goal 5 - PATTERNS, RELATIONS, AND FUNCTIONS

Students will discover, analyze, extend, and create patterns, relations, or functions to model mathematical ideas in a variety of forms.

Indicator 2: Apply relations and functions to complex problem solving situations.

6 - 8 Benchmarks:

a. investigate real-life events that model relations and/or functions.
b. determine solutions to problems using various patterns, functions, or relations.
c. explain patterns and relationships rules used to solve problems.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Sixth Grade	Seventh Grade	Eighth Grade
1. recognize, describe, and extend a variety of numeric and geometric patterns. 2. identify, describe, and generalize patterns involving multiples and perfect squares. 3. use tables and graphs to represent patterns found in real-world events, e.g., month of birth.	1. compute an "output" for a given "input" in a function. 2. identify, describe, and generalize patterns involving geometric growth, square roots, cubes, reciprocals, and exponents. 3. generalize numerical and geometric patterns using algebra and relate the equation, graph, and table of values for the generalization. 4. use tables and graphs to represent patterns found in real-world events, e.g., temperature trends.	1. represent situations with patterns and relations to find exact or approximate solutions to problems. 2. investigate and describe functional relationships of geometric figures. 3. describe and represent relations using tables, graphs, and rules. 4. create and solve problems using proportions, formulas, and functions. 5. identify, describe, represent, extend, and create exponential patterns, e.g., the accumulation of a unit of money (penny) over time.

Goal 5 - PATTERNS, RELATIONS, AND FUNCTIONS

Students will discover, analyze, extend, and create patterns, relations, or functions to model mathematical ideas in a variety of forms.

Indicator 3: Analyze the applications of the concept of mathematical limit.

6 - 8 Benchmarks:

a. explain bounded relationships using various tables, graphs, and algebraic statements.
b. apply models to explain continuous functions and discrete functions.
c. use various models to demonstrate the concept of limit.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Sixth Grade:	Seventh Grade	Eighth Grade
1. apply maximums and minimums to various problem situations, e.g., what is the maximum area that can be enclosed with a minimum amount of fencing? 2. investigate the role of constants in determining relationships, e.g., holding perimeter constant, what is the relationship to area? 3. explore the concept of limit using various representations, e.g., $\frac{1}{2}$ distance to the wall followed by another $\frac{1}{2}$ distance to the wall, . . .	1. connect the concept of maximums and minimums to two- and three-dimensional representations. 2. identify examples of continuous functions. 3. identify examples of discrete functions. 4. model the concept of limit using various representations, e.g., halving distances on the number line.	1. identify the special characteristics of relationships including maximum and minimum values. 2. differentiate between continuous and discrete functions. 3. use exponential growth or decay to explore exponential functions. 4. explain the concept of limit using various representations, e.g., $1 + \frac{1}{2} + \frac{1}{4} + \ldots$

Goal 6 - STATISTICS & PROBABILITY

Students will apply statistical methods to analyze data and explore probability for making decisions and predictions.

Indicator 1: Students will use various statistical models to gather data, study problems, and draw conclusions.

6 - 8 Benchmarks:

a. select and use various data gathering strategies.
b. investigate the impact of variability of data on measures of central tendency.
c. make inferences and draw conclusions through data collection and analysis.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Sixth Grade:	Seventh Grade	Eighth Grade
1. identify different ways to select samples and determine when to use sample data or population data. 2. compare and interpret mean, median, mode, and range. 3. analyze how data is displayed and its impact on conclusions reached. 4. use data to support or reject hypotheses.	1. explore the concept of sampling bias and describe procedures for selecting unbiased samples. 2. solve problems using mean, median, mode and range of a set of data. 3. display data, using frequency distributions, line plots, stem-and-leaf plots, box-and-whisker plots, and scattergrams. 4. make inferences and predictions based on the analysis of student collected data.	1. explain impact of sampling bias on data and describe procedures for selecting unbiased samples. 2. create and solve problems involving the mean, median, mode and range of a set of data. 3. consider effects on reliability of sampling procedures and of missing or incorrect information. 4. use a variety of visual representations to display data to make comparisons, predictions, and inferences. 5. evaluate the validity of claims based on statistical data.

Goal 6 - STATISTICS & PROBABILITY

Students will apply statistical methods to analyze data and explore probability for making decisions and predictions.

Indicator 2: Apply the laws of probability to predict outcomes and solve problems.

