LCB File No. T019-99

ADOPTED TEMPORARY REGULATION OF THE
NEVADA STATE BOARD OF EDUCATION

STATE BOARD FOR OCCUPATIONAL EDUCATION
(Effective February 9, 1999)

Explanation: Matter in italics is new; matter in brackets [ ] is material to be omitted.

MATHEMATICS

Statutory Authority: 385.080

Chapter 389 of NAC is hereby amended by adding the provisions as follows with an effective date of July 1, 1999:

KINDERGARTEN AND ELEMENTARY SCHOOL

Instruction Through Second Grade

By the end of the second grade, students know and are able to do everything required in the previous grades for courses in mathematics offered in public elementary schools and must include instruction designed to teach the following content standards to the pupil by the completion of second grade:

1. For the content areas of Numbers, Number Sense, and Computation:

(a) To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will accurately calculate and use estimation techniques, number relationships, operation rules, and algorithms; they will determine the reasonableness of answers and the accuracy of solutions.

(1) Identify and model basic addition facts (sums to 18) and the corresponding subtraction facts; immediately recall basic addition facts (sums through 10) and the corresponding subtraction facts.

(2) Add and subtract multi-digit numbers without regrouping.

(3) Generate and solve one-step addition and subtraction problems based on practical situations.

(4) Use decimals to show money amounts.

(5) Use the inherent patterns in numbers to skip count by 2's, 3's, 5's, and 10's to 100 and beyond.

(6) Read, write, order, and compare numbers from 0-999.

(7) Estimate the number of objects in a set to 20; read and write number words to 20 and use ordinal positions first to twentieth.

(8) Use, model, and identify place value positions of 1's, 10's, and 100's.

(9) Identify, model, and label _ and _ as parts of a whole.

2. For the content areas of Patterns, Functions, and Algebra

(a) To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will use various algebraic methods to analyze, illustrate, extend, and create numerous representations (words, numbers, tables, and graphs) of patterns, functions, and algebraic relations as modeled in practical situations.

(1) Recognize, describe, extend, and create repeating and increasing patterns using symbols, objects, and manipulatives; use patterns and their extensions to solve problems.

(2) Use variables and open sentences to express relationships.

(3) Generate and solve problems based on various numerical sentences.

(4) Model, explain and solve a number sentence involving addition and subtraction.

3. For the content area of Measurement:

(a) To solve problems, communicate, reason and make connections within and beyond the field of mathematics, students will use appropriate tools and techniques of measurement to determine, estimate, record, and verify direct and indirect measurements.

(1) Compare and order objects by various measurable attributes (e.g., time, temperature, length, weight, capacity, volume, and area) communicating their similarities and differences.

(2) Compare objects to standard whole units to find objects that are greater than, less than, and/or equal to a given unit (e.g., inch, yard, centimeter, meter).

(3) Determine the value of any given set of coins and bills.

(4) Recite and use the months of the year in order; use a calendar to

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identify days, weeks, months, and year; read time to the nearest quarter hour; distinguish between day and night.

4. For the content areas of Spatial Relationships and Geometry

(a) To solve problems, communicate, and make connections within and beyond the field of mathematics, students will identify, represent, verify, and apply spatial relationships and geometric properties.

(1) Identify, name, sort, sketch, describe, and compare two dimensional shapes (circles, triangles, rectangles including squares) regardless of position.

(2) Use position words (e.g., before, far, below, left) to describe location of objects and to place objects; compare the size (larger and smaller) of similar two dimensional figures (e.g., circles, triangles); identify congruent shapes.

(3) Identify figures with symmetry as they appear in the environment; create two dimensional designs that contain a line of symmetry.

(4) Identify, name, sort, describe, compare, and contrast two- and three- dimensional geometric figures (e.g., circle/sphere, square/cube, triangle/pyramid).

5. For the content area of Data Analysis:

(a) To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will collect, organize, display, interpret, and analyze data to determine statistical relationships and probability projections.

(1) Collect, organize, record, and explain classification of data using concrete materials.

6. For the process area of Problem Solving:

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

(1) Select, modify, develop, and apply strategies to solve a variety of mathematical and practical problems and to investigate and understand mathematical concepts.

(2) Apply previous experience and knowledge to new problem-solving situations.

(3) Formulate own problems; use various approaches to investigate and solve problems.

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(4) Explain and verify results with respect to the original problem.

(5) Try more than one strategy when the first strategy proves to be unproductive.

(6) Apply solutions and strategies from earlier problems to new problem situations.

7. For the process area of Mathematical Communication:

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

(1) Discuss and exchange ideas about mathematics as a part of learning.

(2) Use inquiry techniques (e.g. discussion, questioning, research, data gathering) to solve mathematical problems.

(3) Use pictorial representations to identify mathematical operations and concepts.

(4) Use physical materials, models, pictures, or writing to represent and communicate mathematical ideas.

(5) Explain and justify thinking about mathematical ideas and solutions.

(6) Use everyday language to explain thinking about strategies and solutions to mathematical problems.

(7) Express mathematical ideas and use them to define, compare, and solve problems orally and in writing.

(8) Use mathematical notation to communicate and explain mathematical situations.

8. For the process area of Mathematical Reasoning:

(a) Student will develop their ability to reason mathematically by solving problems in which there is a need to investigate significant mathematical ideas and construct their own learning in all content areas in order to justify their thinking; reinforce and extend their logical reasoning abilities; reflect on and clarify their own thinking; and ask questions to extend their thinking.

(1) Justify and explain the solutions to problems using manipulative and physical models.

(2) Use patterns and relationships to analyze mathematical situations; draw logical

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conclusions about mathematical problems.

(3) Ask questions to reflect on, clarify, and extend thinking.

(4) Review and refine the assumptions and steps used to derive conclusions in mathematical arguments.

9. For the process area of Mathematical Connections:

(a) Students will develop the ability to make mathematical connections by solving problems in which there is a need to view mathematics as an integrated whole, identifying relationships between context strands, and integrating mathematics with other disciplines, allowing the flexibility to approach problems in a variety of ways within and beyond the field of mathematics.

(1) Link new concepts to prior knowledge.

(2) Use mathematical ideas from one area of mathematics to explain an idea from another area of mathematics.

(3) Identify practical applications of mathematical principles that can be applied to other disciplines.

(4) Apply mathematical thinking and modeling to solve problems that arise in other disciplines (e.g. rhythm in music and motion in science).

(5) Identify, explain, and use mathematics in everyday life.

Instruction Through Third Grade

By the end of the third grade, students know and are able to do everything required in the previous grades for courses in mathematics offered in public elementary schools and must include instruction designed to teach the following content standards to the pupil by the completion of third grade:

1. For the content areas of Numbers, Number Sense, and Computation:

(a) To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will accurately calculate and use estimation techniques, number relationships, operation rules, and algorithms; they will determine the reasonableness of answers and the accuracy of solutions.

(1) Immediately recall and use addition and subtraction facts and multiplication facts to 81.

(2) Add and subtract multi-digit numbers with regrouping.

(3) Generate and solve 2-step addition and subtraction and 1-step multiplication problems based on practical situations using pencil and paper, mental computation, and estimation.

(4) Add and subtract decimals using money as a model.

(5) Multiply multi-digit numbers by a one-digit number with regrouping. Use addition to model and explain multiplication.

(6) Read, write, order, and compare numbers from 0-9,999.

(7) Round to nearest tens and hundreds to determine reasonableness of the answer.

(8) Use, model, and identify place value positions up to 10,000.

(9) Model, sketch, and label fractions with denominators to 10; write fractions with numerals and with number words.

2. For the content areas of Patterns, Functions, and Algebra

(a) To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will use various algebraic methods to analyze, illustrate, extend, and create numerous representations (words, numbers, tables, and graphs) of patterns, functions, and algebraic relations as modeled in practical situations.

(1) Recognize, describe, and create repeating and increasing patterns using numbers; use number patterns and their extensions to solve problems.

(2) Identify missing terms and missing numbers in open number sentences involving number facts in addition and subtraction.

(3) Complete number sentences with the appropriate words and symbols for addition, subtraction, less than, greater than, and equal to using correct mathematical symbols (e.g., >, <, =, +, ()).

3. For the content area of Measurement:

(a) To solve problems, communicate, reason and make connections within and beyond the field of mathematics, students will use appropriate tools and techniques of measurement to determine, estimate, record, and verify direct and indirect measurements.

(1) Measure and record to a required degree of accuracy and evaluate for error,

identifying the appropriateness of selected units of measure.

