PROPOSED REGULATION OF THE

STATE BOARD OF EDUCATION

LCB File No. R155-06

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EXPLANATION – Matter in ***italics*** is new; matter in brackets **[**~~omitted material~~**]** is material to be omitted.

AUTHORITY: §§1-10, NRS 385.080 and 389.520.

A REGULATION relating to education; revising provisions governing academic standards for courses of study in mathematics for grades kindergarten through 12th; and providing other matters properly relating thereto.

Section 1. NAC 389.236 is hereby amended to read as follows:

389.236 Instruction in kindergarten in mathematics must be designed so that pupils meet the following performance standards by the completion of kindergarten:

1. For the areas of numbers, number sense and computation, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must accurately calculate and use estimation techniques, number relationships, operation rules and algorithms, and determine the reasonableness of answers and the accuracy of solutions. A pupil must demonstrate the ability to:

(a) ~~**[**Use concrete objects to model simple sums and differences;~~

~~(b)**]**~~ Count to 20 ~~**[**;~~

~~(c)**]**~~ ***by demonstrating one-to-one correspondence using objects;***

(b) Recognize, read and write numbers from 0 through 10;

~~**[**(d) Estimate the number of objects in a set with up to 10 members and verify by counting;~~

~~and~~

~~(e) Use~~]

(c) Identify the ordinal positions from first through third ~~[.]~~ ***;***

(d) Match the number of objects in a set to the correct numeral 0 through 10;

(e) Recognize relationships of more than, less than and equal to; and

(f) Use concrete objects to model simple addition and subtraction.

2. For the areas of patterns, functions and algebra, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must use various algebraic methods to analyze, illustrate, extend and create numerous representations, including, without limitation, words, numbers, tables, and graphs of patterns, functions and algebraic relations. A pupil must demonstrate the ability to:

(a) ~~[Sort and describe objects by similar attributes;~~

~~(b) Recognize and replicate a pattern; and~~

~~(c)]~~ Identify and create sets of objects containing unequal ~~[numbers of items, describing]~~ ***amounts, and describe*** them as ~~[more]~~ ***greater than*** or less ~~[.]~~ ***than; and***

(b) Identify attributes used to sort objects.

3. For the area of measurement, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must use appropriate tools and techniques of measurement to determine, estimate, record and verify direct and indirect measurements. A pupil must demonstrate the ability to:

(a) Compare ***,*** ~~[and]~~ order ***and describe*** objects by size ***;*** ~~[, communicating their similarities and differences;]~~

(b) Identify and sort pennies, nickels and dimes; and

(c) Recite, in order, the days of the week.

4. For the areas of spatial relationships ***, logic*** and geometry, to solve problems, communicate and make connections within and beyond the field of mathematics, a pupil must identify, represent, verify and apply spatial relationships and geometric properties. A pupil must demonstrate the ability to:

(a) Identify two-dimensional shapes such as circles, triangles and rectangles, including squares, regardless of orientation;

(b) ~~[Use position words such as "middle," "before" or "down" to place objects; and]~~ ***Demonstrate an understanding of position words to place objects, including, without limitation, before and after, far and near, and over and under;***

(c) Identify two-dimensional figures as they appear in the environment, such as windows are shaped like rectangles ~~[.]~~ ***;***

(d) Identify three-dimensional figures as they appear in the environment;

(e) Sort and classify objects by color and shape; and

(f) Put events in a logical sequence.

5. For the area of data analysis, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must collect, organize, display, interpret and analyze data to determine statistical relationships and probability projections. A pupil must demonstrate the ability to ~~[collect and describe data.]~~ ***:***

(a) Collect, organize and record data using objects and pictures; and

(b) Represent data in a variety of ways in response to questions posed by teachers.

6. For the area of problem solving, to develop the ability to solve problems, a pupil must engage in developmentally appropriate opportunities for problem solving in which there is a need to use various approaches to investigate and understand mathematical concepts to formulate

problems, find solutions to problems, develop and apply strategies to solve problems, and integrate mathematical reasoning, communication and connections. A pupil must demonstrate the ability to:

(a) ~~[Use efficient approaches to investigate and understand mathematical concepts;~~

~~(b) Find solutions to problems that occur in everyday situations;~~

~~(c) Select, modify, develop and apply strategies to solve a wide variety of problems;~~

~~(d) Transfer and generalize]~~ ***Apply*** previous experience ***and knowledge*** to new problem-solving situations;

~~[(e) Demonstrate persistence in problem solving;~~

~~(f)]~~ ***(b)*** Explain and verify results ~~[; and~~

~~(g)]~~ ***with respect to the original problem;***

(c) Try more than one strategy to solve a problem when the first strategy proves unsuccessful; and

(d) Use technology ~~[as a tool in problem solving.]~~ ***, including, without limitation, a calculator, to develop mathematical concepts.***

7. For the area of mathematical communication, to develop the ability to communicate mathematically, a pupil must solve problems in which there is a need to obtain information ~~[, translate the]~~ ***in everyday life by reading, listening and observing to translate*** information into mathematical language and symbols, process ~~[the]~~ information mathematically ***, discuss and exchange ideas about mathematics as part of learning, read various fiction and nonfiction texts to learn about mathematics*** and present the results in written, oral and visual formats. A pupil must demonstrate the ability to:

(a) ~~[Obtain information by reading, listening, observing and inquiring and use that information to solve mathematical problems;~~

~~(b) Use mathematical language and symbols to explain thinking and processes and translate ideas into everyday language;~~

~~(c) Present mathematical ideas and solutions in written, oral and visual forms;~~

~~(d) Discuss, explain, justify and evaluate mathematical ideas and solutions; and~~

~~(e) Use physical, pictorial and symbolic forms to represent mathematical ideas and relationships.]~~ ***Use inquiry techniques to solve mathematical problems;***

(b) Represent and communicate mathematical ideas using physical materials, models, pictures or writing;

(c) Identify and translate key words and phrases that imply mathematical operations; and

(d) Communicate strategies and solutions to mathematical problems by using oral and written expression of everyday language.

8. For the area of mathematical reasoning, to develop the ability to reason mathematically, a pupil must solve problems in which there is a need to investigate ~~[significant]~~ mathematical ideas and construct the pupil's own learning in all content areas to ~~[justify and enhance]~~ ***reinforce and extend*** the pupil's ability to ~~[think and]~~ reason logically ~~[.]~~ ***, reflect on, clarify and justify his thinking, ask questions to extend his learning, use patterns and relationships to analyze mathematical situations, and determine relevant, irrelevant and sufficient information to solve mathematical problems.*** A pupil must demonstrate the ability to:

(a) ~~[Construct meaning and justify thinking by investigating mathematical ideas, patterns and relationships;~~

~~(b) Reinforce and extend abilities for logical reasoning;~~

~~(c) Ask questions to reflect on, clarify and extend thinking;~~

~~(d) Review, refine, explain and justify mathematical processes, arguments and solutions using manipulatives, physical models and abstract ideas; and~~

~~(e) Determine the relevancy and sufficiency of information to solve mathematical problems.~~**]** ***Draw logical conclusions about mathematical problems;***

(b) Discuss the steps used to solve a mathematical problem; and

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

9. For the area of mathematical connections, to develop the ability to make mathematical connections, a pupil must solve problems in which there is a need to view mathematics as an integrated whole, including ***linking new concepts to prior knowledge,*** identifying relationships between content strands and integrating mathematics with other disciplines, thereby allowing the flexibility to approach problems in a variety of ways within and beyond the field of mathematics. A pupil must demonstrate the ability to:

(a) ~~[Identify practical applications of mathematical principles that can be applied to other disciplines;~~

~~(b) Use and analyze the connections within and beyond the field of mathematics in a variety of ways to solve problems;~~

~~(c) Link new concepts to prior knowledge; and~~

~~(d)]~~ Apply mathematical thinking and modeling to solve problems that arise in other disciplines ***, including, without limitation, rhythm in music and motion in science;*** and

(b) Identify mathematics used in everyday life.

Sec. 2. NAC 389.2419 is hereby amended to read as follows:

389.2419 By the end of the first grade, pupils must know and be able to do everything required in kindergarten for mathematics offered in public schools. Instruction in the first grade in mathematics must be designed so that pupils meet the following performance standards by the completion of the first grade:

1. For the areas of numbers, number sense and computation, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must accurately calculate and use estimation techniques, number relationships, operation rules and algorithms, and determine the reasonableness of answers and the accuracy of solutions. A pupil must demonstrate the ability to:

(a) Identify and model basic addition facts, sums through ~~[100]~~ ***10,*** and the corresponding subtraction facts;

(b) ~~[Write, model, and describe one-step]~~ ***Model the meaning of*** addition and subtraction ~~[problems;]~~ ***in a variety of ways, including, without limitation, the comparison of sets using objects, pictorial representations and symbols;***

(c) Use the patterns in numbers ***and models*** to count by ~~[1s,]~~ 2s, 5s and 10s to 100;

(d) Read, write, order and compare numbers from 0 through 100;

(e) Estimate the number of objects in a set through 10 ~~[;]~~ ***and verify by counting;***

(f) Read and write ~~[number words from 0]~~ ***numbers as words*** through 10;

(g) ~~[Use]~~ ***Identify*** the ordinal positions from 1st through 10th;

(h) ~~[Use,]~~ ***Write,*** model, ***read*** and identify place value positions of 1s and 10s; ~~[and]~~

(i) ***Identify the value of a given digit in the 1s and 10s place;***

(j) Identify and model a whole ~~[and one-half.]~~ ***;***

(k) Identify and model 1/2 as two equal parts of a whole or a set of objects;

(l) Create, compare and describe sets of objects and numbers from 0 through 100 as greater than, less than or equal to;

(m) Demonstrate the joining and separating of sets with 20 or fewer objects; and

(n) Describe addition, subtraction and equality by using mathematical vocabulary and symbols.

2. For the areas of patterns, functions and algebra, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must use various algebraic methods to analyze, illustrate, extend and create numerous representations, including, without limitation, words, numbers, tables, and graphs of patterns, functions and algebraic relations. A pupil must demonstrate the ability to:

(a) Recognize, describe, extend and create simple repeating patterns using symbols, objects and manipulatives; ~~[and~~

~~(b) Create, compare and describe sets of objects as having more, fewer or an equal number of objects.]~~

(b) Recognize that the unknown variable in an addition or a subtraction equation represents a missing value that will make the statement true; and

(c) Create, compare and describe sets of objects as greater than, less than or equal to.

3. For the area of measurement, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must use appropriate tools and techniques of measurement to determine, estimate, record and verify direct and indirect measurements. A pupil must demonstrate the ability to:

(a) Compare ***, describe, represent*** and order objects by length and weight ***;*** ~~[, communicating their similarities and differences;]~~

(b) Compare and measure length and weight, using nonstandard units of measurement;

(c) Determine the value of any set of pennies, nickels and dimes;

(d) Recite the months of the year in order;

(e) Use a calendar to identify the days, weeks, months and year; ***and***

(f) Read time to the nearest hour **.** ~~[and half hour; and~~

~~(g) Distinguish between day and night.]~~

4. For the areas of spatial relationships ***, logic*** and geometry, to solve problems, communicate and make connections within and beyond the field of mathematics, a pupil must identify, represent, verify and apply spatial relationships and geometric properties. A pupil must demonstrate the ability to:

(a) Name, sort and sketch two-dimensional shapes such as circles, triangles and rectangles, including squares, regardless of orientation;

(b) ~~[Use]~~ ***Demonstrate an understanding of*** position words ~~[such as "between," "left" or "near" to describe]~~ ***, including, without limitation, up and down, left and right, top and bottom, and between and middle, by describing*** the ***relative*** location of objects; ~~[and]~~

(c) Identify and replicate two-dimensional designs that contain a line of symmetry ~~[.]~~ ***;***

(d) Identify and name three-dimensional figures as they appear in the environment;

(e) Sort and classify objects by size or thickness; and

(f) Identify what comes next in a step-by-step story or event sequence.

5. For the area of data analysis, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must collect, organize, display, interpret and analyze data to determine statistical relationships and probability projections. A pupil must demonstrate the ability to ~~[collect and describe data.]~~ ***:***

(a) Collect, organize and record data in response to questions posed by a teacher and other pupils; and

(b) Use tally marks to represent data.