6 - 8 Benchmarks:

a. recognize equally likely outcomes, establish sample spaces, and determine probabilities of events.
b. make predictions and compare results based on experimental or theoretical probabilities.
c. predict the results of a series of trials once the probability of one trial is known.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

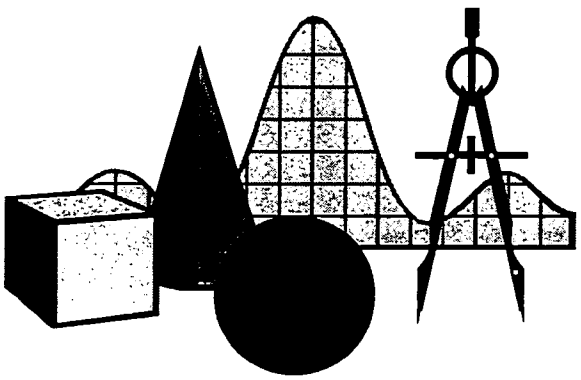
Sixth Grade	Seventh Grade	Eighth Grade
1. represent all possible outcomes for compound events in an organized manner, e.g., tables, tree diagrams. 2. identify probabilities of events and predict outcomes. 3. investigate and describe differences between probabilities of events found through simulation. 4. identify uses and misuses of probability theory in the everyday world.	1. estimate probability of events using a series of trials. 2. represent the results of probability experiments as ratios, decimals, and percents between 0 and 1. 3. use experimental or real world data to estimate the probability of future events. 4. determine and interpret the probability of a given event occurring in a given sample space. 5. use sampling techniques to conduct probability experiments.	1. establish appropriate sample spaces to apply principles of probability for simple and compound chance events. 2. express theoretical probability of experimental outcomes. 3. estimate probability of simple and compound events using a series of trials. 4. explain the difference between independent and dependent events and the impact on results in specific probability situations. 5. determine and interpret the probability of a given event occurring from a given sample space.

SOUTH DAKOTA

MATHEMATICS

9-12

CONTENT STANDARDS



GOALS
INDICATORS
BENCHMARKS
STANDARDS

Goal 1 - ALGEBRA

Students will use the language of algebra to explore, describe, represent, and analyze number expressions and relations that represent variable quantities.

Indicator 1: Analyze procedures to transform algebraic expressions.

9 – 12 Benchmarks:

a. use practical applications to model the properties of equality and inequality.
b. develop procedures for determining solutions for systems of algebraic statements.
c. transform algebraic expressions and analyze the changes in graphs.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Ninth - Twelfth
1. select, justify, and apply a technique to solve quadratic equations over the set of complex numbers and interpret the results graphically.
2. analyze the relationships among the coefficients, factors, and roots of polynomials.
3. apply commutative, associative, distributive, identity, and inverse properties when combining functions.
4. use matrices to organize and manipulate data, including matrix addition, subtraction, and scalar multiplication.
5. analyze various expressions which emphasize the distributive property, e.g., $3(x+2)$; $(x^3 - 4x^2 + 3x + 1)(x^2 - 2x + 3)$.
6. explain the logic of algebraic procedures.
7. extend the concepts of algebra to other types of functions, e.g., trigonometric, exponential, and logarithmic.
8. apply recursive formulas to express iterative patterns of change including those of exponential growth and decay, e.g., mortgages, investment returns.

Goal 1 - ALGEBRA

Students will use the language of algebra to explore, describe, represent, and analyze number expressions and relations that represent variable quantities.

Indicator 2: Use a variety of algebraic concepts and methods to solve problems.

9 – 12 Benchmarks:

a. evaluate the validity of the algebraic representation of given data.
b. solve problems involving systems of linear equations and networks.
c. use the graphs of functions to solve problems.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Ninth - Twelfth
1. determine roots of polynomial functions including complex roots.
2. determine equations for lines meeting certain conditions.
3. use inductive reasoning to test and prove that a formula is correct.
4. explore and develop procedures to identify the real roots of polynomial functions.
5. determine the solution of systems of equations in multiple ways.
6. solve problems using the quadratic formula including graphic representation and analysis.
7. analyze the binomial theorem.

Goal 1 - ALGEBRA

Students will use the language of algebra to explore, describe, represent, and analyze number expressions and relations that represent variable quantities.

Indicator 3: Analyze and describe situations that involve one or more variables.