(2) Estimate and use measuring devices with standard and non-standard units to measure length, surface area, liquid volume, capacity, temperature, and weight, communicating the concepts of more, less, and equivalent.

(3) Read, write, and use money notation determining possible combinations of coins and bills to equal given amounts.

(4) Tell time to the nearest minute, using analog and digital clocks, and identify elapsed time.

4. For the content areas of Spatial Relationships and Geometry

(a) To solve problems, communicate, and make connections within and beyond the field of mathematics, students will identify, represent, verify, and apply spatial relationships and geometric properties.

(1) Describe, sketch, compare, and contrast plane geometric figures.

(2) Demonstrate and describe the motion (transformation) of geometric figures as a slide, rotation, or a flip.

(3) Describe, sketch, model, build, compare, and contrast two- and three dimensional geometric figures.

5. For the content area of Data Analysis:

(a) To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will collect, organize, display, interpret, and analyze data to determine statistical relationships and probability projections.

(1) Collect, organize, display, and describe simple data using number lines, pictographs, bar graphs, and frequency tables.

(2) Use concepts of probability (e.g., impossible, likely, certain) to make predictions about future events.

6. For the process area of Problem Solving:

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

connections.

(1) Select, modify, develop, and apply strategies to solve a variety of mathematical and practical problems and to investigate and understand mathematical concepts.

(2) Apply previous experience and knowledge to new problem-solving situations.

(3) Explain and verify results with respect to the original problem.

(4) Try more than one strategy when the first strategy proves to be unproductive.

(5) Apply solutions and strategies from earlier problems to new problem situations.

7. For the process area of Mathematical Communication:

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

(1) Discuss and exchange ideas about mathematics as a part of learning.

(2) Use inquiry techniques (e.g. discussion, questioning, research, data gathering) to solve mathematical problems.

(3) Identify and translate key words and phrases that imply mathematical operations.

(4) Use physical materials, models, pictures, or writing to represent and communicate mathematical ideas.

(5) Explain and justify thinking about mathematical ideas and solutions.

(6) Use everyday language to explain thinking about strategies and solutions to mathematical problems.

(7) Express mathematical ideas and use them to define, compare, and solve problems orally and in writing.

(8) Use mathematical notation to communicate and explain mathematical situations.

8. For the process area of Mathematical Reasoning:

(a) Student will develop their ability to reason mathematically by solving problems in which there is a need to investigate significant mathematical ideas and construct their own learning in

all content areas in order to justify their thinking; reinforce and extend their logical reasoning abilities; reflect on and clarify their own thinking; and ask questions to extend their thinking.

(1) Justify and explain the solutions to problems using manipulative and physical models.

(2) Use patterns and relationships to analyze mathematical situations; draw logical conclusions about mathematical problems.

(3) Ask questions to reflect on, clarify, and extend thinking.

(4) Review and refine the assumptions and steps used to derive conclusions in mathematical arguments.

9. For the process area of Mathematical Connections:

(a) Students will develop the ability to make mathematical connections by solving problems in which there is a need to view mathematics as an integrated whole, identifying relationships between context strands, and integrating mathematics with other disciplines, allowing the flexibility to approach problems in a variety of ways within and beyond the field of mathematics.

(1) Link new concepts to prior knowledge.

(2) Use mathematical ideas from one area of mathematics to explain an idea from another area of mathematics.

(3) Identify practical applications of mathematical principles that can be applied to other disciplines.

(4) Apply mathematical thinking and modeling to solve problems that arise in other disciplines (e.g. rhythm in music and motion in science).

(5) Identify, explain, and use mathematics in everyday life.

Instruction Through Fifth Grade

By the end of the fifth grade, students know and are able to do everything required in the previous grades for courses in mathematics offered in public elementary schools and must include instruction designed to teach the following content standards to the pupil by the completion of fifth grade:

1. For the content areas of Numbers, Number Sense, and Computation:

(a) To solve problems, communicate, reason, and make connections within and beyond the

field of mathematics, students will accurately calculate and use estimation techniques, number relationships, operation rules, and algorithms; they will determine the reasonableness of answers and the accuracy of solutions.

(1) Immediately recall and use multiplication and corresponding division facts through 12's.

(2) Generate and solve addition, subtraction, multiplication, and division problems using whole numbers in practical situations.

(3) Use order of operations to solve problems.

(4) Multiply and divide multi-digit numbers by 2-digit numbers, including powers of 10.

(5) Compare and order negative numbers within the context of everyday happenings (e.g., temperature) and plot those numbers on a number line.

(6) When rounding, identify which place value will be most helpful in estimating an answer and determine the reasonableness of the answer.

(7) Use and identify place value.

(8) Use models and drawings to identify, compare, add, and subtract fractions with like denominators and to add and subtract decimals; use both to solve problems.

2. For the content areas of Patterns, Functions, and Algebra

(a) To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will use various algebraic methods to analyze, illustrate, extend, and create numerous representations (words, numbers, tables, and graphs) of patterns, functions, and algebraic relations as modeled in practical situations.

(1) Identify, describe, and explain patterns and relationships in the number system (e.g., formed by triangular numbers, perfect squares, arithmetic and geometric sequences) using concrete materials, paper and pencil, and calculators.

(2) Using whole numbers as a replacement set, find possible solutions to such inequalities as 8 + 4 > n.

(3) Use variables in open sentences and to describe simple functions and relationships.

(4) Generate number sequences given the first term and any basic computation rule (e.g., given a 4 and the rule of add 6, 10, 16, 22, 28, É).

(5) Solve simple equations using a variety of methods (e.g. inverse operations, mental

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math, and estimate and verify).

3. For the content area of Measurement:

(a) To solve problems, communicate, reason and make connections within and beyond the field of mathematics, students will use appropriate tools and techniques of measurement to determine, estimate, record, and verify direct and indirect measurements.

(1) Measure, compare, and convert length to the closest fractional part (1/4 and 1/2) of inches, feet, yards, and miles; measure, compare, and convert length to the closest decimal unit of milli, centi-, kilo-, and meters.

(2) Estimate measures of length, volume, capacity, quantity, and weight, communicating degree of accuracy needed and when a more precise measure is required.

(3) Determine totals and change due for monetary amounts in problem-solving situations.

(4) Describe and determine the perimeter of polygons, the area of right triangles and rectangles (including squares), communicating the difference between perimeter and area.

(5) Identify equivalent periods of time, including relationships between and among seconds, minutes, hours, days, months, and years (e.g., 60 sec=1 min).

4. For the content areas of Spatial Relationships and Geometry

(a) To solve problems, communicate, and make connections within and beyond the field of mathematics, students will identify, represent, verify, and apply spatial relationships and geometric properties.

(1) Draw and classify angles and triangles according to their measurement (e.g., right, obtuse, and acute); identify and draw circles and parts of circles, describing the relationships between the various parts (e.g., central angle, arc, diameter).

(2) Identify shapes that have congruence, similarity, and/or symmetry of figures using a variety of methods including transformational motions (e.g., translation/slide, rotation/turn, reflection/flip, enlargement/reduction) and models, drawings, and measurement tools.

(3) Using a grid, identify coordinates for a given point or locate points of given coordinates in the first quadrant.

(4) Identify, describe, compare, and classify two and three- dimensional figures by relevant properties including number of vertices (corners), edges, and shapes of faces; identify and predict the effects of combining, dividing, and changing shapes into other shapes.

(5) Identify, describe, define, and draw geometric figures including points, intersecting,

perpendicular and parallel lines, line segments, rays, angles, and planes.

5. For the content area of Data Analysis:

(a) To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will collect, organize, display, interpret, and analyze data to determine statistical relationships and probability projections.

(1) Collect, organize, read, and interpret data using a variety of graphic representations including tables, line plots, stem and leaf plots, scatter plots, histograms; use data to draw and explain conclusions and predictions.

(2) Conduct simple probability experiments using concrete materials and represent the results using fractions.

(3) Solve probability problems using a variety of methods including constructing sample spaces and tree diagrams.

(4) Model and then compute measures of central tendency including mean, median, and mode.

(5) Describe the limitations of various graph formats; select an appropriate type of graph to accurately represent the data and justify the selection.

6. For the process area of Problem Solving:

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

(1) Select, modify, develop, and apply strategies to solve a variety of mathematical and practical problems and to investigate and understand mathematical concepts.

(2) Apply previous experience and knowledge to new problem-solving situations.