6. For the area of problem solving, to develop the ability to solve problems, a pupil must engage in developmentally appropriate opportunities for problem solving in which there is a need to use various approaches to investigate and understand mathematical concepts to formulate problems, find solutions to problems, develop and apply strategies to solve problems, and integrate mathematical reasoning, communication and connections. A pupil must demonstrate the ability to:

(a) ~~[Use efficient approaches to investigate and understand mathematical concepts;~~

~~(b) Find solutions to problems that occur in everyday situations;~~

~~(c) Select, modify, develop and apply strategies to solve a wide variety of problems;~~

~~(d) Transfer and generalize previous experience to new problem-solving situations;~~

~~(e) Demonstrate persistence in problem solving;~~

~~(f)]~~ ***Apply previous experience and knowledge to new problem-solving situations;***

(b) Explain and verify results ~~[; and~~

~~(g)]~~ ***with respect to the original problem;***

(c) Try more than one strategy to solve a problem when the first strategy proves unsuccessful; and

(d) Use technology ~~[as a tool in problem solving.]~~ ***, including, without limitation, a calculator, to develop mathematical concepts.***

7. For the area of mathematical communication, to develop the ability to communicate mathematically, a pupil must solve problems in which there is a need to obtain information ~~[,~~

~~translate the]~~ ***in everyday life by reading, listening and observing to translate*** information into mathematical language and symbols, process ~~[the]~~ information mathematically***, discuss and exchange ideas about mathematics as part of learning, read various fiction and nonfiction texts to learn about mathematics*** and present the results in written, oral and visual formats. A pupil must demonstrate the ability to:

(a) ~~[Obtain information by reading, listening, observing and inquiring and use that information to solve mathematical problems;~~

~~(b) Use mathematical language and symbols to explain thinking and processes and translate ideas into everyday language;~~

~~(c) Present mathematical ideas and solutions in written, oral and visual forms;~~

~~(d) Discuss, explain, justify and evaluate mathematical ideas and solutions; and~~

~~(e)]~~ Use physical ~~[, pictorial and symbolic forms]~~ ***materials, models, pictures or writing*** to represent ***and communicate*** mathematical ideas ~~[and relationships.]~~ ***;***

(b) Use inquiry techniques to solve mathematical problems;

(c) Identify and translate key words and phrases that imply mathematical operations; and

(d) Communicate strategies and solutions to mathematical problems by using oral and written expression of everyday language.

8. For the area of mathematical reasoning, to develop the ability to reason mathematically, a pupil must solve problems in which there is a need to investigate ~~[significant]~~ mathematical ideas and construct his own learning in all content areas to ~~[justify and enhance]~~ ***reinforce and extend*** his ability to ~~[think and]~~ reason logically ~~[.]~~ ***, reflect on, clarify and justify his thinking, ask questions to extend his learning, use patterns and relationships to analyze mathematical***

situations, and determine relevant, irrelevant and sufficient information to solve mathematical problems. A pupil must demonstrate the ability to:

(a) ~~[Construct meaning and justify thinking by investigating mathematical ideas, patterns and relationships;~~

~~(b) Reinforce and extend abilities for logical reasoning;~~

~~(c) Ask questions to reflect on, clarify and extend thinking;~~

~~(d) Review, refine, explain and justify mathematical processes, arguments and solutions using manipulatives, physical models and abstract ideas; and~~

~~(e) Determine the relevancy and sufficiency of information to solve mathematical problems.]~~ ***Draw logical conclusions about mathematical problems;***

(b) Discuss the steps used to solve a mathematical problem; and

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

9. For the area of mathematical connections, to develop the ability to make mathematical connections, a pupil must solve problems in which there is a need to view mathematics as an integrated whole, including ***linking new concepts to prior knowledge,*** identifying relationships between content strands and integrating mathematics with other disciplines, thereby allowing the flexibility to approach problems in a variety of ways within and beyond the field of mathematics. A pupil must demonstrate the ability to:

(a) ~~[View mathematics as an integrated whole and identify relationships between content strands;~~

~~(b) Identify practical applications of mathematical principles that can be applied to other disciplines;~~

~~(c) Use and analyze the connections within and beyond the field of mathematics in a variety of ways to solve problems;~~

~~(d) Link new concepts to prior knowledge; and~~

~~(e)]~~ Apply mathematical thinking and modeling to solve problems that arise in other disciplines ***, including, without limitation, rhythm in music and motion in science;*** and

(b) Identify mathematics used in everyday life.

Sec. 3. NAC 389.2435 is hereby amended to read as follows:

389.2435 By the end of the second grade, pupils must know and be able to do everything required in the previous grades for courses in mathematics offered in public schools. Instruction in the second grade in mathematics must be designed so that pupils meet the following performance standards by the completion of the second grade:

1. For the areas of numbers, number sense and computation, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must accurately calculate and use estimation techniques, number relationships, operation rules and algorithms, and determine the reasonableness of answers and the accuracy of solutions. A pupil must demonstrate the ability to:

(a) Identify and model basic addition facts for sums through 18 and the corresponding subtraction facts;

(b) Immediately recall from memory ***basic*** addition facts for sums through ~~[10]~~ ***18*** and the corresponding subtraction facts;

(c) Add and subtract ~~[multiplace]~~ ***one-digit and two-digit*** numbers without regrouping;

(d) Generate ~~[, write]~~ and solve one-step addition and subtraction problems based on practical situations;

(e) ~~[Use decimals to show amounts of money;~~

~~(f)]~~ Use the patterns in numbers to skip count;

~~[(g) Estimate , with reasonable results,]~~

(f) Estimate the number of objects in a set through 20 ~~[;~~

~~(h)]~~ ***and verify by counting;***

(g) Read and write numbers ***as words*** through 20 ~~[and use modeling and identifying for the 1st through 20th ordinal positions;~~

~~(i) Use modeling and identifying to place value positions of 1s, 10s and 100s; and~~

~~(j) Identify, model and label]~~ ***;***

(h) Identify and model the unit fractions 1/2 and 1/4 as ***equal*** parts of a whole ~~[.]~~ ***or set of objects;***

(i) Identify, use and model place value positions of 1s, 10s and 100s;

(j) Identify the value of a given digit in the 1s, 10s and 100s place;

(k) Identify equal parts of a whole;

(l) Read, write, compare and order numbers from 0 through 999;

(m) Identify the 1st through 20th ordinal positions;

(n) Create, compare and describe sets of objects and numbers from 1 through 100 as greater than, less than or equal to;

(o) Model addition and subtraction in a variety of ways using pictorial representations and symbols to illustrate subtraction of sets, comparison of sets and missing addends; and

(p) Reinforce the use of mathematical vocabulary and symbols to describe addition, subtraction and equality.

2. For the areas of patterns, functions and algebra, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must use various algebraic methods to analyze, illustrate, extend and create numerous representations, including, without limitation, words, numbers, tables, and graphs of patterns, functions and algebraic relations. A pupil must demonstrate the ability to:

(a) Recognize, describe, extend, create and use repeating and increasing patterns, symbols, objects and manipulatives to solve problems;

(b) Use ~~[variables and open sentences to express relationships;~~

~~(c) Create, model, explain and solve problems by using addition and subtraction; and~~

~~(d) Generate and solve problems based on various numerical sentences and represent]~~ ***patterns and their extensions to solve problems;***

(c) Model, explain and identify missing operations and missing numbers in open number sentences involving number facts in addition and subtraction;

(d) Complete number sentences using the words plus, minus, greater than, less than or equal to, as appropriate, or using the corresponding symbol; and

(e) Represent mathematical situations using numbers, symbols and words.

3. For the area of measurement, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must use appropriate tools and techniques of measurement to determine, estimate, record and verify direct and indirect measurements. A pupil must demonstrate the ability to:

(a) Compare and order objects by various measurable attributes, including, without limitation, time, temperature, length, weight, capacity and area, and describe and define those various attributes;

(b) Compare objects ***to standard whole units to ascertain objects*** that are greater than, less than ~~[,]~~ or equal to a given unit ***;*** ~~[of measurement such as an inch, yard, centimeter and meter;]~~

(c) Determine the value of any given set of coins;

(d) ~~[Recite and use the months of the year in sequential order and use a calendar to identify days, weeks, months and years; and~~

~~(e)]~~ Read the time of day to the nearest ***half hour and*** quarter hour ~~[and distinguish between "a.m." and "p.m."]~~ ***;***

(e) Recognize equivalent combinations of coins;

(f) Use decimals to show amounts of money;

(g) Use elapsed time in one hour increments, beginning on the hour, to determine the start time, end time and elapsed time; and

(h) Recognize that there are 12 months in 1 year, 7 days in 1 week and 24 hours in 1 day.

4. For the areas of spatial relationships ***, logic*** and geometry, to solve problems, communicate and make connections within and beyond the field of mathematics, a pupil must identify, represent, verify and apply spatial relationships and geometric properties. A pupil must demonstrate the ability to:

(a) Describe ***, sketch*** and compare ~~[circles, triangles and rectangles, including squares, regardless of position;~~

~~(b) Describe the location of objects and place objects in position using descriptive words such as before, far, below and left;~~

~~(c) Compare the size of similar two-dimensional figures and identify]~~ ***two-dimensional shapes without regard to orientation;***

(b) Identify shapes that are congruent ~~[,~~

~~(d)]~~ ***and similar, including, without limitation, circles, triangles, rectangles and squares;***

(c) Identify symmetry in figures ***as they appear*** in the environment ~~[and create figures and designs that have a line of symmetry; and~~

~~(e)]~~ ***;***

(d) Identify, name, sort ~~[, describe, compare and contrast]~~ ***and describe*** two-dimensional and three-dimensional ***geometric*** figures ~~[.]~~ ***and objects, including, without limitation, a circle, sphere, square and cube; and***

(e) Sort and classify objects by two or more attributes.

5. For the area of data analysis, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must collect, organize, display, interpret and analyze data to determine statistical relationships and probability projections. A pupil must demonstrate the ability to ~~[collect, organize, record and explain the classification of data using concrete materials.]~~ ***:***

(a) Collect, record and classify data in response to questions posed by a teacher and other pupils;

(b) Use tables, pictographs and bar graphs to represent data; and

(c) Use informal concepts of probability, including, without limitation, certain and impossible probability, to make predictions about future events.

6. For the area of problem solving, to develop the ability to solve problems, a pupil must engage in developmentally appropriate opportunities for problem solving in which there is a need to use various approaches to investigate and understand mathematical concepts to formulate problems, find solutions to problems, develop and apply strategies to solve problems, and

integrate mathematical reasoning, communication and connections. A pupil must demonstrate the ability to:

(a) ~~[Use efficient approaches to investigate and understand mathematical concepts;~~

~~(b) Find solutions to problems that occur in everyday situations;~~

~~(c) Select, modify, develop and apply strategies to solve a wide variety of problems;~~

~~(d) Transfer and generalize]~~ ***Apply*** previous experience ***and knowledge*** to new problem-solving situations;

~~[(e) Demonstrate persistence in problem solving;~~

~~(f) Explain and verify results; and~~

~~(g)]~~ ***(b) Explain and verify results with respect to the original problem;***

(c) Try more than one strategy to solve a problem when the first strategy proves unsuccessful; and

(d) Use technology ~~[as a tool in problem solving.]~~ ***, including, without limitation, a calculator, to develop mathematical concepts.***

7. For the area of mathematical communication, to develop the ability to communicate mathematically, a pupil must solve problems in which there is a need to obtain information ~~[, translate the]~~ ***in everyday life by reading, listening and observing to translate*** information into mathematical language and symbols, process ~~[the]~~ information mathematically ***, discuss and exchange ideas about mathematics as part of learning, read various fiction and nonfiction texts to learn about mathematics*** and present the results in written, oral and visual formats. A pupil must demonstrate the ability to:

(a) ~~[Obtain information by reading, listening, observing and inquiring and use that information to solve mathematical problems;~~

~~(b) Use mathematical language and symbols to explain thinking and processes and translate ideas into everyday language;~~

~~(c) Present mathematical ideas and solutions in written, oral and visual forms;~~

~~(d) Discuss, explain, justify and evaluate mathematical ideas and solutions;~~

~~(e) Use physical, pictorial and symbolic forms to represent mathematical ideas and relationships; and~~

~~(f) Make conjectures, present arguments and evaluate discussions concerning mathematical ideas presented in various written and oral forms.~~] ***Use inquiry techniques to solve mathematical problems;***

(b) Represent and communicate mathematical ideas using physical materials, models, pictures or writing;

(c) Identify and translate key words and phrases that imply mathematical operations; and

(d) Communicate strategies and solutions to mathematical problems using oral and written expression of everyday language.

8. For the area of mathematical reasoning, to develop the ability to reason mathematically, a pupil must solve problems in which there is a need to investigate ~~[significant]~~ mathematical ideas and construct his own learning in all content areas to ~~[justify and enhance]~~ ***reinforce and extend*** his ability to ~~[think and]~~ reason logically ~~[.]~~ ***, reflect on, clarify and justify his thinking, ask questions to extend his learning, use patterns and relationships to analyze mathematical situations, and determine relevant, irrelevant and sufficient information to solve mathematical problems.*** A pupil must demonstrate the ability to:

(a) ~~[Construct meaning and justify thinking by investigating mathematical ideas, patterns and relationships;~~

~~(b) Reinforce and extend abilities for logical reasoning;~~

~~(c) Ask questions to reflect on, clarify and extend thinking;~~

~~(d) Review, refine, explain and justify mathematical processes, arguments and solutions using manipulatives, physical models and abstract ideas;~~

~~(e) Determine the relevancy and sufficiency of information to solve mathematical problems;~~

~~(f) Follow, create and defend valid and logical mathematical arguments; and~~

~~(g) Recognize and apply inductive and deductive reasoning in both concrete and abstract contexts.]~~ ***Draw logical conclusions about mathematical problems;***

(b) Discuss the steps used to solve a mathematical problem; and

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

9. For the area of mathematical connections, to develop the ability to make mathematical connections, a pupil must solve problems in which there is a need to view mathematics as an integrated whole, including ***linking new concepts to prior knowledge,*** identifying relationships between content strands and integrating mathematics with other disciplines, thereby allowing the flexibility to approach problems in a variety of ways within and beyond the field of mathematics. A pupil must demonstrate the ability to:

(a) ~~[View mathematics as an integrated whole and identify relationships between content strands;~~

~~(b) Identify practical applications of mathematical principles that can be applied to other disciplines;~~

~~(c) Use and analyze the connections within and beyond the field of mathematics in a variety of ways to solve problems;~~

~~(d) Link new concepts to prior knowledge;~~

~~(e) Explain the relationship of concepts to procedures using models; and~~

~~(f)]~~ Apply mathematical thinking and modeling to solve problems that arise in other disciplines***, including, without limitation, rhythm in music and motion in science;*** and

(b) Identify mathematics used in everyday life.