9 - 12 Benchmarks:

a. produce a graphic simulation of various phenomena using parametric equations.
b. analyze mathematical simulations to interpret the results of change, e.g., motion, time.
c. analyze and describe systems of equations that represent families of curves, e.g., circles and ellipses.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Ninth - Twelfth
1. solve linear-quadratic and quadratic-quadratic systems of equations algebraically and graphically.
2. derive procedures for determining critical features of circles, ellipses, hyperbolas, or parabolas given equations in standard form.
3. create algebraic models to represent problem situations.
4. compare quadratic growth with linear and exponential growth.
5. explain the graphical impact of the xy term in a quadratic equation.
6. graph and interpret complex numbers in vector and polar form.
7. build formulas representing patterns that are algebraic, trigonometric, logarithmic and exponential.
8. find sums, differences, scalar products, dot products, and norms of vectors noting properties which apply.
9. determine, interpret, and use a unit directional vector, perpendicular components, and norms to express vectors in the coordinate plane.

Goal 2 - GEOMETRY

Students will use the language of geometry to discover, analyze, and communicate geometric concepts, properties, and relationships.

Indicator 1: Apply deductive and inductive reasoning to analyze geometric properties to solve problems.

9 - 12 Benchmarks:

a. describe properties of geometric figures using inductive reasoning.
b. support identified properties of geometric figures using deductive reasoning.
c. select geometric properties to represent and solve problems.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Ninth - Twelfth
1. know, use, derive formulas for, and solve problems involving perimeter, circumference, area, volume, lateral area, and surface area of common geometric figures.
2. prove the properties of geometric figures using algebraic and deductive proofs.
3. justify conjectures pertaining to geometric figures.
4. use given information to deduce properties of and relationships between figures.
5. explore and analyze the properties of triangles.
6. investigate and identify congruence and similarity relationships among triangles.
7. determine the values of the six trigonometric functions of angles in standard position.
8. investigate and use properties of angles, arcs, chords, tangents, and secants to solve problems.
9. identify, create, and solve practical problems involving triangles and vectors.

Goal 2 - GEOMETRY

Students will use the language of geometry to discover, analyze, and communicate geometric concepts, properties, and relationships.

Indicator 2: Analyze geometric figures from a variety of perspectives.

9 - 12 Benchmarks:

a. analyze and apply geometric relationships involving cross-sections and other perspectives of geometric figures.
b. create two-and three-dimensional models from geometric shapes and objects.
c. apply transformations, coordinates, and vectors in problem solving.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Ninth - Twelfth
1. create three-dimensional figures from two-dimensional shapes or drawings.
2. create two-dimensional drawings of three-dimensional objects from various perspectives.
3. build three-dimensional objects to scale.
4. use matrices to translate, reflect, rotate, or scale polygonal figures represented on the coordinate plane.
5. use graphing tools to study transformations, e.g., congruence using rigid motion, similarity using magnification of images.
6. select transformations required to map images of objects.
7. use proportional reasoning to solve practical problems.
8. identify, create, and solve practical problems using a system of vectors and their horizontal and vertical components.
9. represent situations using the properties of coordinate geometry to answer pertinent questions.

Goal 3 - MEASUREMENT

Students will apply systems of measurement and use appropriate measurement tools to describe and analyze the world around them.

Indicator 1: Use various units of measure within a system of measurement.

9 - 12 Benchmarks:

a. determine the referents used in relating different scales.
b. justify the appropriateness of a scale selected for measurement situations.
c. create scales with referents that fit unique measurement situations.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Ninth - Twelfth
1. investigate and explain the relationships between linear, square, and cubic measures and describe how changes in one of the measures of an object affect the others.
2. use dimensional analysis to check answers and determine units of a problem solution.
3. use quotient measures and relate them to slope, e.g., speed, density.
4. derive and use formulas for solving problems involving measurements.
5. develop units or combinations of units for a given situation or application.
6. create tools or application processes to extend the physical senses in problem situations that defy direct measurement.

Goal 3 - MEASUREMENT

Students will apply systems of measurement and use appropriate measurement tools to describe and analyze the world around them.

Indicator 2: Apply measurement concepts in practical applications.

9 - 12 Benchmarks:

a. determine the measurement tools necessary to achieve indicated degree of accuracy or precision.
b. develop mathematical techniques to provide indirect measurements in problematic measurement situations.
c. determine and use the most appropriate units for measurement situations.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Ninth - Twelfth
1. use the concept of significant digits in giving answers to an appropriate degree of accuracy.
2. create tools or application processes to improve accuracy or minimize error in measurement situations.
3. analyze specific measurement situations to determine necessary degree of accuracy and/or allowable error tolerance.
4. identify the structural parts and characteristics of objects to answer questions about them, e.g., a penny can be seen as a cylinder with a small height so its volume is $V=\Pi r^2h$.
5. solve measurement problems involving perimeter, area, volume, and mass of irregularly-shaped objects.