(3) Verify, interpret, and evaluate results with respect to the original problem situation, determining an efficient strategy for the given situation.

(4) Try more than one strategy when the first strategy proves to be unproductive.

(5) Apply multi-step, integrated, mathematical problem-solving strategies, persisting until a solution is found or until it is clear that no solution exists.

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(6) Generalize solutions and strategies from earlier problems to new problem situations.

(7) Interpret and solve a variety of mathematical problems by paraphrasing, identifying necessary and extraneous information, selecting and justifying efficient methods and/or strategies, and ensuring the answer is reasonable.

7. For the process area of Mathematical Communication:

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

(1) Discuss and exchange ideas about mathematics as a part of learning.

(2) Use inquiry techniques (e.g. discussion, questioning, research, data gathering) to solve mathematical problems.

(3) Identify and translate key words and phrases that imply mathematical operations.

(4) Use physical material, diagrams, and tables to represent and then communicate mathematical ideas through oral, verbal, and written formats.

(5) Explain and justify thinking about mathematical ideas and solutions.

(6) Make conjectures and present arguments in discussions of mathematical ideas.

(7) Use everyday language to explain thinking about strategies and solutions to mathematical problems.

(8) Express mathematical ideas and use them to define, compare, and solve problems orally and in writing.

(9) Use mathematical notation to communicate and explain mathematical situations.

8. For the process area of Mathematical Reasoning:

(a) Student will develop their ability to reason mathematically by solving problems in which there is a need to investigate significant mathematical ideas and construct their own learning in all content areas in order to justify their thinking; reinforce and extend their logical reasoning abilities; reflect on and clarify their own thinking; and ask questions to extend their thinking.

(1) Justify answers and the steps taken to solve problems with and without manipulatives

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and physical models.

(2) Use patterns and relationships to analyze mathematical situations; draw logical conclusions about mathematical problems.

(3) Follow a logical argument and judge its validity.

(4) Apply deductive and inductive reasoning in mathematical situations to extend logical reasoning.

(5) Ask questions to reflect on, clarify, and extend thinking.

(6) Review and refine the assumptions and steps used to derive conclusions in mathematical arguments.

(7) Determine relevant, irrelevant, and/or sufficient information to solve mathematical problems.

9. For the process area of Mathematical Connections:

(a) Students will develop the ability to make mathematical connections by solving problems in which there is a need to view mathematics as an integrated whole, identifying relationships between context strands, and integrating mathematics with other disciplines, allowing the flexibility to approach problems in a variety of ways within and beyond the field of mathematics.

(1) Link new concepts to prior knowledge.

(2) Use mathematical ideas from one area of mathematics to explain an idea from another area of mathematics.

(3) Use models to explain the relationship of concepts to procedures.

(4) Identify practical applications of mathematical principles that can be applied to other disciplines.

(5)Apply mathematical thinking and modeling to solve problems that arise in other disciplines (e.g. rhythm in music and motion in science).

(6) Identify, explain, and use mathematics in everyday life.

Instruction Through Eighth Grade

By the end of the eighth grade, students know and are able to do everything required in the

previous grades for courses in mathematics offered in public elementary schools and must include instruction designed to teach the following content standards to the pupil by the completion of eighth grade:

1. For the content areas of Numbers, Number Sense, and Computation:

(a) To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will accurately calculate and use estimation techniques, number relationships, operation rules, and algorithms; they will determine the reasonableness of answers and the accuracy of solutions.

(1) Read, write, add, subtract, multiply, and divide real numbers in various forms including radicals, exponential, and scientific notation.

(2) Compute with rational and irrational numbers to solve a variety of problems including rates, recipes, unit cost, and percents (e.g., discounts, interest, sale price, commissions, taxes).

(3) Explain and apply concepts of number theory and properties of real numbers to solve problems.

(4) Estimate in problem-solving situations and in practical applications; determine the reasonableness of the answer and verify the results.

(5) Explain the relationship between fractions, decimals, and percents and translate among various representations of equal numbers (e.g., from fractions to decimals to percents, various forms of "1" such as 3/3 or 16/16) to solve problems efficiently.

2. For the content areas of Patterns, Functions, and Algebra

(a) To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will use various algebraic methods to analyze, illustrate, extend, and create numerous representations (words, numbers, tables, and graphs) of patterns, functions, and algebraic relations as modeled in practical situations.

(1) Use inductive reasoning to find the missing term in number and geometric patterns and to generalize basic patterns to the nth term, with and without calculators; use written, oral, and symbolic language to identify and describe patterns, sequences and functions.

(2) Identify, model, describe, and evaluate relationships including functions using diagrams and equations, with and without technology.

(3) Evaluate formulas and algebraic expressions for given values of a variable (e.g., $A = lw$ given $l = 6$, $w = 2$, then $A = 12$).

(4) Add and subtract binomials describing the connection between the algebraic process and the arithmetic process.

(5) Describe how a change in one variable of a mathematical relationship affects the remaining variables using various tools and methods.

(6) Model, identify, and solve linear equations and inequalities, using formal and informal methods, and relate this process to the order of operations.

(7)Solve simple linear equations and connect that process to the order of operations.

3. For the content area of Measurement:

(a) To solve problems, communicate, reason and make connections within and beyond the field of mathematics, students will use appropriate tools and techniques of measurement to determine, estimate, record, and verify direct and indirect measurements.

(1) Compare and convert units of measure for length, weight / mass, and volume within the same measurement system (customary and metric); estimate conversions between like units of the two systems to solve problems.

(2) Demonstrate an understanding of precision, error and tolerance in measurement using the appropriate measurement tool to the required degree of accuracy.

(3) Estimate, measure to the required degree of accuracy, derive, and apply formulas to find perimeter, circumference and area of plane figures and volume and surface area of solid figures; identify the relationship between changes in area and volume and changes in linear measures of figures.

(4) Apply ratios and proportions to calculate rates and as a method of indirect measure (e.g., miles per hour, cost per unit).

4. For the content areas of Spatial Relationships and Geometry

(a) To solve problems, communicate, and make connections within and beyond the field of mathematics, students will identify, represent, verify, and apply spatial relationships and geometric properties.

(1) Identify, classify, compare, and draw regular and irregular polygons such as triangles, quadrilaterals, pentagons, hexagons, and octagons; find the sum of the interior angles of polygons.

(2) Apply the properties of equality and proportionality to solve problems involving congruent or similar shapes (e.g., create scale drawings, perspective drawings).

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(3) Use coordinate geometry and models to change scale (enlarge and reduce); demonstrate other geometric transformations by finding the ordered pairs and describe the location of the original and the transformed figures.

(4) Make a model of a three-dimensional figure from a two-dimensional drawing and make a two-dimensional drawing of a three-dimensional object.

(5) Use coordinate geometry to represent and interpret relationships defined by equations and formulas (including distance, midpoint, and slope) with and without technology.

(6) Form generalizations and validate conclusions about properties of geometric shapes including parallel lines, perpendicular lines, bisectors, triangles, and quadrilaterals.

(7) Verify and explain the Pythagorean Theorem with various methods (e.g., using grid paper, applying it to a missing side of a right triangle); determine missing sides and angles of triangles based on properties of their sides and angles including the Triangle Sum Theorem.

(8) Use hand tools, technology, and models to construct figures and bisect angles and line segments; distinguish among constructions, sketches and drawings.

5. For the content area of Data Analysis:

(a) To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will collect, organize, display, interpret, and analyze data to determine statistical relationships and probability projections.

(1) Organize, display, read, and analyze data with and without technology using a variety of displays including circle graphs, frequency distributions, and box and whisker plots.

(2) Find the theoretical probability (the mathematical expectations) of an event using different counting methods (e.g., tree diagrams, sample space, organized lists) and compare those results with actual (experimental) results, differentiating between the probability of an event and the odds of an event.

(3) Find the number of combinations possible in given situations using a variety of counting methods.

(4) Evaluate arguments that are based on data analysis for accuracy and validity; analyze the effect a change of scale or a change of format will have on statistical charts and graphs.

(5) Describe the limitations of various graph formats; select an appropriate type of graph to accurately represent the data and justify the selection; describe the limitations of various graph formats.

6.   For the process area of Problem Solving:

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

(1) Select, modify, develop, and apply strategies to solve a variety of mathematical and practical problems and to investigate and understand mathematical concepts.

(2) Apply previous experience and knowledge to new problem-solving situations.

(3) Verify, interpret, and evaluate results with respect to the original problem situation, determining an efficient strategy for the given situation.