Sec. 4. NAC 389.251 is hereby amended to read as follows:

389.251 By the end of the third grade, pupils must know and be able to do everything required in the previous grades for courses in mathematics offered in public schools. Instruction in the third grade in mathematics must be designed so that pupils meet the following performance standards by the completion of the third grade:

1. For the areas of numbers, number sense and computation, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must accurately calculate and use estimation techniques, number relationships, operation rules and algorithms, and determine the reasonableness of answers and the accuracy of solutions. A pupil must demonstrate the ability to:

(a) Immediately recall and use addition and subtraction facts ~~[and]~~ ***;***

(b) Immediately recall multiplication facts for products through 81;

~~[(b)]~~ ***(c)*** Add and subtract ~~[multiplace]~~ ***two-digit and three-digit*** numbers with ***and without*** regrouping;

~~[(c)]~~ ***(d)*** Generate and solve two-step addition and subtraction problems based on practical situations ~~[by using paper and pencil, mental computation and estimation;~~

~~(d)]~~ ***;***

(e) Generate and solve one-step multiplication problems based on practical situations ~~[by using paper and pencil, mental computation and estimation;~~

~~(e)]~~ ***;***

(f) Add and subtract decimals ~~[that represent amounts of money;~~

~~(f) Use repeated addition to model and explain multiplication;]~~ ***using money as a model;***

(g) Read ~~[and write numerals and words that represent numbers and]~~ ***, write,*** compare and order numbers from 0 through ~~[999;~~

~~(h) Determine the reasonableness of answers by rounding to the nearest 10 and 100;~~

~~(i)]~~ ***9,999;***

(h) Read and write numbers as words through 100;

(i) Use, model and identify the place value positions ~~[through 10,000;~~

~~(j) Model, sketch and label fractions with denominators through 10; and~~

~~(k) Write commonly used fractions using both numerals and words.]~~ ***of 1s, 10s, 100s and 1,000s;***

(j) Identify the value of a given digit in the 1s, 10s, 100s and 1,000s place;

(k) Identify and model the unit fractions 1/2, 1/3, 1/4, 1/6 and 1/8 as equal parts of a whole or set of objects;

(l) Read and write unit fractions with numbers and with words that represent numbers;

(m) Model and explain multiplication and division as skip counting patterns;

(n) Model and explain multiplication and division as repeated addition or subtraction;

(o) Estimate the number of objects in a set using a variety of techniques;

(p) Model addition, subtraction, multiplication and division in a variety of ways; and

(q) Use mathematical vocabulary and symbols to describe multiplication and division.

2. For the areas of patterns, functions and algebra, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must use various

algebraic methods to analyze, illustrate, extend and create numerous representations, including, without limitation, words, numbers, tables, and graphs of patterns, functions and algebraic relations. A pupil must demonstrate the ability to:

(a) Recognize, describe ~~[, extend]~~ and create ~~[repeating and increasing]~~ patterns by using ***objects and*** numbers ~~[, number patterns and their extensions to solve problems; and~~

~~(b) Identify missing symbols and missing numbers in open sentences involving number facts in addition and subtraction.]~~ ***found in tables, number charts and charts;***

(b) Record results of patterns created by using manipulatives, pictures and numeric representations and describe how they are extended;

(c) Model, explain and solve open number sentences involving addition, subtraction and multiplication facts;

(d) Use variables and open sentences to express relationships; and

(e) Complete number sentences using the words plus, minus, greater than, less than or equal to, as appropriate, or using the corresponding symbol.

3. For the area of measurement, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must use appropriate tools and techniques of measurement to determine, estimate, record and verify direct and indirect measurements. A pupil must demonstrate the ability to:

(a) ~~[Measure to a required degree of accuracy, record the measurement, evaluate the measurement for error and describe the appropriateness of selected units of measure;~~

~~(b) Estimate measurements and use measuring devices with standard and nonstandard units to measure length, area of a region, liquid volume, capacity, temperature and weight, and communicate the concepts of more, less and equivalent;~~

~~(c) Read, write and use notations of money and determine possible combinations of coins and bills to equal given amounts; and~~

~~(d) Read~~] ***Compare, order and describe objects by using various measurable attributes for area, volume and capacity;***

(b) Select and use appropriate units of measure;

(c) Measure to a required degree of accuracy to the nearest 1/2 unit;

(d) Determine possible combinations of coins and bills to equal given amounts;

(e) Read, write and use money notations;

(f) Recognize equivalent relationships between and among bills and coins;

(g) Tell the time of day to the nearest minute ***by*** using analog and digital clocks ~~[and measure time that has elapsed.]~~ ***;***

(h) Determine start, end and elapsed time by using elapsed time in half-hour increments, beginning on the hour or half-hour; and

(i) Recognize that there are 60 minutes in 1 hour.

4. For the areas of spatial relationships ***, logic*** and geometry, to solve problems, communicate and make connections within and beyond the field of mathematics, a pupil must identify, represent, verify and apply spatial relationships and geometric properties. A pupil must demonstrate the ability to:

(a) Describe, sketch, compare and contrast plane geometric figures;

(b) Demonstrate and describe the ~~[transformation]~~ ***transformational motions*** of a geometric figure ~~[as]~~ ***, including, without limitation,*** a ***translation or*** slide, ***a*** rotation ***or turn, and a reflection*** or flip; ~~[and]~~

(c) Sketch, model, build, compare and contrast two-dimensional and three-dimensional geometric figures ~~[.]~~ ***and objects;***

(d) Create two-dimensional designs that contain a line of symmetry;

(e) Identify, draw and describe horizontal, vertical and oblique lines; and

(f) Use the quantifiers all, some and none to describe the characteristics of a set.

5. For the area of data analysis, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must collect, organize, display, interpret and analyze data to determine statistical relationships and probability projections. A pupil must demonstrate the ability to:

(a) ~~[Collect, organize, display and describe simple data using number lines, pictographs, bar graphs and frequency tables by hand and with computers, if available; and~~

~~(b)]~~ Use ***informal*** concepts of probability such as impossible, unlikely, likely and certain to make predictions about future events ~~[.]~~ ***;***

(b) Pose questions that can be used to guide data collection, organization and representation; and

(c) Use graphical representations, including, without limitation, number lines, frequency tables and pictographs, to represent data.

6. For the area of problem solving, to develop the ability to solve problems, a pupil must engage in developmentally appropriate opportunities for problem solving in which there is a need to use various approaches to investigate and understand mathematical concepts to formulate problems, find solutions to problems, develop and apply strategies to solve problems, and integrate mathematical reasoning, communication and connections. A pupil must demonstrate the ability to:

(a) ~~[Use efficient approaches to investigate and understand mathematical concepts;~~

~~(b) Find solutions to problems that occur in everyday situations;~~

~~(c) Select, modify, develop and apply strategies to solve a wide variety of problems;~~

~~(d) Transfer and generalize previous experience to new problem-solving situations;~~

~~(e) Demonstrate persistence in problem solving;~~

~~(f) Explain and verify results;]~~ ***Generalize and apply previous experiences and strategies to new problem-solving situations;***

(b) Determine an efficient problem-solving strategy and verify, interpret and evaluate the results with respect to the original problem;

(c) Try more than one strategy to solve a problem when the first strategy proves unsuccessful;

(d) Interpret and solve a variety of mathematical problems by paraphrasing;

(e) Identify necessary and extraneous information;

(f) Check the reasonableness of a solution; and

(g) Use technology ~~[as a tool in problem solving.]~~ ***, including, without limitation, a calculator, to develop mathematical concepts.***

7. For the area of mathematical communication, to develop the ability to communicate mathematically, a pupil must solve problems in which there is a need to obtain information ~~[, translate the]~~ ***in everyday life by reading, listening and observing to translate*** information into mathematical language and symbols, process ~~[the]~~ information mathematically ***, discuss and exchange ideas about mathematics as part of learning, read various fiction and nonfiction texts to learn about mathematics*** and present the results in written, oral and visual formats. A pupil must demonstrate the ability to:

(a) ~~[Obtain information by reading, listening, observing and inquiring and use that information to solve mathematical problems;~~

~~(b) Use mathematical language and symbols to explain thinking and processes and translate those ideas into everyday language;~~

~~(c) Present mathematical ideas and solutions in written, oral and visual forms;~~

~~(d) Discuss, explain, justify and evaluate mathematical ideas and solutions;~~

~~(e) Use physical, pictorial and symbolic forms to represent mathematical ideas and relationships; and~~

~~(f) Make conjectures, present arguments and evaluate discussions concerning mathematical ideas presented in various written and oral forms.]~~ ***Use inquiry techniques to solve mathematical problems;***

(b) Use a variety of methods to represent and communicate mathematical ideas through oral, verbal and written formats;

(c) Identify and translate key words and phrases that imply mathematical operations; and

(d) Communicate strategies and solutions to mathematical problems by using oral and written expression of everyday language.

8. For the area of mathematical reasoning, to develop the ability to reason mathematically, a pupil must solve problems in which there is a need to investigate ~~[significant]~~ mathematical ideas and construct his own learning in all content areas to ~~[justify and enhance]~~ ***reinforce and extend*** his ability to ~~[think and]~~ reason logically ~~[.]~~ ***, reflect on, clarify and justify his thinking, ask questions to extend his learning, use patterns and relationships to analyze mathematical situations, and determine relevant, irrelevant and sufficient information to solve mathematical problems.*** A pupil must demonstrate the ability to:

(a) ~~[Construct meaning and justify thinking by investigating mathematical ideas, patterns and relationships;~~

~~(b) Reinforce and extend abilities for logical reasoning;~~

~~(c) Ask questions to reflect on, clarify and extend thinking;~~

~~(d) Review, refine, explain and justify mathematical processes, arguments and solutions using manipulatives, physical models and abstract ideas;~~

~~(e) Determine the relevancy and sufficiency of information to solve mathematical problems;~~

~~(f) Follow, create and defend valid logical mathematical arguments; and~~

~~(g) Recognize and apply inductive and deductive reasoning in both concrete and abstract contexts.]~~ ***Draw logical conclusions about mathematical problems;***

(b) Follow a logical argument and judge the validity of the argument;

(c) Review and refine the assumptions and steps used to derive conclusions in mathematical arguments; and

(d) Justify and explain the solutions to problems using manipulatives and physical models.

9. For the area of mathematical connections, to develop the ability to make mathematical connections, a pupil must solve problems in which there is a need to view mathematics as an integrated whole, including ***linking new concepts to prior knowledge,*** identifying relationships between content strands and integrating mathematics with other disciplines, thereby allowing the flexibility to approach problems in a variety of ways within and beyond the field of mathematics. A pupil must demonstrate the ability to:

(a) ~~[View mathematics as an integrated whole and identify relationships between content strands;~~

~~(b) Identify practical applications of mathematical principles that can be applied to other disciplines;~~

~~(c) Use and analyze the connections within and beyond the field of mathematics in a variety of ways to solve problems;~~

~~(d) Link new concepts to prior knowledge;~~

~~(e) Explain the relationship of concepts to procedures using models; and~~

~~(f)~~] ***Use mathematical ideas from one area of mathematics to explain an idea from another area of mathematics;***

(b) Use physical models to explain the relationship between concepts and procedures;

(c) Apply mathematical thinking and modeling to solve problems that arise in other disciplines ***, including, without limitation, rhythm in music and motion in science;*** and

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

Sec. 5. NAC 389.2934 is hereby amended to read as follows:

389.2934 By the end of the fourth grade, pupils must know and be able to do everything required in the previous grades for courses in mathematics offered in public schools. Instruction in the fourth grade in mathematics must be designed so that pupils meet the following performance standards by the completion of the fourth grade:

1. For the areas of numbers, number sense and computation, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must accurately calculate and use estimation techniques, number relationships, operation rules and algorithms and determine the reasonableness of answers and the accuracy of solutions. A pupil must demonstrate the ability to:

(a) Immediately recall and use multiplication and corresponding division facts through ~~[12;]~~ ***products of 144;***

(b) Generate and solve ~~[two-step]~~ ***addition, subtraction,*** multiplication and division problems ~~[based on]~~ ***using whole numbers in*** practical situations ***;*** ~~[using pencil and paper, mental computation and estimation;]~~

(c) ~~[Multiply and divide money amounts by a one-digit whole number producing a solution with no remainder;~~

~~(d)]~~ Multiply and divide multidigit numbers by one-digit numbers ~~[;~~

~~(e) Model and explain division as repeated subtraction and equal groups;~~

~~(f)]~~ ***with regrouping, including, without limitation, monetary amounts as decimals;***

(d) Read, write, order and compare whole numbers;

~~[(g)]~~ ***(e)*** Use estimation to determine the reasonableness of an answer ~~[;~~

~~(h)]~~ ***in mathematical and practical situations;***

(f) Use and identify place value positions of whole numbers ~~[; and~~

~~(i)]~~ ***to 1,000,000;***

(g) Identify and compare fractions with like denominators using numbers, models and drawings ~~[.]~~ ***;***

(h) Read and write numbers as words;

(i) Count by multiples of a given number;

(j) Explain relationships between skip counting, repeated addition and multiples; and

(k) Add and subtract multidigit numbers.