Goal 4 - NUMBER SENSE

Students will develop and use number sense to investigate the characteristics of numbers in a variety of forms and modes of operation.

Indicator 1: Analyze the structural characteristics of the real number system and its various subsystems.

9 - 12 Benchmarks:

a. describe the structure of the real number system and identify its appropriate applications and limitations.
b. construct physical representations of various number concepts.
c. analyze the real number system to identify connections between various subsystems and determine the logical extensions.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Ninth - Twelfth
1. describe the structure of the real number system and related subsets.
2. apply properties and axioms of the real number system to various subsets, e.g., axioms of order, closure.
3. understand that real numbers can be represented in a variety of forms, e.g., integers, fractions, decimals, percents, scientific notation, exponents, radicals, absolute value, logarithms.
4. describe the relationship of the real number system to the complex number system.
5. explain the meaning of the number *e*.

Goal 4 - NUMBER SENSE

Students will develop and use number sense to investigate the characteristics of numbers in a variety of forms and modes of operation.

Indicator 2: Apply number operations with real numbers and other number systems.

9 - 12 Benchmarks:

a. analyze algorithms which extend operations within the real number system.
b. use numbers in a variety of equivalent forms to solve problems.
c. analyze relationships between roots and exponents.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Ninth - Twelfth
1. add, subtract, multiply, and divide algebraic expressions.
2. evaluate algebraic expressions.
3. add, subtract, multiply, and divide real numbers including roots and exponents using appropriate computational strategies, e.g., mental mathematics, paper and pencil, calculator.
4. explain the effects of arithmetic operations on real numbers, e.g., roots, exponents, and inverse relationships.
5. analyze and describe fractional exponents, e.g., $10^{3/4}$.
6. analyze the, decimal representation of numbers, e.g., $\frac{1}{3}$ = .33333....,
7. add, subtract, multiply, divide, and simplify expressions containing fractional exponents.

Goal 4 - NUMBER SENSE

Students will develop and use number sense to investigate the characteristics of numbers in a variety of forms and modes of operation.

Indicator 3: Develop conjectures, predictions, or estimations to solve problems and verify or justify the results.

9 - 12 Benchmarks:

a. develop, test, and explain conjectures using properties of a number system.
b. justify the process used for solving problems.
c. justify the reasonableness of the solution for any method of calculation.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Ninth - Twelfth
1. use estimation strategies in complex situations to predict results and to check the reasonableness of results.
2. select and justify alternative strategies, e.g., use properties of numbers that allow operational shortcuts for computational procedures.
3. apply properties of arithmetic and geometric sequences and series to solve problems, e.g., write the first n terms, find the nth term, evaluate summation formulas.
4. use logic strategies to develop and defend mathematical arguments.

Goal 4 - NUMBER SENSE

Students will develop and use number sense to investigate the characteristics of numbers in a variety of forms and modes of operation.

Indicator 4: Analyze the concept of value, magnitude, and relative magnitude of real numbers.

9 - 12 Benchmarks:

a. express extremely large or extremely small numbers using appropriate notation.
b. analyze the effect of operations on extremely large or extremely small numbers.
c. create generalizations discovered through investigations of finite and infinite sets of numbers.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Ninth - Twelfth
1. understand and use basic concepts of infinity and limits.
2. compare, contrast, and extend arithmetic and geometric patterns of growth and use them to make predictions about events for which there is no data.
3. understand the relative size of sets of rational numbers and irrational numbers.
4. describe impact of powers on products and quotients.
5. apply operations to numbers expressed in scientific notation.

Goal 5 - PATTERNS, RELATIONS, AND FUNCTIONS

Students will discover, analyze, extend, and create patterns, relations, or functions to model mathematical ideas in a variety of forms.

Indicator 1: Analyze and describe the properties and behaviors of relations, functions, and related inverses.

9 - 12 Benchmarks:

a. analyze the relationship between dependent and independent variables.
b. analyze the effects of change in coefficients on the graphs of functions or relations.
c. interpret and describe general properties and behaviors of a function operating on another function.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Ninth – Twelfth
1. use various representations of functions, e.g., graphs, tables, symbolic forms.
2. analyze relations to determine whether a direct or inverse variation exists.
3. apply transformations to the graph of a basic function and predict and analyze the results.
4. determine the domain, range, zeros, y-intercepts, end behavior, relative maximum and minimum points, and symmetry of functions.
5. demonstrate and explain the effect that changing coefficients and/or constants has on the graph of a function.
6. use a graph of a function to find the graph of the inverse function.
7. determine the restrictions that must be placed on the domain and range of a relation for it to be a function.
8. create tables or graphs to interpret relations and/or functions.
9. create geometric and numerical patterns that model relations and/or functions.