(4) Try more than one strategy when the first strategy proves to be unproductive.

(5) Apply multi-step, integrated, mathematical problem-solving strategies, persisting until a solution is found or until it is clear that no solution exists.

(6) Generalize solutions and strategies from earlier problems to new problem situations.

(7) Interpret and solve a variety of mathematical problems by paraphrasing, identifying necessary and extraneous information, selecting and justifying efficient methods and/or strategies, and ensuring the answer is reasonable.

7. For the process area of Mathematical Communication:

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

(1) Discuss and exchange ideas about mathematics as a part of learning.

(2) Use inquiry techniques (e.g. discussion, questioning, research, data gathering) to solve mathematical problems.

(3) Read expository text to learn about mathematics.

(4) Interpret and solve word problems without the necessity of key words or phrases.

(5) Model and explain mathematical relationships using oral, written, graphical, and algebraic methods.

(6) Explain and evaluate thinking about mathematical ideas and solutions.

(7) Evaluate the effectiveness of written and oral presentations of mathematics.

(8) Make conjectures and present arguments in discussions of mathematical ideas.

(9) Explain and evaluate thinking about mathematical ideas and solutions based on the role of definitions, properties, common rules, and symbols in solving problems.

(10) Use everyday language to explain thinking about strategies and solutions to mathematical problems.

(11) Express mathematical ideas and use them to define, compare, and solve problems orally and in writing.

8. For the process area of Mathematical Reasoning:

(a) Student will develop their ability to reason mathematically by solving problems in which there is a need to investigate significant mathematical ideas and construct their own learning in all content areas in order to justify their thinking; reinforce and extend their logical reasoning abilities; reflect on and clarify their own thinking; and ask questions to extend their thinking.

(1) Construct, justify, and defend mathematical conclusions using logical arguments, in situations related to mathematics, science, and technology.

(2) Use patterns and relationships to analyze mathematical situations; draw logical conclusions about mathematical problems.

(3) Follow a logical argument and judge its validity.

(4) Recognize and apply deductive and inductive reasoning in both concrete and abstract contexts.

(5) Ask questions to reflect on, clarify, and extend thinking.

(6) Review and refine the assumptions and steps used to derive conclusions in mathematical arguments.

(7) Determine relevant, irrelevant, and/or sufficient information to solve mathematical problems.

9. For the process area of Mathematical Connections:

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(a) Students will develop the ability to make mathematical connections by solving problems in which there is a need to view mathematics as an integrated whole, identifying relationships between context strands, and integrating mathematics with other disciplines, allowing the flexibility to approach problems in a variety of ways within and beyond the field of mathematics.

(1) Link new concepts to prior knowledge.

(2) Use mathematical ideas from one area of mathematics to explain an idea from another area of mathematics.

(3) Use models to explain the relationship of concepts to procedures.

(4) Use the connections among mathematical topics to develop multiple approaches to problems.

(5) Identify practical applications of mathematical principles that can be applied to other disciplines.

(6) Apply mathematical thinking and modeling to solve problems that arise in other disciplines (e.g. rhythm in music and motion in science).

(7) Use and analyze the connections between Mathematics and other disciplines.

(8) Identify, explain, and use mathematics in everyday life.

HIGH SCHOOL

Required Course of Study

By the end of grade 12, students know and are able to do everything required in the previous grades for courses in mathematics offered in public schools and must include instruction designed to teach the following content standards to the pupil by the completion of grade 12:

1. For the content areas of Numbers, Number Sense, and Computation:

(a) To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will accurately calculate and use estimation techniques, number relationships, operation rules, and algorithms; they will determine the reasonableness of answers and the accuracy of solutions.

(1) Calculate and estimate sums, differences, products, quotients, powers, and roots

using mental math, formulas, and algorithms.

(2) Apply the laws of exponents to perform operations on expressions with integral exponents and scientific notation.

(3) Apply properties and theories of the real number system to everyday situations.

(4) Perform simple operations on matrices.

2. For the content areas of Patterns, Functions, and Algebra

(a) To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will use various algebraic methods to analyze, illustrate, extend, and create numerous representations (words, numbers, tables, and graphs) of patterns, functions, and algebraic relations as modeled in practical situations.

(1) Represent, analyze, and solve problem situations using discrete structures including graphs and matrices, with and without technology.

(2) Create and use different forms of a variety of equations, proportions, and/or formulas ($I=PRT$ or $R=I/PT$), solving for the needed variable as necessary in given situations.

(3) Add, subtract, multiply, and factor (1st and 2nd degree) polynomials, describing each step in the process and the connection between the algebraic process and the arithmetic process; use quadratic equations to solve practical and mathematical problems, with and without technology.

(4) Model practical problems from everyday situations with a variety of models that includes matrices, translating among tabular, symbolic and graphical representations of functions, with and without technology.

(5) Determine the domain and range of linear relations given a graph or a set of ordered pairs; explain their importance in problem solving situations.

(6) Solve systems of two linear equations both algebraically and graphically; use graphing calculators as a primary tool in solving these problems and to verify solutions found by other methods.

3. For the content area of Measurement:

(a) To solve problems, communicate, reason and make connections within and beyond the field of mathematics, students will use appropriate tools and techniques of measurement to determine, estimate, record, and verify direct and indirect measurements.

(1) Convert one unit of measure to another between customary and metric systems and

between monetary systems.

(2) Select and use measurement tools, techniques, and formulas to calculate and compare rates, cost, distances, interest, temperatures, and weight/mass.

(3) Distinguish and differentiate among the structures, language and uses of systems of measures (e.g., linear, square units, cubic units); justify and communicate the differences between accuracy, precision, error, and tolerance in measurement; describe how each of these can affect solutions found in problem situations.

(4) Use and interpret consumer data (e.g., amortization tables, tax tables, and compound interest charts) to make informed financial decisions related to practical applications such as budget.

(5) Use relationships (e.g., proportions) and formulas (indirect measurement) to determine the measurement of unknown dimensions, angles, areas, and volumes to solve problems.

4. For the content areas of Spatial Relationships and Geometry

(a) To solve problems, communicate, and make connections within and beyond the field of mathematics, students will identify, represent, verify, and apply spatial relationships and geometric properties.

(1) Identify and use the properties of polygons (including interior and exterior angles) and elements of circles (e.g., angles, arc, chord, secants and tangents) to solve practical problems.

(2) Use coordinate geometry to graph linear equations, determine slopes of lines, identify parallel and perpendicular lines and find possible solutions to sets of equations; use algebraic techniques to solve problems determined by geometric relationships.

(3) Use complementary and supplementary angles, congruent angles, vertical angles, angles formed when parallel lines are cut by a transversal, and angles in polygons to solve practical problems.

(4) Apply the Pythagorean Theorem, its converse, properties of special right triangles, and right triangle trigonometry to solve practical problems.

(5) Use tools, technology, and models to sketch, draw, and construct geometric figures in order to solve problems and to demonstrate the properties of geometric figures.

(6) Construct, justify and defend mathematical conclusions using logical, sequential, deductive reasoning supported by established mathematical principles.

5. For the content area of Data Analysis:

(a) To solve problems, communicate, reason, and make connections within and beyond the field of mathematics, students will collect, organize, display, interpret, and analyze data to determine statistical relationships and probability projections.

(1) Use calculators and computers to create and manipulate tables, graphs, and matrices to communicate statistical information; use the shape of graphs of normal distributions to compare and analyze information.

(2) Design, conduct, analyze, and communicate the results of multi-stage probability experiments.

(3) Identify a probability situation as a permutation or a combination and find the possible outcomes using a variety of methods.

(4) Select and use the measures of central tendency such as mean, median, mode and variability including range, distribution and possible outliers that are appropriate for given situations.

(5) Analyze the validity of statistical conclusions noting various sources of bias, misuse, and abuse of data caused by a wide variety of factors including choices of scale, probability versus odds, inappropriate uses of measures of central tendency, inaccurate curve fitting and inappropriate uses of controls or sample groups.

6. For the process area of Problem Solving:

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

(1) Select, modify, develop, and apply strategies to solve a variety of mathematical and practical problems and to investigate and understand mathematical concepts.

(2) Apply previous experience and knowledge to new problem-solving situations.

(3) Verify, interpret, and evaluate results with respect to the original problem situation, determining an efficient strategy for the given situation.

(4) Try more than one strategy when the first strategy proves to be unproductive.