2. For the areas of patterns, functions and algebra, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must use various

algebraic methods to analyze, illustrate, extend and create numerous representations, including, without limitation, words, numbers, tables, and graphs of patterns, functions and algebraic relations. A pupil must demonstrate the ability to:

(a) Identify, describe and represent ~~[numeric and geometric]~~ patterns and relationships ~~[; and~~

~~(b) Find solutions to given equations from a given replacement set, such as finding the solution to 3 X 7 = , given the replacement set {19, 20, 21}.]~~ ***in the number system, including, without limitation, arithmetic and geometric sequences;***

(b) Model, explain and solve open number sentences involving addition, subtraction, multiplication and division;

(c) Select the solution to an equation from a given set of numbers; and

(d) Complete number sentences using the words plus, minus, multiplied by, divided by, greater than, less than and equal to, as appropriate, or using the corresponding symbol.

3. For the area of measurement, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must use appropriate tools and techniques of measurement to determine, estimate, record and verify direct and indirect measurements. A pupil must demonstrate the ability to:

(a) ~~[Select and use appropriate units and tools to describe an attribute such as length, width or perimeter, measure to a required degree of accuracy and record the results;~~

~~(b) Communicate the difference between perimeter and area, and describe]~~ ***Define*** and determine the perimeter of polygons and the area of rectangles, including squares;

~~[(c)]~~ ***(b)*** Determine totals for monetary amounts in ~~[problem-solving situations;~~

~~(d) Identify equivalent periods of time, including relationships between and among seconds, minutes, hours, days, months and years, such as 60 seconds = 1 minute; and~~

~~(e) Describe the difference between perimeter and area and determine the perimeter of any polygon and the area of right triangles and rectangles, including squares.]~~ ***practical situations;***

(c) Estimate and convert units of measure for length, area and weight within the same measurement system, including customary and metric;

(d) Estimate temperature in practical situations;

(e) Measure length, area, temperature and weight to a required degree of accuracy using the customary and metric systems;

(f) Use money notation to add and subtract given monetary amounts;

(g) Describe time using "a.m." and "p.m." designations appropriately;

(h) Determine start, end and elapsed time using elapsed time in quarter-hour increments, beginning on the quarter-hour; and

(i) Recognize the number of weeks in a year, days in a year and days in a month.

4. For the areas of spatial relationships ***, logic*** and geometry, to solve problems, communicate and make connections within and beyond the field of mathematics, a pupil must identify, represent, verify and apply spatial relationships and geometric properties. A pupil must demonstrate the ability to:

(a) Identify, draw, and classify angles ~~[according to their type, either]~~ ***, including, without limitation, straight,*** right, obtuse or acute ~~[, and by given measurements;~~

~~(b) Represent concepts of similarity, congruence and symmetry using transformational motions;~~

~~(c)]~~ ***angles;***

(b) Identify, describe and classify ~~[two]~~ ***two-dimensional*** and three-dimensional figures by relevant properties including the number of ~~[angles,]~~ ***vertices,*** edges and ~~[shapes of]~~ faces using models; ~~[and~~

~~(d)]~~ ***(c)*** Identify, ***label,*** describe and draw ~~[geometric figures including points, intersecting lines, parallel lines,]~~ ***points,*** line segments, rays and angles ~~[.]~~ ***;***

(d) Identify shapes that are congruent, similar or symmetrical, or any combination thereof, using a variety of methods, including, without limitation, transformational motions;

(e) Identify coordinates for a given point in the first quadrant;

(f) Locate points of given coordinates on a grid in the first quadrant; and

(g) Use the connectors "and," "or" and "not" to describe the members of a set.

5. For the area of data analysis, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must collect, organize, display, interpret and analyze data to determine statistical relationships and probability projections. A pupil must demonstrate the ability to:

(a) ~~[Collect, organize, display, describe and interpret simple data using lines, pictographs, bar graphs and frequency tables; and~~

~~(b)]~~ Conduct simple probability experiments using concrete materials ~~[and represent the results using fractions.]~~ ***;***

(b) Pose questions that can be used to guide the collection of categorical and numerical data;

(c) Organize and represent data using a variety of graphical representations, including, without limitation, frequency tables and line plots;

(d) Model and compute range;

(e) Model the measures of central tendency for mode and median;

(f) Interpret data and make predictions using frequency tables and line plots; and

(g) Represent the results of simple probability experiments as fractions to make predictions about future events.

6. For the area of problem solving, to develop the ability to solve problems, a pupil must engage in developmentally appropriate opportunities for problem solving in which there is a need to use various approaches to investigate and understand mathematical concepts to formulate problems, find solutions to problems, develop and apply strategies to solve problems and integrate mathematical reasoning, communication and connections. A pupil must demonstrate the ability to:

(a) ~~[Use efficient approaches to investigate and understand mathematical concepts;~~

~~(b) Find solutions to problems that occur in everyday situations;~~

~~(c) Select, modify, develop and apply strategies to solve a wide variety of problems;~~

~~(d) Transfer and generalize previous experience to new problem-solving situations;~~

~~(e) Demonstrate persistence in problem solving;~~

~~(f) Explain and verify results;]~~ ***Generalize and apply previous experiences and strategies to new problem-solving situations;***

(b) Determine an efficient problem-solving strategy and verify, interpret and evaluate the results with respect to the original problem;

(c) Try more than one strategy to solve a problem when the first strategy proves unsuccessful;

(d) Interpret and solve a variety of mathematical problems by paraphrasing;

(e) Identify necessary and extraneous information;

(f) Check the reasonableness of a solution; and

(g) Use technology ~~[as a tool in problem solving.]~~ ***, including, without limitation, a calculator, to develop mathematical concepts.***

7. For the area of mathematical communication, to develop the ability to communicate mathematically, a pupil must solve problems in which there is a need to obtain information ~~[, translate the]~~ ***in everyday life by reading, listening and observing to translate*** information into mathematical language and symbols, process ~~[the]~~ information mathematically ***, discuss and exchange ideas about mathematics as part of learning, read various fiction and nonfiction texts to learn about mathematics*** and present the results in written, oral and visual formats. A pupil must demonstrate the ability to:

(a) ~~[Obtain information by reading, listening, observing and inquiring and use that information to solve mathematical problems;~~

~~(b) Use mathematical language and symbols to explain thinking and processes and translate ideas into everyday language;~~

~~(c) Present mathematical ideas and solutions in written, oral and visual forms;~~

~~(d) Discuss, explain, justify and evaluate mathematical ideas and solutions;~~

~~(e) Use physical, pictorial and symbolic forms to represent mathematical ideas and relationships; and~~

~~(f) Make conjectures, present arguments and evaluate discussions concerning mathematical ideas presented in various written and oral forms.]~~ ***Use inquiry techniques to solve mathematical problems;***

(b) Use a variety of methods to represent and communicate mathematical ideas through oral, verbal and written formats;

(c) Identify and translate key words and phrases that imply mathematical operations; and

(d) Communicate strategies and solutions to mathematical problems by using oral and written expression of everyday language.

8. For the area of mathematical reasoning, to develop the ability to reason mathematically, a pupil must solve problems in which there is a need to investigate ~~[significant]~~ mathematical ideas and construct his own learning in all content areas to ~~[justify and enhance]~~ ***reinforce and extend*** his ability to ~~[think and]~~ reason logically ~~[.]~~ ***, reflect on, clarify and justify his thinking, ask questions to extend his learning, use patterns and relationships to analyze mathematical situations, and determine relevant, irrelevant and sufficient information to solve mathematical problems.*** A pupil must demonstrate the ability to:

(a) ~~[Construct meaning and justify thinking by investigating mathematical ideas, patterns and relationships;~~

~~(b) Reinforce and extend abilities for logical reasoning;~~

~~(c) Ask questions to reflect on, clarify and extend thinking;~~

~~(d) Review, refine, explain and justify mathematical processes, arguments and solutions using manipulatives, physical models and abstract ideas;~~

~~(e) Determine the relevancy and sufficiency of information to solve mathematical problems;~~

~~(f) Follow, create and defend valid and logical mathematical arguments; and~~

~~(g) Recognize and apply inductive and deductive reasoning in both concrete and abstract contexts.]~~ ***Draw logical conclusions about mathematical problems;***

(b) Follow a logical argument and judge the validity of the argument;

(c) Review and refine the assumptions and steps used to derive conclusions in mathematical arguments; and

(d) Justify and explain the solutions to problems using manipulatives and physical models.

9. For the area of mathematical connections, to develop the ability to make mathematical connections, a pupil must solve problems in which there is a need to view mathematics as an integrated whole, including ***linking new concepts to prior knowledge,*** identifying relationships between content strands and integrating mathematics with other disciplines, thereby allowing the flexibility to approach problems in a variety of ways within and beyond the field of mathematics. A pupil must demonstrate the ability to:

(a) ~~[View mathematics as an integrated whole and identify relationships between content strands;~~

~~(b) Identify practical applications of mathematical principles that can be applied to other disciplines;~~

~~(c) Use and analyze the connections within and beyond the field of mathematics in a variety of ways to solve problems;~~

~~(d) Link new concepts to prior knowledge;~~

~~(e) Explain the relationship of concepts to procedures using models; and~~

~~(f)]~~ ***Use mathematical ideas from one area of mathematics to explain an idea from another area of mathematics;***

(b) Use physical models to explain the relationship between concepts and procedures;

(c) Apply mathematical thinking and modeling to solve problems that arise in other disciplines ***, including, without limitation, rhythm in music and motion in science;*** and

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

Sec. 6. NAC 389.2943 is hereby amended to read as follows:

389.2943 By the end of the fifth grade, pupils must know and be able to do everything required in the previous grades for courses in mathematics offered in public schools. Instruction in the fifth grade in mathematics must be designed so that pupils meet the following performance standards by the completion of the fifth grade:

1. For the areas of numbers, number sense and computation, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must accurately calculate and use estimation techniques, number relationships, operation rules and algorithms, and determine the reasonableness of answers and the accuracy of solutions. A pupil must demonstrate the ability to:

(a) ~~[Immediately recall and use multiplication and corresponding division facts using factors of 0 through 12;~~

~~(b) Multiply and divide multiplace numbers by two-digit numbers, including using strategies for multiplying and dividing powers of 10;~~

~~(c)]~~ Generate and solve addition, subtraction, multiplication and division problems ~~[that involve]~~ ***using*** whole numbers and ~~[order of operations based on]~~ ***decimals in*** practical situations;

~~[(d) Compare and order negative numbers based on practical situations and plot integer values on a number line;~~

~~(e) Estimate to determine the reasonableness of an answer by identifying and using the correct place value position;~~

~~(f) Model, draw, identify, compare, add and subtract decimals and fractions with like denominators to solve problems; and~~

~~(g)~~ ***(b) Identify and use place value positions of whole numbers and decimals to the hundredths;***

(c) Add and subtract fractions with like denominators using models, drawings and numbers;

(d) Compare fractions with unlike denominators by using models and drawings and by finding common denominators;

(e) Identify, model and compare improper fractions and mixed numbers;

(f) Read, write, compare and order integers in mathematical and practical situations;

(g) Use multiples of 10 to expand knowledge of basic multiplication and division facts;

(h) Estimate to determine the reasonableness of an answer in mathematical and practical situations involving decimals;

(i) Add and subtract decimals ~~[and multiply]~~ ***;***

(j) Multiply and divide decimals by whole numbers in problems that represent practical situations ~~[.]~~ ***; and***

(k) Use order of operations to evaluate expressions with whole numbers.

2. For the areas of patterns, functions and algebra, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must use various algebraic methods to analyze, illustrate, extend and create numerous representations, including, without limitation, words, numbers, tables and graphs of patterns, functions and algebraic relations. A pupil must demonstrate the ability to:

(a) Identify, describe and ~~[explain number]~~ ***represent*** patterns and relationships ~~[,]~~ ***in the number system,*** including, without limitation, triangular numbers ~~[,]~~ ***and*** perfect squares ~~[, and arithmetic and geometric sequences, using paper and pencil, concrete materials and calculators;~~

~~(b) Use variables in open sentences to describe simple functions and relationships;~~

~~(c) Solve simple whole number equations and inequalities using a variety of methods; and~~

~~(d) Generate number sequences given the first term of the sequence and any simple computation rule.]~~ ***;***

(b) Find possible solutions to an inequality involving a variable using whole numbers as a replacement set;

(c) Solve equations with whole numbers using a variety of methods, including, without limitation, inverse operations, mental math and guess and check; and

(d) Complete number sentences using the words greater than or equal to, less than or equal to and not equal to, as appropriate, and using the corresponding symbol.

3. For the area of measurement, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must use appropriate tools and techniques of measurement to determine, estimate, record and verify direct and indirect measurements. A pupil must demonstrate the ability to:

(a) Estimate and ~~[directly measure length, volume, capacity and quantity;~~

~~(b) Select and justify the use of estimation or direct measurement and weight in a given situation;~~

~~(c) Determine the total cost of purchases and the amount of change in practical situations; and~~

~~(d) Describe the difference between perimeter and area.]~~ ***convert units of measure for weight, volume and capacity within the same measurement system, including customary and metric;***

(b) Measure volume and weight to a required degree of accuracy in the customary and metric systems;

(c) Describe the difference between perimeter and area, including, without limitation, the difference in units of measure;

(d) Determine total, differences and change due for monetary amounts in practical situations; and

(e) Determine equivalent periods of time, including, without limitation, relationships between and among seconds, minutes, hours, days, months and years.