Goal 5 - PATTERNS, RELATIONS, AND FUNCTIONS

Students will discover, analyze, extend, and create patterns, relations, or functions to model mathematical ideas in a variety of forms.

Indicator 2: Apply relations and functions to complex problem-solving situations.

9 - 12 Benchmarks:

a. analyze and compare linear, exponential, logarithmic and/or trigonometric models of phenomena.
b. apply models to produce potential solution strategies for increasingly difficult problems.
c. describe and evaluate the attributes of various solution strategies.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Ninth - Twelfth
1. determine which type of function best models a situation, write an equation, and use this equation to answer questions about the situation.
2. identify and use laws of logarithms to simplify expressions and solve equations involving logarithms and exponents.
3. analyze the relationship between exponential and logarithmic functions.
4. graph various parametric polar equations.
5. identify natural phenomena that are cyclic.
6. apply special number relationships, e.g., sequences and series to real-world problems.
7. compare, contrast, and extend arithmetic and geometric patterns of growth and use them to make predictions.
8. determine and use recursive formulas to express iterative patterns of change including those of exponential growth and decay.

Goal 5 - PATTERNS, RELATIONS, AND FUNCTIONS

Students will discover, analyze, extend, and create patterns, relations, or functions to model mathematical ideas in a variety of forms.

Indicator 3: Analyze the applications of the concept of mathematical limit.

9 - 12 Benchmarks:

a. analyze the attributes of bounded relationships.
b. analyze functions and relations to determine continuity.
c. demonstrate the concept of limit using various geometric, numeric, and algebraic models.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Ninth - Twelfth
1. use concepts of infinity and limits to solve problems.
2. use successive approximation techniques to solve problems.
3. apply limits of geometric series to problem situations.
4. use iteration and recursion to evaluate problem situations.
5. solve equations that include both infinite solutions and restricted domain solutions.
6. estimate the limit of a given infinite sequence.

Goal 6 - STATISTICS & PROBABILITY

Students will apply statistical methods to analyze data and explore probability for making decisions and predictions.

Indicator 1: Use various statistical models to gather data, study problems, and draw conclusions.

9 - 12 Benchmarks:

a. determine appropriate sampling techniques for specific investigations.
b. analyze the impact of variability of data on measures of central tendency.
c. support conclusions and make decisions based on graphic and/or algebraic models of data.

GRADE LEVEL STANDARDS

THE STUDENT WILL:

Ninth - Twelfth
1. analyze and evaluate surveys and experiments conducted by others, e.g., bias, randomness, analysis, interpretation.
2. create, implement, and defend a plan for gathering data to answer relevant questions.
3. compare multiple one-variable data sets, using statistical techniques including measures of central tendency and dispersion.
4. calculate measures of central tendency and dispersion for complex sets of data.
5. demonstrate how statistical analysis can quantify variability.
6. describe the normal curve and use it to predict percentiles and probabilities.
7. use scatterplots, regression lines, and correlation coefficients to model data and support conclusions.

Goal 6 - STATISTICS & PROBABILITY

Students will apply statistical methods to analyze data and explore probability for making decisions and predictions.

Indicator 2: Apply the laws of probability to predict outcomes and solve problems.

9 - 12 Benchmarks:

a. use theoretical probability models to determine outcomes of chance events.
b. develop convincing arguments and inferences supported by simulations.
c. analyze the accuracy of probabilistic models.

9 – 12 GRADE LEVEL STANDARDS

THE STUDENT WILL:

Ninth - Twelfth
1. determine probabilities using counting procedures, tables, tree diagrams, and formulas for permutations and combinations.
2. determine probability of compound, complementary, independent, and dependent events.
3. evaluate effectiveness and accuracy of the model in respect to the theoretical probability.
4. design, implement, and interpret simulations to estimate probabilities of events.
5. determine probability using given graphs of distributions or table of outcomes.
6. predict outcomes of simple and compound events using given theoretical probabilities.
7. determine whether experimental or theoretical methods were used to calculate a particular probability.
8. use combinations, permutations, and probabilities to solve problems.

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