(5) Apply multi-step, integrated, mathematical problem-solving strategies, persisting until

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a solution is found or until it is clear that no solution exists.

(6) Generalize solutions and strategies from earlier problems to new problem situations.

(7) Interpret and solve a variety of mathematical problems by paraphrasing, identifying necessary and extraneous information, selecting and justifying efficient methods and/or strategies, and ensuring the answer is reasonable.

(8) Apply combinations of proven strategies and previous knowledge to solve non-routine problems.

7. For the process area of Mathematical Communication:

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

(1) Discuss and exchange ideas about mathematics as a part of learning.

(2) Use inquiry techniques (e.g. discussion, questioning, research, data gathering) to solve mathematical problems.

(3) Read expository text to learn about mathematics.

(4) Interpret and solve word problems without the necessity of key words or phrases.

(5) Model and explain mathematical relationships using oral, written, graphical, and algebraic methods.

(6) Explain and evaluate thinking about mathematical ideas and solutions.

(7) Evaluate the effectiveness of written and oral presentations of mathematics.

(8) Make conjectures and present arguments in discussions of mathematical ideas.

(9) Explain and evaluate thinking about mathematical ideas and solutions based on the role of definitions, properties, common rules, and symbols in solving problems.

(10) Use everyday language to explain thinking about strategies and solutions to mathematical problems.

(11) Express mathematical ideas and use them to define, compare, and solve problems orally and in writing.

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8. For the process area of Mathematical Reasoning:

(a) Student will develop their ability to reason mathematically by solving problems in which there is a need to investigate significant mathematical ideas and construct their own learning in all content areas in order to justify their thinking; reinforce and extend their logical reasoning abilities; reflect on and clarify their own thinking; and ask questions to extend their thinking.

(1) Construct, justify, and defend mathematical conclusions using logical arguments, in situations related to mathematics, science, and technology.

(2) Use patterns and relationships to analyze mathematical situations; draw logical conclusions about mathematical problems.

(3) Follow a logical argument and judge its validity.

(4) Recognize and apply deductive and inductive reasoning in both concrete and abstract contexts.

(5) Ask questions to reflect on, clarify, and extend thinking.

(6) Review and refine the assumptions and steps used to derive conclusions in mathematical arguments.

(7) Construct valid arguments; make and test conjectures about algebraic and geometric properties based on mathematical principles.

(8) Determine relevant, irrelevant, and/or sufficient information to solve mathematical problems.

9. For the process area of Mathematical Connections:

(a) Students will develop the ability to make mathematical connections by solving problems in which there is a need to view mathematics as an integrated whole, identifying relationships between context strands, and integrating mathematics with other disciplines, allowing the flexibility to approach problems in a variety of ways within and beyond the field of mathematics.

(1) Link new concepts to prior knowledge.

(2) Use mathematical ideas from one area of mathematics to explain an idea from another area of mathematics.

(3) Use models to explain the relationship of concepts to procedures.

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(4) Use the connections among mathematical topics to develop multiple approaches to problems.

(5) Identify practical applications of mathematical principles that can be applied to other disciplines.

(6) Apply mathematical thinking and modeling to solve problems that arise in other disciplines (e.g. rhythm in music and motion in science).

(7) Use and analyze the connections between Mathematics and other disciplines.

(8) Identify, explain, and use mathematics in everyday life.

The following Mathematics regulations are hereby repealed effective July 1, 1999:

NAC 389.292, NAC 389.310, NAC 389.360, NAC 389.400, NAC 389.465, NAC 389.467, NAC 389.468, NAC 389.470, NAC 389.472, NAC 389.474, NAC 389.476, NAC 389.478, NAC 389.480, NAC 389.482, NAC 389.484

TEXT OF REPEALED SECTIONS

[389.292 Mathematics. The courses in mathematics offered in public elementary schools must include instruction designed to teach the pupil, by the completion of the fourth grade, to do the following:

1. For the areas of solving problems and logic:

(a) Use the process of solving a problem to investigate and understand the content of mathematics.

(b) Formulate a problem from a situation in everyday life regarding mathematics.

(c) Develop and apply strategies to solve a wide variety of mathematical problems.

(d) Verify and interpret the results of a solution to a problem.

(e) Solve a problem by using a calculator, a computer or other technology and know when it is appropriate to use such technology.

(f) Demonstrate confidence in the practical use of mathematics.

(g) Demonstrate persistence when working independently or with others to solve a problem.

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2. For the area of communication:

(a) Use reading, writing and other learning skills to develop an understanding of mathematics.

(b) Relate language used in everyday life to mathematical language and symbols.

(c) Relate physical materials, pictures and diagrams to mathematical ideas.

(d) Describe different methods of thinking to clarify mathematical ideas and mathematical situations.

(e) Discuss options for solving problems.

(f) Use a computer or other technological resources to present results in proper form.

3. For the areas of reasoning and mathematical connections:

(a) Use models, known facts, properties and relationships to explain his thinking.

(b) Use patterns and relationships to interpret mathematical situations.

(c) Construct criteria for sorting and organizing materials or data.

(d) Justify and defend answers to problems and any methods used to reach those answers.

(e) Use different physical materials, visualizations and descriptions to represent the same mathematical concept.

(f) Describe connections between activities that he is physically participating in and mathematical procedures and situations related thereto.

(g) Investigate different situations that are related to the same mathematical concepts.

(h) Recognize that mathematical topics are interrelated.

(i) Use previously learned mathematical ideas to understand new mathematical ideas.

(j) Use mathematics in other areas of curriculum and in his daily life.

4. For the area of the development of the concept of numbers:

(a) As it relates to understanding numbers:

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(1) Understand the meanings of numbers from a variety of personal experiences by using physical materials.

(2) Understand the system of numeration by relating counting, grouping and the different concepts of place values.

(3) Develop an understanding of the relationships between numbers.

(4) Interpret the different uses for numbers that are encountered in everyday life.

(b) As it relates to making estimates:

(1) Develop strategies for making estimates.

(2) Recognize when making an estimate is appropriate.

(3) Determine the reasonableness of the results of making estimates.

(4) Apply strategies for estimation when working with quantities, measurement or computation and when solving a problem.

(c) As it relates to concepts and operations of whole numbers:

(1) Understand the meaning of the operations of addition, subtraction, multiplication and division by creating and discussing a wide variety of situations in which problems arise.

(2) Relate informal language, visualizations and concrete models to mathematical language and symbolism.

(3) Recognize that a wide variety of structures of problems can be represented by a single operation of addition, subtraction, multiplication or division.

(4) Describe relationships between the operations of addition, subtraction, multiplication and division.

(5) Develop an understanding of the relationships between numbers and the operations of numbers.

(6) Use models and strategies to develop a reasonable proficiency in the basic facts for addition and subtraction of whole numbers and for addition and subtraction of algorithms.

(7) Use calculators and computers in the appropriate computational situations.

(8) Use and describe a variety of techniques for mental computation and estimation.

(9) Select and use techniques for estimation and computation that are appropriate for a specific problem.

(10) Determine the reasonableness of results.

(d) As it relates to common fractions and decimal fractions:

(1) Create and describe common fractions and decimal fractions, including mixed numbers, by using physical materials.

(2) Develop an understanding of the relationship between numbers or common fractions and decimal fractions.

(3) Investigate relationships between common fractions by using physical materials.

(4) Investigate relationships between decimal fractions by using physical materials.

(5) Investigate relationships between common fractions and decimal fractions, including equivalent fractions, by using physical materials.

(6) Investigate the operations of addition, subtraction, multiplication and division on common fractions and decimal fractions by using physical materials.

(7) Create and solve problems involving the meaning of common fractions and decimal fractions by using physical materials.

5. For the areas of geometry and measurement:

(a) Recognize and describe geometry in everyday life.

(b) Describe, model, draw and sort shapes.

(c) Investigate and predict the results of combining, subdividing and changing shapes.

(d) Develop a sense of his surroundings and the objects contained in those surroundings.

(e) Relate geometric ideas to ideas relating to numbers and measurements.

(f) Describe the relative position and location of objects in space.

(g) Describe different figures and objects in terms of length, capacity, weight, area and volume.

(h) Describe the attributes of an object in terms of length, capacity, weight, area, volume, time, temperature and angle.

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(i) Estimate and measure objects by using nonstandard units.

(j) Estimate and measure objects by using half units in customary measurement used in the United States and whole units in metric measurement.

(k) Make and use measurements to solve specific problems and situations in everyday life.

6. For the areas of probability and statistics:

(a) Investigate the concept of chance.