4. For the areas of spatial relationships ***, logic*** and geometry, to solve problems, communicate and make connections within and beyond the field of mathematics, a pupil must identify, represent, verify and apply spatial relationships and geometric properties. A pupil must demonstrate the ability to:

(a) Draw ***, identify, describe*** and classify triangles ~~[according to their proportions;]~~ ***and quadrilaterals based on their properties;***

(b) Identify and draw circles and ~~[elements]~~ ***parts*** of circles and describe the relationships between the various ~~[elements;~~

~~(c) Identify a transformation as translation, rotation, reflection, enlargement or reduction;~~

~~(d) Identify shapes that have congruence,]~~ ***parts;***

(c) Represent concepts of congruency, similarity or symmetry using a variety of methods, including, without limitation, transformational motions and ~~[models, drawings and tools of measurement;~~

~~(e) Graph ordered pairs and identify coordinates for a given point]~~ ***dilation;***

(d) Graph coordinates representing geometric shapes in the first quadrant;

~~[(f) Identify, describe, compare and classify two-dimensional and three-dimensional figures by their properties, including the number of vertices and edges and the number and shape of the faces; and~~

~~(g) Identify, describe, classify and draw one-dimensional and two-dimensional geometric figures, including lines that are intersecting, perpendicular and parallel, line segments, rays, and angles with given measurements.]~~

(e) Predict and describe the effects of combining, dividing and changing shapes into other shapes;

(f) Identify, draw, label and describe planes, parallel lines, intersecting lines and perpendicular lines;

(g) Describe the characteristics of right, acute, obtuse, scalene, equilateral and isosceles triangles; and

(h) Represent relationships using Venn diagrams.

5. For the area of data analysis, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must collect, organize, display, interpret and analyze data to determine statistical relationships and probability projections. A pupil must demonstrate the ability to:

(a) ~~[Collect, organize, read and interpret data using graphic representations, including tables, line plots, stem and leaf plots, scatter plots and histograms;~~

~~(b) Use data and graphs to formulate and explain conclusions and predictions, with and without the assistance of technology;~~

~~(c)]~~ Model and compute measures of central tendency ~~[, including]~~ ***for*** mean, median and mode; ~~[and~~

~~(d) Describe the limitations of various formats of graphs, select a type of graph to accurately represent the given data and justify the selection.]~~

(b) Pose questions that can be used to guide the collection of categorical and numerical data;

(c) Organize and represent data using a variety of graphical representations, including, without limitation, stem and leaf plots and histograms;

(d) Compute range;

(e) Interpret data and make predictions using stem and leaf plots and histograms;

(f) Represent and solve problems involving combinations using a variety of methods;

(g) Conduct simple probability experiments using concrete materials;

(h) Represent the results of simple probability experiments as decimals to make predictions about future events; and

(i) Select an appropriate type of graph to accurately represent the data and justify the selection.

6. For the area of problem solving, to develop the ability to solve problems, a pupil must engage in developmentally appropriate opportunities for problem solving in which there is a need to use various approaches to investigate and understand mathematical concepts to formulate problems, find solutions to problems, develop and apply strategies to solve problems, and integrate mathematical reasoning, communication and connections. A pupil must demonstrate the ability to:

(a) ~~[Use efficient approaches to investigate and understand mathematical concepts;~~

~~(b) Find solutions to problems that occur in everyday situations;~~

~~(c) Select, modify, develop and apply strategies to solve a wide variety of problems;~~

~~(d) Apply previous experience to new problem-solving situations;~~

~~(e) Demonstrate persistence in problem solving;~~

~~(f) Explain and verify results;~~] ***Generalize and apply previous experiences and strategies to new problem-solving situations;***

(b) Determine an efficient problem-solving strategy and verify, interpret and evaluate the results with respect to the original problem;

(c) Try more than one strategy to solve a problem when the first strategy proves unsuccessful;

(d) Interpret and solve a variety of mathematical problems by paraphrasing;

(e) Identify necessary and extraneous information;

(f) Check the reasonableness of a solution; and

(g) Use technology ~~[as a tool in problem solving.]~~ ***, including, without limitation, a calculator, to develop mathematical concepts.***

7. For the area of mathematical communication, to develop the ability to communicate mathematically, a pupil must solve problems in which there is a need to obtain information ~~[, translate the]~~ ***in everyday life by reading, listening and observing to translate*** information into mathematical language and symbols, process ~~[the]~~ information mathematically ***, discuss and exchange ideas about mathematics as part of learning, read various fiction and nonfiction texts to learn about mathematics*** and present the results in written, oral and visual formats. A pupil must demonstrate the ability to:

(a) ~~[Obtain information by reading, listening, observing and inquiring and use this information to solve mathematical problems;~~

~~(b) Use mathematical language and symbols to explain thinking and processes and translate those ideas into everyday language;~~

~~(c) Present mathematical ideas and solutions in written, oral and visual forms;~~

~~(d) Discuss, explain, justify and evaluate mathematical ideas and solutions;~~

~~(e) Use physical, pictorial and symbolic forms to represent mathematical ideas and relationships; and~~

~~(f) Make conjectures, present arguments and evaluate discussions concerning mathematical ideas presented in various written and oral forms.]~~ ***Use inquiry techniques to solve mathematical problems;***

(b) Use a variety of methods to represent and communicate mathematical ideas through oral, verbal and written formats;

(c) Identify and translate key words and phrases that imply mathematical operations; and

(d) Communicate strategies and solutions to mathematical problems by using oral and written expression of everyday language.

8. For the area of mathematical reasoning, to develop the ability to reason mathematically, a pupil must solve problems in which there is a need to investigate ~~[significant]~~ mathematical ideas and construct his own learning in all content areas to ~~[justify and enhance]~~ ***reinforce and extend*** his ability to ~~[think and]~~ reason logically ~~[.]~~ ***, reflect on, clarify and justify his thinking, ask questions to extend his learning, use patterns and relationships to analyze mathematical situations, and determine relevant, irrelevant and sufficient information to solve mathematical problems.*** A pupil must demonstrate the ability to:

(a) ~~[Construct meaning and justify thinking by investigating mathematical ideas, patterns and relationships;~~

~~(b) Reinforce and extend abilities for logical reasoning;~~

~~(c) Ask questions to reflect on, clarify and extend thinking;~~

~~(d) Review, refine, explain and justify mathematical processes, arguments and solutions by using manipulatives, physical models and abstract ideas;~~

~~(e) Determine the relevancy and sufficiency of information to solve mathematical problems;~~

~~(f) Follow, create and defend valid logical mathematical arguments; and~~

~~(g) Recognize and apply inductive and deductive reasoning in concrete and abstract contexts.]~~ ***Draw logical conclusions about mathematical problems;***

(b) Follow a logical argument and judge the validity of the argument;

(c) Review and refine the assumptions and steps used to derive conclusions in mathematical arguments; and

(d) Justify and explain the solutions to problems using manipulatives and physical models.

9. For the area of mathematical connections, to develop the ability to make mathematical connections, a pupil must solve problems in which there is a need to view mathematics as an integrated whole, including ***linking new concepts to prior knowledge,*** identifying relationships between content strands and integrating mathematics with other disciplines, thereby allowing the flexibility to approach problems in a variety of ways within and beyond the field of mathematics. A pupil must demonstrate the ability to:

(a) ~~[View mathematics as an integrated whole and identify relationships between content strands;~~

~~(b) Identify practical applications of mathematical principles that can be applied to other disciplines;~~

~~(c) Use and analyze the connections within and beyond the field of mathematics in a variety of ways to solve problems;~~

~~(d) Link new concepts to prior knowledge;~~

~~(e) Explain the relationship of concepts to procedures using models; and~~

~~(f)]~~ ***Use mathematical ideas from one area of mathematics to explain an idea from another area of mathematics;***

(b) Use physical models to explain the relationship between concepts and procedures;

(c) Apply mathematical thinking and modeling to solve problems that arise in other disciplines ***, including, without limitation, rhythm in music and motion in science;*** and

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

Sec. 7. NAC 389.301 is hereby amended to read as follows:

389.301 By the end of the sixth grade, pupils must know and be able to do everything required in the previous grades for courses in mathematics offered in public schools. Instruction in the sixth grade in mathematics must be designed so that pupils meet the following performance standards by the completion of the sixth grade:

1. For the areas of numbers, number sense and computation, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must accurately calculate and use estimation techniques, number relationships, operation rules and algorithms, and determine the reasonableness of answers and the accuracy of solutions. A pupil must demonstrate the ability to:

(a) ~~[Read, write, add, subtract, multiply and divide using fractions, decimals and percents;~~

~~(b) Apply decimals, fractions and percents to solve mathematical and practical problems;~~

~~(c) Use the concepts of number theory, including prime and composite numbers, factors, multiples and the rules of divisibility;~~

~~(d)]~~ Compare ***, read, write*** and order groups of fractions ***, groups of percents*** and groups of decimals;

~~[(e) Round to a given decimal place;~~

~~(f)]~~ ***(b)*** Estimate using decimals, fractions and percents;

~~[(g) Use models and drawings to identify, compare, add]~~

(c) Add and subtract fractions with unlike denominators; ~~[and~~

~~(h) Use models to translate among fractions, decimals and percents.]~~

(d) Identify and use place value positions to the thousandths;

(e) Multiply and divide with fractions using models, drawings and numbers;

(f) Use models to translate among fractions, decimals and percents;

(g) Identify equivalent expressions between and among fractions, decimals and percents;

(h) Use estimation strategies in mathematical and practical situations;

(i) Calculate using fractions, decimals and percents in mathematical and practical situations;

(j) Use order of operations to evaluate expressions with integers; and

(k) Use the concepts of number theory, including, without limitation, prime and composite numbers, factors, multiples and rules of divisibility, to solve problems.

2. For the areas of patterns, functions and algebra, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must use various algebraic methods to analyze, illustrate, extend and create numerous representations, including,

without limitation, words, numbers, tables, and graphs of patterns, functions and algebraic relations. A pupil must demonstrate the ability to:

(a) Use and create tables and charts to extend a pattern to ~~[find]~~ ***describe*** a rule ~~[;~~

~~(b) Identify, model, describe and evaluate relationships using charts and tables, with and without technology; and~~

~~(c) Use a rule to]~~ ***for input and output tables and to find missing terms in a sequence;***

(b) Evaluate formulas and algebraic expressions using whole number values;

(c) Solve and graphically represent equations and simple inequalities in one variable;

(d) Write simple expressions and equations using variables to represent mathematical situations; and

(e) When given a rule relating two variables, create a table and represent the ordered pairs on a coordinate ~~[grid.]~~ ***plane.***

3. For the area of measurement, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must use appropriate tools and techniques of measurement to determine, estimate, record and verify direct and indirect measurements. A pupil must demonstrate the ability to:

(a) ~~[Estimate and convert units of measurement for length, weight and capacity, within the same measurement system;~~

~~(b)]~~ Explain how the size of the unit ***of measure*** used affects the precision;

~~[(c)]~~ ***(b)*** Given two measurements of the same object, select the one that is more precise;

~~[(d) Estimate, measure to the required degree of accuracy, and derive and apply formulas to find the perimeter, circumference and area of plane figures; and~~

~~(e) Use ratios to describe and compare relationships between various objects.]~~

(c) Estimate and compare, using customary and metric systems, the corresponding units of measure for temperature, length, weight and mass;

(d) Select, model and apply formulas to find the perimeter, circumference and area of plane figures;

(e) Compare and use unit cost in practical situations;

(f) Write and apply ratios in mathematical and practical problems involving measurement and monetary conversions; and

(g) Use equivalent periods of time to solve practical problems.

4. For the areas of spatial relationships ***, logic*** and geometry, to solve problems, communicate and make connections within and beyond the field of mathematics, a pupil must identify, represent, verify and apply spatial relationships and geometric properties. A pupil must demonstrate the ability to:

(a) Measure angles ~~[~~;~~]~~

~~(b) Identify, describe by properties, classify, compare and draw regular and irregular quadrilaterals;~~

~~(c) Find the sum of the interior angles of triangles and quadrilaterals;~~

~~(d)~~ ~~]~~ ***using a protractor;***

(b) Determine actual measurements represented on scale drawings;

~~[~~~~(e)~~ ~~]~~ ***(c)*** Using a coordinate ~~[~~~~grid, identify coordinates for a given point~~~~]~~ ***plane, identify*** and locate points ~~[~~~~with given coordinates;~~

~~(f) Plot~~~~]~~ ***;***

(d) Graph coordinates representing geometric shapes in all four quadrants ~~[~~;~~]~~

~~(g)~~ ~~]~~ ***on a coordinate plane;***

(e) Make a model of a three-dimensional prism from a two-dimensional drawing ~~[and make]~~ ***;***

(f) Make a two-dimensional drawing of a three-dimensional prism;

~~[(h)]~~ ***(g)*** Model slope ***, including, without limitation, pitch and angle of inclination,*** using concrete objects and practical examples;

~~[(i)]~~ ***(h)*** Draw ***, identify and find measures of*** complementary and supplementary angles ~~[;~~

~~(j) Identify and find measures of complementary and supplementary angles using arithmetic and geometric methods;~~

~~(k)]~~ ***using arithmetic and geometric methods;***

(i) Determine the measures of missing angles of triangles based on the Triangle Sum Theorem; ~~[and~~

~~(l)]~~ ***(j)*** Construct circles, angles and triangles based on given measurements using a variety of methods ~~[,]~~ ***and tools, including, without limitation, a compass, straight edge, paper folding and technology;***

(k) Identify, classify, compare and draw regular and irregular quadrilaterals;

(l) Identify, draw and use central angles to represent fractions of a circle;

(m) Convert actual measurements to scale; and

(n) Identify counterexamples to disprove a conditional statement.