(b) Describe an example of probability in everyday life.

(c) Collect, organize and describe data by using different methods.

(d) Construct, read and interpret displays of data.

(e) Create and solve a problem that requires the collection and interpretation of data.

7. For the areas of patterns and relationships:

(a) Recognize, describe, extend and create a wide variety of patterns.

(b) Represent and describe mathematical relationships.

(c) Investigate the use of open sentences and variables to describe relationships by using physical materials.]

[389.310 Mathematics. The courses in mathematics offered in public elementary schools must include instruction designed to teach the pupil, by the completion of the sixth grade, to do the following:

1. For the areas of solving problems and logic:

(a) Use an approach for solving a problem to investigate and understand mathematics.

(b) Formulate a problem from situations within and outside the field of mathematics.

(c) Develop and apply different strategies to solve problems with emphasis on problems that require multiple steps or problems that are not routine.

(d) Verify and interpret the results of a problem.

(e) Apply general strategies to specific problem situations that reflect experiences in

everyday life.

2. For the area of communication:

(a) Express mathematical situations by using oral, written, concrete, pictorial and graphical methods.

(b) Use reading, writing and other learning skills to interpret and evaluate mathematical ideas.

(c) Use a computer and other technological resources to present results in proper form.

3. For the areas of reasoning and mathematical connections:

(a) Recognize and draw a valid conclusion from specific information.

(b) Make and support a mathematical conjecture.

(c) Construct a system for classifying and organizing materials or data.

(d) Investigate a problem and describe conclusions made by using graphical, numerical, physical, algebraic and verbal mathematical models or representations.

(e) Investigate the connections between mathematical topics, mathematics and other disciplines.

(f) Use a previously learned mathematical idea to further his understanding of other mathematical ideas or problems.

(g) Apply mathematical thinking to solve problems that arise in other disciplines.

4. For the area of understanding numbers:

(a) As it relates to the relationship of numbers:

(1) Investigate, develop and use numbers in a variety of equivalent forms in everyday life and situations relating to mathematical problems.

(2) Develop an understanding of whole numbers, fractions and decimals.

(3) Investigate relationships among fractions, decimals and percentages by using physical materials and by making the appropriate symbolic connections.

(4) Represent numerical relationships in one-dimensional and two-dimensional graphs.

(b) As it relates to making estimates and computations:

 (1) Estimate and compute with whole numbers, fractions and decimals.

 (2) Develop, analyze and explain procedures for computation and techniques for making estimates by using objects and by making the appropriate symbolic connections.

 (3) Select the proper method of computation for a specific situation, such as the use of estimation, the use of paper and pencil, the use of calculators and mental computation.

 (4) Make estimates and computations to solve problems.

 (5) Use estimation to check the reasonableness of results.

(c) As it relates to systems and theories of numbers:

 (1) Investigate the need for numbers other than whole numbers.

 (2) Compare whole numbers, fractions and decimals.

 (3) Expand the use of adding, subtracting, multiplying and dividing whole numbers to fractions and decimals.

 (4) Understand how the basic operations of arithmetic are related.

 (5) Develop concepts of theories of numbers and make the appropriate connections to situations in everyday life and mathematical problems.

5. For the areas of geometry and measurement:

(a) Identify, describe, compare and classify geometric figures.

(b) Construct geometric figures with emphasis on developing a sense of his surroundings and the objects in those surroundings.

(c) Investigate simple transformations of geometric figures.

(d) Develop and solve problems by using geometric models.

(e) Relate his knowledge of geometry in describing the physical world.

(f) Investigate geometric properties and geometric relationships as they relate to two-dimensional objects and three-dimensional objects.

(g) Compare geometric shapes by using measurements.

(h) Describe and compare the structure and use of systems of measurement.

(i) Select the proper units and tools to determine measurements to the appropriate degree of accuracy in a specific situation.

(j) Estimate, make and use measurements to describe and compare the physical world.

(k) Investigate activities related to solving problems to develop the concepts of perimeter, area, volume, weight, mass, capacity and the measurement of an angle.

6. For the areas of probability and statistics:

(a) Investigate the variety of uses of probability in everyday life.

(b) Investigate situations in everyday life by experimenting with various models to determine probabilities.

(c) Use results of experiments to represent or predict events.

(d) Discover the power of using a model of probability by comparing experimental results with mathematical expectations.

(e) Systematically collect, organize and describe data.

(f) Construct, read and interpret tables, charts and graphs.

(g) Analyze and extend patterns of graphs.

7. For the areas of patterns and functions:

(a) Describe, extend, analyze and create a wide variety of patterns.

(b) Describe and depict relationships by using tables, graphs and rules.

(c) Investigate functional relationships to explain how a change in one quantity results in a change in another.

(d) Use patterns and functions to depict and solve problems.

8. For the area of algebra:

(a) Investigate the concepts of a variable, an expression and an equation.

(b) Develop situations and patterns of numbers with tables, graphs, and equations and

investigate the relationships of these representations.

(c) Analyze tables and graphs to identify properties and relationships.

(d) Experiment with solutions to linear equations by using concrete, informal and formal methods.]

[389.360 Mathematics. The courses in mathematics offered in public elementary schools must include instruction designed to teach the pupil, by the completion of the eighth grade, to do the following:

1. For the areas of solving problems and logic:

(a) Apply the appropriate strategy to solve a problem that requires multiple steps or a problem that is not routine.

(b) Prepare, explain and validate arguments to support solutions to a problem and determine the reasonableness of those solutions.

(c) Apply general strategies to problem situations that reflect experiences in everyday life.

2. For the area of communication:

(a) Express situations by using oral, written, concrete, pictorial, graphical and algebraic methods.

(b) Use reading, writing and other learning skills to interpret and evaluate mathematical ideas.

(c) Use computers and other technological resources to present results in proper form.

3. For the areas of reasoning and mathematical connections:

(a) Make and support mathematical conjectures from specific information.

(b) Judge and support the validity of mathematical conjectures.

(c) Develop a system for classifying and organizing material or data.

(d) Describe connections between activities involving physical models and any symbolic representations of those activities.

(e) Analyze connections between mathematical topics.

(f) Apply mathematical thinking and modeling to solve problems that arise in other

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disciplines.

4. For the area of understanding numbers:

(a) As it relates to the relationship of numbers:

(1) Develop an understanding of whole numbers, common decimals, common fractions, integers and rational numbers.

(2) Investigate relationships among common fractions, decimal fractions and percentages by using physical materials.

(b) As it relates to making estimates and computations:

(1) Perform addition, subtraction, multiplication and division with whole numbers, integers, common fractions and decimal fractions.

(2) Make reasonable estimations for mathematical problems occurring in everyday life.

(3) Solve problems through different skills, including the use of calculators, computers, paper and pencil and mental computation.

5. For the areas of systems and theories of numbers:

(a) Describe the necessity of using different systems of numbers, including common fractions, decimal fractions and integers.

(b) Use the concepts of theories of numbers in everyday life and in situations involving mathematical problems.

(c) Develop an informal understanding of mathematical ideas, including the role of definitions in providing the pupil with a basis of knowledge.

6. For the areas of geometry and measurement:

(a) Identify, describe, compare and classify geometric figures.

(b) Create, represent and visualize various geometric figures with emphasis on developing a sense of his surroundings and the objects in those surroundings.

(c) Investigate geometric properties and relationships as they relate to two-dimensional objects and three-dimensional objects.

(d) Recognize transformations of geometric figures.

(e) Investigate similarity and congruence in geometric figures.

(f) Apply geometric models to solve problems in everyday life.

(g) Select appropriate units and tools for measuring objects to a specified degree of accuracy.

(h) Estimate the size of an object in the physical world by using both the customary units of measurement used in the United States and the metric units of measurement.

(i) Use measurement to describe and compare objects in the physical world.

(j) Solve problems by using both the metric system of measurement and the customary system of measurement used in the United States.

(k) Develop a procedure to solve a problem that requires measurement.

(l) Understand the concept of rates.

7. For the areas of probability and statistics:

(a) Devise and carry out experiments to determine probabilities.

(b) Predict outcomes that are based on experimental and theoretical probabilities.

(c) Investigate the different uses for probability in everyday life.

(d) Generate and organize data and construct and interpret tables, charts and graphs by using such data.

(e) Analyze and extend patterns of graphs.

(f) Apply key statistical terms to the data found in tables, charts and graphs.

8. For the areas of patterns and functions:

(a) Describe, extend, analyze and create a wide variety of patterns.

(b) Find a pattern in a specific example.

(c) Use patterns and functions to depict and solve problems and explain how a change in one quantity results in a change in another.

(d) Investigate patterns, tables of data and graphs to formulate a conjecture.

9. For the area of algebra:

    (a) Demonstrate an understanding of algebraic expressions or terms and formulas by using graphical, concrete or pictorial representations.

    (b) Present and solve simple linear equations by using concrete and informal methods.

    (c) Communicate mathematically by using and differentiating between word phrases, concrete models, pictorial models, graphical models and algebraic models.]

    [389.400 Mathematics. A course of study in mathematics must include instruction designed to teach the pupil by the completion of the eighth grade to do the following:

1. Understand place value in the structure of the decimal system.

2. Add, subtract, multiply and divide with increased efficiency and accuracy.

3. Understand rational numbers.

4. Understand real number.

5. Apply the properties of real numbers to algorithms for subsets of the system of real numbers.

6. Multiply and divide with numbers expressed in exponential notation.

7. Use the properties of inverse operations to solve simple equations.

8. Demonstrate an understanding of the theory of sets.

9. Recognize common geometrical figures and the relationships among them.

10. Apply geometric concepts and constructions to solve a problem.

11. Apply the concepts of measurement to practical problems.

12. Use both English and metric systems of measurement to solve problems in length, area and volume.

13. Extend the use of mathematical tools, other than the basic operations, such as proportions and statistical analysis.

14. Use a variety of formulas in practical situations.

15. Apply other mathematical skills to practical situations.

16. Explore opportunities for employment in the field of mathematics.]

[389.465 Mathematics: Generally.

1. A local school district shall ensure that pupils, by the completion of the twelfth grade, are able to comply with the objectives of the core curriculum for mathematics listed in NAC 389.467. In carrying out this requirement, the district shall:

(a) Develop minimum objectives for two courses which must encompass all of the requirements for the core curriculum; and

(b) Institute any number of classes in mathematics to cover the minimum objectives for the respective course.

2. A class must be designated as including the objectives of either course developed pursuant to subsection 1. A district shall notify the department of education of each class being offered and which course it falls under.

3. A district may develop a third course which builds and expands upon the objectives of the courses developed and instituted pursuant to subsection 1.

4. A pupil may receive a maximum of one credit in mathematics under each course.

5. A pupil who begins a program in high school mathematics with the courses listed under NAC 389.468 to 389.484, inclusive, shall also meet the objectives listed in the core curriculum. The courses developed pursuant to subsection 1 must be designed to allow pupils to study both the objectives of the core curriculum and the objectives of the specific courses listed under NAC 389.468 to 389.484, inclusive.

6. If an integrated curriculum encompasses the objectives of the specific courses listed under NAC 389.468 to 389.484, inclusive, the requirements of all the courses must be met within the integrated curriculum.]

[389.467 Mathematics: Core curriculum. The objectives of the core curriculum for mathematics are to teach a pupil, by the completion of the twelfth grade to do the following:

1. For the areas of solving problems and logic, define, formulate and solve problems by applying the strategies and processes of mathematical modeling to problems in everyday life that are relevant to the pupil's experiences.

2. For the area of communication:

(a) Express, at a level which is consistent with the content of a specific course, mathematical ideas orally and in writing, including concrete, pictorial, graphical and algebraic methods.

(b) Read and understand, at a level which is consistent with the content of the specific course, written presentations of mathematics.

(c) Formulate a mathematical definition and describe a generalization discovered through an investigation.

(d) Use computers and other technological resources to present results in proper form.

3. For the areas of reasoning and mathematical connections:

(a) Make and test conjectures relating to numerical patterns and geometric patterns.

(b) Construct a simple valid argument and judge the validity of an argument.

(c) Connect concrete models to their equivalent symbolic representations.

(d) Analyze connections between mathematical topics.

(e) Recognize that there may be different methods available to solve a problem.

(f) Solve a problem that requires the integration of mathematical topics.

(g) Identify and use the connections between mathematics and other disciplines.

4. For the area of geometry:

(a) Represent the relationship between two sets of data on a coordinate system.

(b) Classify figures in terms of congruence and similarity.

(c) Describe and classify characteristics of two- dimensional figures and three-dimensional objects.

(d) Represent and solve a problem by using a geometric model.

(e) Solve problems by using both the metric system of measurement and the customary system of measurement used in the United States.

(f) Solve a problem by using relationships between triangles.

5. For the areas of probability and statistics:

(a) Estimate probabilities and odds by using simulations.

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(b) Design an experiment to represent and solve a problem involving uncertainty.

(c) Construct charts, tables and graphs that summarize data from situations encountered in everyday life and draw inferences from those charts, tables and graphs.

(d) Recognize sampling and its role in statistical claims.

(e) Design a statistical experiment to study a problem, conduct the experiment, and interpret and communicate the results.

(f) Analyze how changes in data affect the mean, median and mode.

6. For the area of algebra:

(a) Express a situation that involves variable quantities with mathematical symbols, equations and inequalities.

(b) Interpret expressions, equations and inequalities by using tables and graphs.

(c) Solve simple equations and inequalities at the appropriate level.

(d) Determine the reasonableness of results of problems regarding algebra.

7. For the area of precalculus:

(a) Express problems by using directed graphs and matrices.

(b) Present problem situations by using sequences involving recurrence relations.

(c) Investigate limits informally by examining infinite series and sequences.

(d) Interpret and determine maximum and minimum points from a graph representing a specific application.

8. For the area of functions:

(a) Analyze sequences to formulate generalizations.

(b) Describe and interpret a situation from everyday life that is depicted on a graph.]

[389.468 Prealgebra. A course of study in prealgebra must include instruction designed to teach the pupil to do the following:

1. Demonstrate strategies for solving problems, including the use of sets, Venn diagrams, sketching diagrams, and techniques of estimation.

2. Solve and graph equations and inequalities of the first degree.

3. Demonstrate an understanding of exponents.

4. Evaluate algebraic expressions and algebraic formulas by using the correct order of operations.

5. Perform basic monomial operations.

6. Add and subtract polynomials.

7. Formulate and solve problems in everyday life by using ratio, proportion and percentages.

8. Formulate and solve problems in everyday life by using the basic techniques of algebra.]

[389.470 Algebra I. A course of study in Algebra I must include instruction designed to teach the pupil to do the following:

1. Formulate and solve problems in everyday life by using the basic techniques of algebra.

2. Solve and graph linear equations and linear inequalities.

3. Perform algebraic operations with polynomials.

4. Solve quadratic equations by algebraic methods.

5. Depict and represent problems or phenomena in everyday life by using algebra.

6. Depict and represent problems in everyday life by using matrices.

7. Solve linear equations by using algebraic methods.

8. Solve problems by using the basic laws of exponents and radicals.

9. Justify the logic of algebraic procedures by using field properties.

10. Formulate predictions based on collections of data points.]

[389.472 Geometry. A course of study in geometry must include instruction designed to teach the pupil to do the following:

1. Investigate and compare the different geometric systems to develop an understanding of

an axiomatic system.

    2. Compare and contrast properties of geometric figures on a plane.

    3. Investigate and draw three-dimensional objects.

    4. Create and validate formulas for two-dimensional figures and three-dimensional objects.

    5. Construct proofs for mathematical assertions, including indirect proofs and paragraph proofs.

    6. Analyze and solve problems by using inductive reasoning and deductive reasoning.

    7. Construct figures to discover and validate mathematical assertions.

    8. Apply coordinate geometry to validate properties of geometric figures.

    9. Investigate and solve problems by using relationships of the right triangle.

    10. Formulate and solve problems in everyday life by using geometric models.]

[389.474 Algebra II. A course of study in Algebra II must include instruction designed to teach the pupil to do the following:

    1. Analyze the effect of changing parameters on graphs of functions.

    2. Formulate and solve problems in everyday life by using matrices.

    3. Investigate transformations on different classes of algebraic functions by using technology.

    4. Solve linear and quadratic equations and inequalities by using algebraic methods and apply these skills to solving problems in everyday life.