5. For the area of data analysis, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must collect, organize, display, interpret and analyze data to determine statistical relationships and probability projections. A pupil must demonstrate the ability to:

(a) Interpret data ***and make predictions*** using ~~[various formats including]~~ circle graphs ~~[;~~

~~(b) Conduct simple probability experiments~~] ***and scatter plots;***

(b) Find experimental probability using concrete materials [~~and represent the results using decimals, percents and ratios;~~

~~(c) Solve probability problems using a variety of methods including~~] ***;***

(c) Find the number of outcomes for a specific event by constructing sample spaces and tree diagrams;

(d) Analyze the effect a change of [~~format will have on interpretation of statistical charts and graphs; and~~

~~(e) Analyze data in a variety of formats~~] ***type of graph will have on the interpretation of a set of data;***

(e) Analyze various representations of a set of data to draw conclusions and make predictions [~~.~~] ***;***

(f) Pose questions that guide the collection of data;

(g) Organize and represent data using a variety of graphical representations, including, without limitation, circle graphs and scatter plots;

(h) Select and apply the measures of central tendency to describe data;

(i) Represent the results of simple probability experiments as fractions, decimals, percents and ratios to make predictions about future events; and

(j) Describe the limitations of a variety of graphical representations.

6. For the area of problem solving, to develop the ability to solve problems, a pupil must engage in developmentally appropriate opportunities for problem solving in which there is a need to use various approaches to investigate and understand mathematical concepts to formulate problems, find solutions to problems, develop and apply strategies to solve problems, and

integrate mathematical reasoning, communication and connections. A pupil must demonstrate the ability to:

(a) ~~[Use efficient approaches to investigate and understand mathematical concepts;~~

~~(b) Find solutions to problems that occur in everyday situations;~~

~~(c) Select, modify, develop and apply strategies to solve a wide variety of problems;~~

~~(d) Transfer and generalize previous experience to new problem-solving situations;~~

~~(e) Demonstrate persistence in problem solving;~~

~~(f) Explain and verify results; and~~

~~(g) Use]~~ ***Generalize solutions and apply previous knowledge to new problem-solving situations;***

(b) Determine an efficient problem-solving strategy and verify, interpret and evaluate the results with respect to the original problem;

(c) Apply problem-solving strategies until a solution is found or it is clear that no solution exists;

(d) Interpret and solve a variety of mathematical problems by paraphrasing;

(e) Identify necessary and extraneous information;

(f) Check the reasonableness of a solution; and

(g) Apply technology as a tool in problem solving ~~[.]~~ ***situations.***

7. For the area of mathematical communication, to develop the ability to communicate mathematically, a pupil must solve problems in which there is a need to obtain information ~~[, translate the]~~ ***in everyday life by reading, listening and observing to translate*** information into mathematical language and symbols, process ~~[the]~~ information mathematically ***, discuss and exchange ideas about mathematics as part of learning, read various fiction and nonfiction***

texts to learn about mathematics and present the results in written, oral and visual formats. A pupil must demonstrate the ability to:

(a) ~~[Obtain information by reading, listening, observing and inquiring and use that information to solve mathematical problems;~~

~~(b) Use mathematical language and symbols to explain thinking and processes and translate those ideas into everyday language;~~

~~(c) Present mathematical ideas and solutions in written, oral and visual forms;~~

~~(d) Discuss, explain, justify and evaluate mathematical ideas and solutions;~~

~~(e) Use physical, pictorial and symbolic forms to represent mathematical ideas and relationships; and~~

~~(f) Make conjectures, present arguments and evaluate discussions concerning mathematical ideas presented in various written and oral forms.]~~ ***Use formulas, algorithms, inquiry and other techniques to solve mathematical problems;***

(b) Evaluate written and oral presentations in mathematics;

(c) Identify and translate key words and phrases that imply mathematical operations;

(d) Model and explain mathematical relationships using oral, written, graphic and algebraic methods; and

(e) Communicate strategies and solutions to mathematical problems by using oral and written expression of everyday language.

8. For the area of mathematical reasoning, to develop the ability to reason mathematically, a pupil must solve problems in which there is a need to investigate ~~[significant]~~ mathematical ideas and construct his own learning in all content areas to ~~[justify and enhance]~~ ***reinforce and extend*** his ability to ~~[think and]~~ reason logically ~~[.]~~ ***, reflect on, clarify and justify his thinking, ask***

questions to extend his learning, use patterns and relationships to analyze mathematical situations, and determine relevant, irrelevant and sufficient information to solve mathematical problems. A pupil must demonstrate the ability to:

(a) ~~[Construct meaning and justify thinking by investigating mathematical ideas, patterns and relationships;~~

~~(b) Reinforce and extend abilities for logical reasoning;~~

~~(c) Ask questions to reflect on, clarify and extend thinking;~~

~~(d) Review, refine, explain and justify mathematical processes, arguments and solutions using manipulatives, physical models and abstract ideas;~~

~~(e) Determine the relevancy and sufficiency of information to solve mathematical problems;~~

~~(f) Follow, create and defend valid logical mathematical arguments; and~~

~~(g)]~~ Recognize and apply inductive and deductive reasoning ~~[in both concrete and abstract contexts.]~~ ***;***

(b) Review and refine the assumptions and steps used to derive conclusions in mathematical arguments; and

(c) Justify answers and the steps taken to solve problems with and without manipulatives and physical models.

9. For the area of mathematical connections, to develop the ability to make mathematical connections, a pupil must solve problems in which there is a need to view mathematics as an integrated whole, including ***linking new concepts to prior knowledge,*** identifying relationships between content strands and integrating mathematics with other disciplines, thereby allowing the flexibility to approach problems in a variety of ways within and beyond the field of mathematics. A pupil must demonstrate the ability to:

(a) ~~[View mathematics as an integrated whole and identify relationships between content strands;~~

~~(b) Identify practical applications of mathematical principles that can be applied to other disciplines;~~

~~(c) Use the connections within and beyond the field of mathematics in a variety of ways to solve problems;~~

~~(d) Link new concepts to prior knowledge;~~

~~(e) Explain the relationship of concepts to procedures by using models; and~~

~~(f)]~~ ***Use mathematical ideas from one area of mathematics to explain an idea from another area of mathematics;***

(b) Use manipulatives and physical models to explain the relationships between concepts and procedures;

(c) Use the connections among mathematical topics to develop multiple approaches to problems;

(d) Apply mathematical thinking and modeling to solve problems that arise in other disciplines ***, including, without limitation, rhythm in music and motion in science;*** and

(e) Identify, explain and apply mathematics in everyday life.

Sec. 8. NAC 389.323 is hereby amended to read as follows:

389.323 By the end of the seventh grade, pupils must know and be able to do everything required in the previous grades for courses in mathematics offered in public schools. Instruction in the seventh grade in mathematics must be designed so that pupils meet the following performance standards by the completion of the seventh grade:

1. For the areas of numbers, number sense and computation, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must accurately calculate and use estimation techniques, number relationships, operation rules and algorithms, and determine the reasonableness of answers and the accuracy of solutions. A pupil must demonstrate the ability to:

(a) ~~[Read, write and find ratios and proportions;~~

~~(b) Read, write, add, subtract, multiply and divide positive and negative numbers;~~

~~(c) Apply positive and negative numbers, ratios and proportions to solve mathematical and practical problems;~~

~~(d) Use absolute value and the properties of real numbers including distributive, commutative and associative to solve problems;~~

~~(e) Compare and order groups containing a mix of fractions, percents and decimals;~~

~~(f) Select and use the appropriate significant digit in problem situations;~~

~~(g) Compare and describe a variety of estimation strategies; and~~

~~(h)]~~ Translate among fractions, decimals and percents ~~[.]~~ ***, including, without limitation, fractional percents;***

(b) Identify and use place value in mathematical and practical situations;

(c) Write, identify and use powers of 10 from 10^{-3} through 10^{6};

(d) Compare and order a combination of rational numbers, including, without limitation, fractions, decimals, percents and integers, in mathematical and practical situations;

(e) Identify absolute values of integers;

(f) Generate a reasonable estimate for a computation using a variety of methods;

(g) Select and round to the appropriate significant digit;

(h) Calculate with integers and other rational numbers to solve mathematical and practical situations;

(i) Use order of operations to evaluate expressions and solve one-step equations containing rational numbers; and

(j) Identify and apply the distributive, commutative and associative properties of rational numbers to solve problems.

2. For the areas of patterns, functions and algebra, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must use various algebraic methods to analyze, illustrate, extend and create numerous representations, including, without limitation, words, numbers, tables, and graphs of patterns, functions and algebraic relations. A pupil must demonstrate the ability to:

(a) ~~[Use and create coordinate graphs to represent or interpret patterns and relationships, with and without calculators;~~

~~(b) Identify, model, describe and evaluate relationships using graphs, with and without technology;~~

~~(c)]~~ Evaluate formulas and algebraic expressions for given ~~[values of a variable;]~~

~~[(d) Represent mathematical situations using algebraic language and symbols;~~

~~(e) Combine like terms in variable expressions;~~

~~(f) Model, identify]~~ ***integer values;***

(b) Model and solve ~~[linear equations and inequalities]~~ ***equations*** using concrete and ~~[informal methods, and relate this process to the order of operations; and~~

~~(g)]~~ ***visual representations;***

(c) Generate and graph a set of ordered pairs that represent a linear equation ~~[.]~~ ***;***

(d) Use and create tables, charts and graphs to extend a pattern to describe a linear rule, including, without limitation, integer values;

(e) Solve and graphically represent equations and inequalities in one variable with integer solutions;

(f) Simplify algebraic expressions by combining like terms; and

(g) Identify linear equations and inequalities.

3. For the area of measurement, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must use appropriate tools and techniques of measurement to determine, estimate, record and verify direct and indirect measurements. A pupil must demonstrate the ability to:

(a) Estimate and ~~[convert]~~ ***compare, using the customary and metric systems, the corresponding*** units of ~~[measurement for mass]~~ ***measure for area, capacity*** and volume ~~[, within the same measurement system;~~

~~(b) Compare, convert and estimate units of measure of capacity, mass and volume within the same measurement system;~~

~~(c) Compare corresponding units in the metric and customary systems;~~

~~(d)]~~ ***;***

(b) Given a measurement, ~~[determine]~~ ***identify*** the greatest possible error;

~~[(e) Estimate, measure to the required degree of accuracy, derive and apply standard formulas to find the volume and surface area of solid figures;~~

~~(f) Write, solve]~~

(c) Select, model and apply formulas to find the volume and surface area of solid figures;

(d) Calculate simple interest in monetary problems;

(e) Write and apply proportions ~~[; and~~

~~(g)]~~ ***to solve mathematical and practical problems involving measurement and monetary conversions; and***

(f) Use elapsed time to solve practical problems.

4. For the areas of spatial relationships ***, logic*** and geometry, to solve problems, communicate and make connections within and beyond the field of mathematics, a pupil must identify, represent, verify and apply spatial relationships and geometric properties. A pupil must demonstrate the ability to:

(a) Identify, ~~[describe by properties,]~~ classify ***,*** compare, and draw regular and irregular polygons;

(b) Find ***and verify*** the sum of the ***measures of*** interior angles of ~~[polygons;]~~ ***triangles and quadrilaterals;***

(c) Use ~~[ratio]~~ ***ratios*** and proportions to create scale drawings;

(d) Use coordinate geometry and models to demonstrate ~~[geometric transformation, including rotate and turn, translate and slide, and reflect and flip by finding the ordered pairs that describe the location of the original and the transformed figures;]~~ ***translation, reflection and rotation;***

(e) Make a model of a three-dimensional figure from a two-dimensional drawing ~~[and make]~~ ***;***

(f) Make a two-dimensional drawing of a three-dimensional object;

~~[(f) Use coordinate geometry to represent slope, midpoint,]~~

(g) Determine the slope of a line, midpoint of a segment, and horizontal and vertical distance ~~[;~~

~~(g)]~~ ***between two points using coordinate geometry;***

(h) Describe the ~~[properties of]~~ geometric relationships ~~[, including]~~ ***of*** parallel lines, perpendicular lines, bisectors, triangles and quadrilaterals ~~[, such as the properties of angles formed by a transversal of parallel lines;~~

~~(h)]~~ ***;***

(i) Model the Pythagorean Theorem ~~[;~~

~~(i) Solve]~~ ***and solve*** for the hypotenuse ~~[using the Pythagorean Theorem; and~~

~~(j)]~~ ***;***

(j) Construct and ~~[verify]~~ ***identify*** congruent angles ***,*** ~~[and]~~ parallel ***lines*** and perpendicular lines ~~[using hand tools.]~~ ***;***

(k) Describe the location of the original figure and its transformation on a coordinate plane; and

(l) Make and test conjectures to explain observed mathematical relationships and to develop logical arguments to justify conclusions.