    5. Solve systems of equations and inequalities and apply these skills to solving problems in everyday life.

    6. Solve algebraic problems by using absolute value, exponential functions and logarithmic functions.

    7. Prove algebraic assertions by using field properties.

    8. Organize data to aid in the interpretation of data and to make predictions on the basis of such data.

9. Represent and solve problems by using linear programming and difference equations.

10. Develop the complex system of numbers.

11. Investigate series and sequences.

12. Investigate different principles of counting and their use in probability.

[389.476 Trigonometry. A course of study in trigonometry must include instruction designed to teach the pupil to do the following:

1. Solve problems in everyday life by using transformations, coordinates and vectors.

2. Validate mathematical assertions by using techniques of trigonometry.

3. Demonstrate how phenomena occur in everyday life by using trigonometric and circular functions.

4. Investigate the connections between trigonometric functions, polar coordinates, series and complex numbers.

5. Investigate transformations on trigonometric functions by using technology.]

[389.478 Analytic geometry. A course of study in analytic geometry must include instruction designed to teach the pupil to do the following:

1. Demonstrate an understanding of coordinate geometry.

2. Recognize the equations of conic sections in both polar and rectangular forms.

3. Recognize the three-dimensional conic sections generated by the revolution of a locus of points.

4. Use and sketch the graphs of the polynomial functions and the rational functions.

5. Demonstrate the translation and rotation of axes in a two-dimensional system.

6. Demonstrate an understanding of the operation on a vector and the properties of vectors.

7. Write vectors and parametric equations to solve problems.

8. Demonstrate the translation and rotation of axes in a three-dimensional system.]

[389.480 Precalculus. A course of study in precalculus must include instruction designed to

teach the pupil to do the following:

1. Analyze the graphs of polynomial, rational, radical and transcendental functions by using technology.

2. Determine the maximum and minimum points of a graph and interpret the results in situations involving problems in everyday life.

3. Investigate limits by examining infinite sequences and series and areas under curves.

4. Investigate different techniques available to solve problems in everyday life.

5. Solve problems in everyday life by using complex numbers and vectors.

6. Investigate the relationship between vectors and complex numbers.

7. Investigate and describe functions and their inverses by using techniques to sketch curves.

8. Investigate and describe the general properties and behavior of classes of functions.

9. Validate mathematical assertions by using mathematical induction.

10. Solve problems in everyday life by applying the techniques of elementary probability and statistics.]

[389.482 Calculus. A course of study in calculus must include instruction designed to teach the pupil to do the following:

1. Interpret limits geometrically and evaluate them.

2. Differentiate between continuous functions and noncontinuous functions.

3. Analyze domains of functions.

4. Differentiate rational, transcendental and implicitly defined functions.

5. Investigate the upper and lower sums of a function by using technology.

6. Analyze the graphs of functions by using technology.

7. Integrate elementary functions.

8. Solve problems in everyday life by using the techniques of calculus.]

[389.484 Probability and statistics. A course of study in probability and statistics must include instruction designed to teach the pupil to do the following:

1. Analyze the effects of transformations of data on measures of central tendency and variability.

2. Design a statistical experiment to study a problem occurring in everyday life, interpret and communicate the outcomes, and test the hypothesis by using the appropriate statistics.

3. Analyze sets of data assumed to be distributed normally by using the properties of a normal curve.

4. Demonstrate an understanding of notations for combinations and permutations.

5. Apply the concept of a random variable to generate and interpret probability distributions including binomial, uniform, normal and chi square.

6. Solve problems in everyday life by using the techniques of statistical analysis.

7. Solve problems in everyday life by using conditional probability.

8. Formulate and solve problems in the physical world by using techniques in statistical analysis.]

NEVADA DEPARTMENT OF EDUCATION

NEVADA STATE BOARD OF EDUCATION
NEVADA STATE BOARD FOR OCCUPATIONAL EDUCATION

LEGISLATIVE REVIEW OF ADOPTED REGULATIONS AS REQUIRED
BY ADMINISTRATIVE PROCEDURES ACT, NRS 233B.066
NAC 389, English Language Arts Course of Study, Science Course of Study
and Mathematics Course of Study

IMPACT STATEMENT

The following statement is submitted for adopted amendments to Nevada Administrative Code (NAC) 389, English Language Arts Course of Study, Science Course of Study, and Mathematics Course of Study:

1.   **A description of how public comment was solicited, a summary of public response, and explanation how other interested persons may obtain a copy of the summary.**

Notice of Workshop to Solicit Comments on Proposed Regulations was sent to approximately one-hundred twenty-five individuals and educational organizations. One workshop was held July 14, 1998. There were no comments from the public.

The Notice of Intent to Act Upon a Regulation for public hearing on the proposed revisions to NAC 389 was sent to approximately one-hundred twenty-five individuals and educational organizations. One public hearing was conducted on August 20, 1998 to provide the opportunity for comments by affected parties and the public. Public response focused on proposed revisions to English Language Arts Course of Study, Science Course of Study and Mathematics Course of Study. There were comments from the public.

2.   **The Number of Persons Who:**

a) **Attended Each Hearing:**   Workshop: _1_   First Hearing: _59_   Second Hearing: _n/a_

b) **Testified at Each Hearing;**   Workshop: _0_   First Hearing: _4_   Second Hearing: _n/a_

and,

c) **Submitted Written Statements**: Workshop: _0_   First Hearing: _0_   Second Hearing: _n/a_

No written comments were submitted.

A copy of any written comments may be obtained by calling LaDonna Byrd, Board Secretary, at the Department of Education (702) 687-9225, or by writing to the Department of Education, 700 East Fifth Street, Carson City, Nevada 89701-5096.

3. **A description of how comment was solicited from affected businesses, a summary of the response and an explanation how other interested parties may obtain a copy of the summary.**

    Comment was solicited through the workshop notice of June 10, 1998, and public hearing notice of July 15, 1998.

    At the public hearing, comments from interested parties were as follows: Elaine Lancaster, President, Nevada State Education Association stated that the association supports new standards and assessments. She had three questions that she felt needed to be addressed: 1) how will every classroom teacher get the new standards?; 2) who is responsible for the training needed for implementation and how will that be accomplished?; and, 3) if the materials, supplies or equipment are not available to meet the new standards, who pays to obtain the needed materials? Anne Loring, Member, Washoe County School District Board of Trustees, and member of the Math Writing Team, thanked the members of the Council to Establish Academic Standard for Public Schools for their hard work and for producing the documents to be adopted by the State Board of Education. She hoped that the Council would consider revisiting the reading list. Eric Anderson, Consultant, Standards, Curricula and Assessment Team, Department of Education, urged the adoption of the new standards for science. He had a concern that the regulation language does not identify that a student will know and be able to do all that was learned from previous years, and urged recognition of the individuals who were involved in the standards development process. Dr. Richard Vineyard, Reno, stated that, as the incoming science consultant for the Department of Education, he is prepared to implement the new science content standards in the schools.

    A copy of the summary and/or minutes of the public hearing may be obtained by calling LaDonna Byrd, Board Secretary, at the Department of Education (702) 687-9225, or by writing to the Department of Education at 700 East Fifth Street, Carson City, Nevada 89701-5096.

4. **If the regulation was adopted with or without change to any part of the proposed regulation, a summary of the reasons for adopting.**

    The <u>temporary</u> regulation was adopted by the Nevada State Board of Education at the public hearing held August 20, 1998, <u>with</u> revisions to the content standards for mathematics, English Language Arts and science, and incorporated into the regulation language as approved by the Council to Establish Academic Standards for Public Schools (per Senate Bill 482, enacted by the 1997 Legislature) to become effective July

1, 1999. The board also moved to not repeal current language until further review on the advanced courses in mathematics, English Language Arts and science.

5. **The estimated economic effect of the adopted regulation on the business which it is to regulate and on the public. These must be stated separately, and each case must include:**

The possible economic effect on the local school districts will in the purchase of new textbooks, manipulatives and calculators to meet the new standards. There is no estimated economic effect on the public, either adversely or beneficially, nor immediate or long term.

6. **The estimated cost to the agency for enforcement of the adopted regulation.**

There is no additional cost to the agency for enforcement of this regulation.

7. **A description of any regulations of other state or government agencies which the proposed regulation overlaps or duplicates and a statement explaining why the duplication or overlapping is necessary. If the regulation overlaps or duplicates a federal regulation, the name of the regulating federal agency.**

No other state or government agency regulations will be overlapped or duplicated by the above noted regulations. There is no duplication or overlap of federal regulations.

8. **If the regulation includes provisions which are more stringent than a federal regulation which regulates the same activity, a summary of such provisions.**

There are none.

9. **If the regulation provides a new fee or increases an existing fee, the total annual amount the agency expects to collect and the manner in which the money will be used.**

This regulation does not provide or involve a new fee.