5. For the area of data analysis, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must collect, organize, display, interpret and analyze data to determine statistical relationships and probability projections. A pupil must demonstrate the ability to:

(a) Organize, display ~~[, read and analyze]~~ ***and read*** data, with and without ***the assistance of*** technology, using ~~[a variety of displays including frequency distributions and circle graphs; and~~

~~(b) Select, use and graph, when possible, measures of variability including range, distribution and possible outliers.]~~ ***the appropriate graphical representations;***

(b) Formulate questions that guide the collection of data;

(c) Interpret graphical representations of data to describe patterns, trends and data distribution;

(d) Analyze the effect that a change of scale will have on statistical charts and graphs;

(e) Find the number of permutations possible for an event in mathematical and practical situations;

(f) Find the theoretical probability of an event using different counting methods, including, without limitation, sample spaces, and compare that probability with experimental results;

(g) Represent the probability of an event as a number between 0 and 1; and

(h) Interpolate and extrapolate from a given set of data to make predictions for the data.

6. For the area of problem solving, to develop the ability to solve problems, a pupil must engage in developmentally appropriate opportunities for problem solving in which there is a need to use various approaches to investigate and understand mathematical concepts to formulate problems, find solutions to problems, develop and apply strategies to solve problems and integrate mathematical reasoning, communication and connections. A pupil must demonstrate the ability to:

(a) ~~[Use efficient approaches to investigate and understand mathematical concepts;~~

~~(b) Find solutions to problems that occur in everyday situations;~~

~~(c) Select, modify, develop and apply strategies to solve a wide variety of problems;~~

~~(d) Transfer and generalize previous experience to new problem-solving situations;~~

~~(e) Demonstrate persistence in problem solving;~~

~~(f) Explain and verify results; and~~

~~(g) Use~~] ***Generalize solutions and apply previous knowledge to new problem-solving situations;***

(b) Determine an efficient problem-solving strategy and verify, interpret and evaluate the results with respect to the original problem;

(c) Apply problem-solving strategies until a solution is found or it is clear that no solution exists;

(d) Interpret and solve a variety of mathematical problems by paraphrasing;

(e) Identify necessary and extraneous information;

(f) Check the reasonableness of a solution; and

(g) Apply technology as a tool in problem solving ~~[.]~~ ***situations.***

7. For the area of mathematical communication, to develop the ability to communicate mathematically, a pupil must solve problems in which there is a need to obtain information ~~[, translate the]~~ ***in everyday life by reading, listening and observing to translate*** information into mathematical language and symbols, process ~~[the]~~ information mathematically ***, discuss and exchange ideas about mathematics as part of learning, read various fiction and nonfiction texts to learn about mathematics*** and present the results in written, oral and visual formats. A pupil must demonstrate the ability to:

(a) ~~[Obtain information by reading, listening, observing and inquiring and use that information to solve mathematical problems;~~

~~(b) Use mathematical language and symbols to explain thinking and processes and translate those ideas into everyday language;~~

~~(c) Present mathematical ideas and solutions in written, oral and visual forms;~~

~~(d) Discuss, explain, justify and evaluate mathematical ideas and solutions;~~

~~(e) Use physical, pictorial and symbolic forms to represent mathematical ideas and relationships; and~~

~~(f) Make conjectures, present arguments and evaluate discussions concerning mathematical ideas presented in various written and oral forms.]~~ ***Use formulas, algorithms, inquiry and other techniques to solve mathematical problems;***

(b) Evaluate written and oral presentations in mathematics;

(c) Identify and translate key words and phrases that imply mathematical operations;

(d) Model and explain mathematical relationships using oral, written, graphic and algebraic methods; and

(e) Communicate strategies and solutions to mathematical problems using oral and written expression of everyday language.

8. For the area of mathematical reasoning, to develop the ability to reason mathematically, a pupil must solve problems in which there is a need to investigate ~~[significant]~~ mathematical ideas and construct his own learning in all content areas to ~~[justify and enhance]~~ ***reinforce and extend*** his ability to ~~[think and]~~ reason logically ~~[.]~~ ***, reflect on, clarify and justify his thinking, ask questions to extend his learning, use patterns and relationships to analyze mathematical situations, and determine relevant, irrelevant and sufficient information to solve mathematical problems.*** A pupil must demonstrate the ability to:

(a) ~~[Construct meaning and justify thinking by investigating mathematical ideas, patterns and relationships;~~

~~(b) Reinforce and extend abilities for logical reasoning;~~

~~(c) Ask questions to reflect upon, clarify and extend thinking;~~

~~(d) Review, refine, explain and justify mathematical processes, arguments and solutions using manipulatives, physical models and abstract ideas;~~

~~(e) Determine the relevancy and sufficiency of information to solve mathematical problems;~~

~~(f) Follow, create and defend valid logical mathematical arguments; and~~

~~(g)]~~ Recognize and apply inductive and deductive reasoning ~~[in both concrete and abstract contexts.]~~ ***;***

(b) Review and refine the assumptions and steps used to derive conclusions in mathematical arguments; and

(c) Justify answers and the steps taken to solve problems, with and without, manipulatives and physical models.

9. For the area of mathematical connections, to develop the ability to make mathematical connections, a pupil must solve problems in which there is a need to view mathematics as an integrated whole, including ***linking new concepts to prior knowledge,*** identifying relationships between content strands and integrating mathematics with other disciplines, thereby allowing the flexibility to approach problems in a variety of ways within and beyond the field of mathematics. A pupil must demonstrate the ability to:

(a) ~~[View mathematics as an integrated whole and identify relationships between content strands;~~

~~(b) Identify practical applications of mathematical principles that can be applied to other disciplines;~~

~~(c) Use the connections within and beyond the field of mathematics in a variety of ways to solve problems;~~

~~(d) Link new concepts to prior knowledge;~~

~~(e) Explain the relationship of concepts to procedures by using models; and~~

~~(f)~~] ***Use mathematical ideas from one area of mathematics to explain an idea from another area of mathematics;***

(b) Use manipulatives and physical models to explain the relationships between concepts and procedures;

(c) Use the connections among mathematical topics to develop multiple approaches to problems;

(d) Apply mathematical thinking and modeling to solve problems that arise in other disciplines ***, including, without limitation, rhythm in music and motion in science;*** and

(e) Identify, explain and apply mathematics in everyday life.

Sec. 9. NAC 389.406 is hereby amended to read as follows:

389.406 By the end of the eighth grade, pupils must know and be able to do everything required in the previous grades for courses in mathematics offered in public schools. Instruction in the eighth grade in mathematics must be designed so that pupils meet the following performance standards by the completion of the eighth grade:

1. For the areas of numbers, number sense and computation, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must accurately calculate and use estimation techniques, number relationships, operation rules and algorithms, and determine the reasonableness of answers and the accuracy of solutions. A pupil must demonstrate the ability to:

(a) ~~[Read, write, apply and compute]~~ ***Calculate*** with real numbers ~~[in various forms, including, without limitation, radicals, exponentials and scientific notations;]~~ ***to solve problems in mathematical and practical situations;***

(b) Compare and order ~~[rational numbers;~~

~~(c) Estimate in problem-solving situations and practical applications]~~ ***real numbers, including, without limitation, powers of whole numbers, in mathematical and practical situations;***

(c) Use estimation strategies to determine the reasonableness of answers ~~[and verify the results;~~

~~(d) Explain the relationship among fractions, decimals and percents and translate among representations; and~~

~~(e) Explain and use concepts of:~~

~~(1) Number theory such as factors and multiples;~~

~~(2) Properties of real numbers such as the commutative, associative and distributive; and~~

~~(3) Order of operations,~~

~~to solve problems.]~~ ***in mathematical and practical situations;***

(d) Represent numbers using scientific notation in mathematical and practical situations;

(e) Translate among fractions, decimals and percents, including, without limitation, percents greater than 100 and percents less than 1;

(f) Explain and use the relationship among equivalent representations of rational numbers in mathematical and practical situations;

(g) Identify perfect squares to 225 and their corresponding square roots;

(h) Use order of operations to solve equations in the real number system; and

(i) Identify and apply the identity property, inverse property and the absolute value of real numbers to solve problems.

2. For the areas of patterns, functions and algebra, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must use various algebraic methods to analyze, illustrate, extend and create numerous representations, including, without limitation, words, numbers, tables, and graphs of patterns, functions and algebraic relations. A pupil must demonstrate the ability to:

(a) ~~[Use inductive reasoning to find a missing term in numeric, arithmetic and geometric sequences and generalize basic patterns to the nth term, with and without the assistance of calculators;~~

~~(b) Identify, describe, model and evaluate relationships, including, without limitation, patterns, sequences and functions using oral, written and symbolic language, with and without the assistance of technology;~~

~~(c) Solve an equation or a formula for any variable;~~

~~(d)]~~ Describe how a change in ***the value of*** one variable ~~[of a mathematical relationship]~~ affects the remaining variables ~~[by using various tools and methods;~~

~~(e) Model, identify and solve simple linear equations and inequalities and relate that process to the order of operations;~~

~~(f)]~~ ***in a mathematical relationship;***

(b) Add and subtract binomials ~~[and describe the connection between the algebraic process and the arithmetic process; and~~

~~(g)]~~ ***;***

(c) Translate among verbal descriptions, graphic, tabular and algebraic representations of mathematical situations ~~[.]~~ ***, with and without the assistance of technology;***

(d) Find the missing term in a numerical sequence or a pictorial representation of a sequence;

(e) Evaluate formulas and algebraic expressions using rational numbers, with and without the assistance of technology;

(f) Solve and graphically represent equations and inequalities in one variable, including, without limitation, absolute value;

(g) Identify, model, describe and evaluate functions, with and without the assistance of technology;

(h) Solve linear equations and represent the solution graphically; and

(i) Solve inequalities and represent the solution on a number line.

3. For the area of measurement, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must use appropriate tools and techniques of measurement to determine, estimate, record and verify direct and indirect measurements. A pupil must demonstrate the ability to:

(a) ~~[Identify the range]~~ ***Demonstrate an understanding*** of precision, error of measure and tolerance in measurement when using the appropriate tool of measurement ~~[and measure to the required degree of accuracy;~~

~~(b) Estimate and measure length, weight, mass and volume to the required degree of accuracy;~~

~~(c) Select and apply formulas to identify the relationship between changes in area and volume and changes in linear measures of figures;~~

~~(d) Evaluate formulas and algebraic expressions for given values of a variable;]~~ ***;***

(b) Estimate and convert units of measure for mass and capacity using the same system of measurement, including the customary and metric systems;

(c) Identify how changes in a dimension of a figure effect changes in its perimeter, area and volume;

(d) Calculate percents in monetary problems; and

(e) Apply ~~[ratio and proportion]~~ ***ratios and proportions*** to calculate rates ~~[and as a method of]~~ ***and solve mathematical and practical problems using*** indirect measure.

4. For the areas of spatial relationships ***, logic*** and geometry, to solve problems, communicate and make connections within and beyond the field of mathematics, a pupil must identify, represent, verify and apply spatial relationships and geometric properties. A pupil must demonstrate the ability to:

(a) Apply the properties of equality and proportionality to ~~[solve problems that involve]~~ congruent or similar shapes;

(b) ~~[Use coordinate geometry and models to illustrate change in scale;~~

~~(c) Represent and interpret relationships defined by equations and formulas, including distance, midpoint and slope, on a coordinate plane, with and without the assistance of technology;~~

~~(d) Form generalizations and validate conclusions about properties of geometric shapes including those associated with parallel lines, perpendicular lines, bisectors, triangles and quadrilaterals;~~

~~(e) Verify, explain and use]~~ ***Verify and explain*** the Pythagorean Theorem ~~[to determine missing sides and angles of triangles; and~~

~~(f) Construct, draw and sketch]~~ ***using a variety of methods;***

(c) Construct geometric figures ~~[, bisected angles and lines and line segments with given specifications by using hand tools and technology.]~~ ***using a variety of tools;***

(d) Find and use the sum of the measures of interior angles of polygons;

(e) Demonstrate dilation using coordinate geometry and models;

(f) Describe the relationship between an original figure and its transformation or dilation;

(g) Calculate slope, midpoint and distance using equations and formulas, with and without the assistance of technology;

(h) Determine the x- and y- intercepts of a line;

(i) Form generalizations and validate conclusions about geometric figures and their properties;

(j) Determine the measure of the missing side of a right triangle; and

(k) Represent logical relationships using conditional statements.

5. For the area of data analysis, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must collect, organize, display, interpret and analyze data to determine statistical relationships and probability projections. A pupil must demonstrate the ability to:

(a) Organize, display ~~[, read and analyze]~~ ***and read*** data, with and without the assistance of technology, by using ~~[a variety of displays, including]~~ box and whisker plots;

(b) ~~[Determine the theoretical probability of a simple or independent event using different counting methods, including tree diagrams, sample spaces and organized lists, and compare those results with the results of conducting an experiment;~~

~~(c)]~~ Differentiate between the probability of an event and the odds of an event;

~~[(d) Identify]~~

(c) Determine the number of combinations possible in ~~[given situations by using a variety of counting methods;~~

~~(e)]~~ ***mathematical and practical situations;***

(d) Evaluate the accuracy and validity of ***statistical*** arguments based on data analysis ~~[and analyze the effect that a change of scale or a change of format has on statistical charts and graphs; and~~

~~(f)]~~ ***;***

(e) Formulate ***reasonable*** inferences and ~~[projections]~~ ***predictions*** based on interpolations and extrapolations of data to solve ***practical*** problems ~~[.]~~ ***;***

(f) Formulate questions and design a study that guides the collection of data;

(g) Select and apply appropriate measures of data distribution using interquartile range and central tendency; and

(h) Distinguish between permutations and combinations.

6. For the area of problem solving, to develop the ability to solve problems, a pupil must engage in developmentally appropriate opportunities for problem solving in which there is a need to use various approaches to investigate and understand mathematical concepts to formulate problems, find solutions to problems, develop and apply strategies to solve problems, and integrate mathematical reasoning, communication and connections. A pupil must demonstrate the ability to:

(a) ~~[Use efficient approaches to investigate and understand mathematical concepts;~~

~~(b) Find solutions to problems that occur in everyday situations;~~

~~(c) Select, modify, develop and apply strategies to solve a wide variety of problems;~~

~~(d) Transfer and generalize previous experience to new problem-solving situations;~~

~~(e) Demonstrate persistence in problem solving;~~

~~(f) Explain and verify results; and~~

~~(g) Use~~] ***Generalize solutions and apply previous knowledge to new problem-solving situations;***

(b) Determine an efficient problem-solving strategy and verify, interpret and evaluate the results with respect to the original problem;

(c) Apply problem-solving strategies until a solution is found or it is clear that no solution exists;

(d) Interpret and solve a variety of mathematical problems by paraphrasing;

(e) Identify necessary and extraneous information;

(f) Check the reasonableness of a solution; and

(g) Apply technology as a tool in problem solving ~~[.]~~ ***situations.***

7. For the area of mathematical communication, to develop the ability to communicate mathematically, a pupil must solve problems in which there is a need to obtain information ~~[, translate the]~~ ***in everyday life by reading, listening and observing to translate*** information into mathematical language and symbols, process ~~[the]~~ information mathematically ***, discuss and exchange ideas about mathematics as part of learning, read various fiction and nonfiction texts to learn about mathematics*** and present the results in written, oral and visual formats. A pupil must demonstrate the ability to:

(a) ~~[Obtain information by reading, listening, observing and inquiring and use that information to solve mathematical problems;~~

~~(b) Use mathematical language and symbols to explain thinking and processes and translate those ideas into everyday language;~~

~~(c) Present mathematical ideas and solutions in written, oral and visual forms;~~

~~(d) Discuss, explain, justify and evaluate mathematical ideas and solutions;~~

~~(e) Use physical, pictorial and symbolic forms to represent mathematical ideas and relationships; and~~

~~(f) Make conjectures, present arguments and evaluate discussions concerning mathematical ideas presented in various written and oral forms.~~~~]~~ ***Use formulas, algorithms, inquiry and other techniques to solve mathematical problems;***

(b) Evaluate written and oral presentations in mathematics;

(c) Identify and translate key words and phrases that imply mathematical operations;

(d) Model and explain mathematical relationships using oral, written, graphic and algebraic methods; and

(e) Communicate strategies and solutions to mathematical problems using oral and written expression of everyday language.

8. For the area of mathematical reasoning, to develop the ability to reason mathematically, a pupil must solve problems in which there is a need to investigate ~~[significant]~~ mathematical ideas and construct his own learning in all content areas to ~~[justify and enhance]~~ ***reinforce and extend*** his ability to ~~[think and]~~ reason logically ~~[.]~~ ***, reflect on, clarify and justify his thinking, ask questions to extend his learning, use patterns and relationships to analyze mathematical situations, and determine relevant, irrelevant and sufficient information to solve mathematical problems.*** A pupil must demonstrate the ability to:

(a) ~~[Construct meaning and justify thinking by investigating mathematical ideas, patterns and relationships;~~

~~(b) Reinforce and extend abilities for logical reasoning;~~

~~(c) Ask questions to reflect on, clarify and extend thinking;~~

~~(d) Review, refine, explain and justify mathematical processes, arguments and solutions using manipulatives, physical models and abstract ideas;~~

~~(e) Determine the relevancy and sufficiency of information to solve mathematical problems;~~

~~(f) Follow, create and defend valid logical mathematical arguments; and~~

~~(g)]~~ Recognize and apply inductive and deductive reasoning ~~[in both concrete and abstract contexts.]~~ ***;***

(b) Review and refine the assumptions and steps used to derive conclusions in mathematical arguments; and

(c) Justify answers and the steps taken to solve problems with and without manipulatives and physical models.

9. For the area of mathematical connections, to develop the ability to make mathematical connections, a pupil must solve problems in which there is a need to view mathematics as an integrated whole, including ***linking new concepts to prior knowledge,*** identifying relationships between content strands and integrating mathematics with other disciplines, thereby allowing the flexibility to approach problems in a variety of ways within and beyond the field of mathematics. A pupil must demonstrate the ability to:

(a) ~~[View mathematics as an integrated whole and identify relationships between content strands;~~

~~(b) Identify practical applications of mathematical principles that can be applied to other disciplines;~~

~~(c) Use and analyze the connections within and beyond the field of mathematics in a variety of ways to solve problems;~~

~~(d) Link new concepts to prior knowledge;~~

~~(e) Explain the relationship of concepts to procedures by using models; and~~

~~(f)]~~ ***Use mathematical ideas from one area of mathematics to explain an idea from another area of mathematics;***

(b) Use manipulatives and physical models to explain the relationships between concepts and procedures;

(c) Use the connections among mathematical topics to develop multiple approaches to problems;

(d) Apply mathematical thinking and modeling to solve problems that arise in other disciplines ***, including, without limitation, rhythm in music and motion in science;*** and

(e) Identify, explain and apply mathematics in everyday life.

Sec. 10. NAC 389.4675 is hereby amended to read as follows:

389.4675 By the end of the 12th grade, pupils must know and be able to do everything required in the previous grades for courses in mathematics offered in public schools. Instruction in the 12th grade in mathematics must be designed so that pupils meet the following performance standards by the completion of the 12th grade:

1. For the areas of numbers, number sense and computation, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must accurately calculate and use estimation techniques, number relationships, operation rules and algorithms, and determine the reasonableness of answers and the accuracy of solutions. A pupil must demonstrate the ability to:

(a) Determine ~~[the reasonableness of answers and the accuracy of solutions;~~

~~(b) Calculate and estimate sums, differences, products, quotients, powers and roots, and apply formulas and algorithms;~~

~~(c) Apply the laws of exponents to perform operations on expressions with integral exponents and scientific notation;~~

~~(d) Apply properties and theories of the real number system to practical situations; and~~

~~(e) Add, subtract and scalar multiplying matrices.~~~~]~~ ***an approximate value of radical and exponential expressions using a variety of methods;***

(b) Solve mathematical problems involving exponents and roots;

(c) Perform addition, subtraction and scalar multiplication on matrices; and

(d) Identify and apply real number properties to solve problems.

2. For the areas of patterns, functions and algebra, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must use various algebraic methods to analyze, illustrate, extend and create numerous representations, including, without limitation, words, numbers, tables, and graphs of patterns, functions and algebraic relations. A pupil must demonstrate the ability to:

(a) ~~[Represent, analyze and solve problem situations using discrete models, including, without limitation, graphs and matrices, with and without the assistance of technology;~~

~~(b) Create and use different forms of a variety of equations, proportions and formulas, solving for the needed variable as necessary in given situations;~~

~~(c)]~~ Add, subtract ~~[and multiply polynomials,]~~ ***, multiply and*** factor first and second degree polynomials ~~[and describe the process and connection between]~~ ***connecting*** the algebraic process and arithmetic process;

~~[(d) Use simple quadratic equations with integer roots to solve practical and mathematical problems;~~

~~(e) Model practical situations mathematically and translate a practical problem into a variety of mathematical forms, including, without limitation, matrices, tabular, symbolic and graphical representations of functions, with and without the assistance of technology;~~

~~(f)]~~ ***(b)*** Determine the domain and the range of ***functions, including, without limitation,*** linear ~~[relations given a graph or a set of ordered pairs and explain the importance of the domain and range in problem-solving situations; and~~

~~(g)]~~ ***, quadratic and absolute value, algebraically and graphically;***

(c) Solve systems of two linear equations algebraically and graphically, ~~[using graphing calculators as a primary tool to solve problems]~~ and verify solutions ~~[found by other methods.]~~ ***with and without the assistance of technology;***

(d) Use algebraic expressions to identify and describe the n^{th} term of a sequence;

(e) Isolate any variable in given equations, inequalities, proportions and formulas to use in mathematical and practical situations;

(f) Simplify algebraic expressions, including, without limitation, exponents and radicals;

(g) Solve absolute value equations and inequalities algebraically and graphically; and

(h) Solve, with and without the assistance of technology, mathematical and practical problems involving linear and quadratic equations with a variety of methods, including, without limitation, discrete methods.

3. For the area of measurement, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must use appropriate tools and

techniques of measurement to determine, estimate, record and verify direct and indirect measurements. A pupil must demonstrate the ability to:

(a) ~~[Distinguish, differentiate]~~ ***Estimate*** and convert units of measure ~~[among and]~~ between customary and metric systems ***;*** ~~[and between monetary systems;]~~

(b) Select and use ***appropriate*** tools of measurement, techniques and formulas to ~~[calculate and compare rates, costs, distances, interests, temperatures, weights and masses;]~~ ***solve problems in mathematical and practical situations;***

(c) Justify ***, differentiate*** and communicate the differences between ~~[accuracy,]~~ precision, error ~~[of measure]~~ and tolerance in ~~[measurement and describe how each of these can affect solutions found in problem situations;~~

~~(d) Use and interpret]~~ ***practical problems;***

(d) Interpret and apply consumer data ~~[such as amortization tables, tax tables and compound interest]~~ ***presented in*** charts ***, tables and graphs*** to make informed financial decisions related to practical applications; and

(e) ~~[Use relationships and formulas to determine]~~ ***Determine*** the measurement of unknown dimensions, angles, areas and volumes ***by using relationships and formulas*** to solve problems.

4. For the areas of spatial relationships ***, logic*** and geometry, to solve problems, communicate and make connections within and beyond the field of mathematics, a pupil must identify, represent, verify and apply spatial relationships and geometric properties. A pupil must demonstrate the ability to:

(a) Identify and ~~[use]~~ ***apply*** the properties of ***interior and exterior angles of*** polygons ~~[, determine measures of interior and exterior angles and elements of circles]~~ to solve ***mathematical and*** practical problems;

(b) Use coordinate geometry to graph linear equations ~~[, determine slopes of lines, identify parallel and perpendicular lines]~~ and find possible solutions to ~~[sets of linear equations;]~~

~~[(c) Use algebraic techniques to solve problems involving geometric relationships;~~

~~(d)]~~ ***those equations;***

(c) 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;

~~[(e)]~~ ***(d)*** Apply the Pythagorean Theorem and its converse ~~[, properties of special right triangles, and right triangle trigonometry, sine, cosine and tangent to solve practical problems;~~

~~(f) Use tools, technology and models to sketch, draw and construct]~~ ***in mathematical and practical situations;***

(e) Draw and construct geometric figures to solve problems and to demonstrate ~~[the properties of geometric figures; and~~

~~(g) Construct, justify and defend mathematical conclusions using logical, sequential and deductive reasoning supported by established mathematical principles.]~~ ***geometric relationships;***

(f) Identify and use the parts of a circle to solve mathematical and practical problems;

(g) Apply properties of similarity using right triangle trigonometry to find missing angles and sides;

(h) Use coordinate geometry and algebraic techniques to determine the slope of a line;

(i) Identify parallel, perpendicular and intersecting lines by slope;

(j) Find possible solution sets of systems of equations whose slopes indicate parallel; and

(k) Formulate, evaluate and justify arguments using inductive and deductive reasoning in mathematical and practical situations.

5. For the area of data analysis, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must collect, organize, display, interpret and analyze data to determine statistical relationships and probability projections. A pupil must demonstrate the ability to:

(a) ~~[Use calculators and computers to create and manipulate tables, graphs and matrices to communicate statistical information;~~

~~(b) Use the shape of graphs of normal distributions to compare and analyze information;~~

~~(c) Design, conduct, analyze and communicate the results of multistage probability and statistical experiments;~~

~~(d) Identify a probability situation as a permutation or a combination and find the number of possible outcomes, with and without the assistance of graphing calculators;~~

~~(e) Select and use the measures of central tendency such as mean, median and mode that are appropriate for given situations;~~

~~(f) Select and use measures of dispersion including range, distribution and possible outliers that are appropriate for given situations; and~~

~~(g) Analyze the validity of statistical conclusions and note various sources of bias and misuse and abuse of data caused by a variety of factors.]~~ ***Organize statistical data by using tables, graphs and matrices, with and without the assistance of technology;***

(b) Select and apply appropriate statistical measures in mathematical and practical situations;

(c) Distinguish between a sample and a census;

(d) Identify sources of bias and their effect on data representations and statistical conclusions;

(e) Use the shape of a normal distribution to compare and analyze data from a sample;

(f) Apply permutations and combinations to mathematical and practical situations, including, without limitation, the Fundamental Counting Principle;

(g) Determine the probability of an event, with and without replacement, using sample spaces;

(h) Design, conduct, analyze and effectively communicate the results of multistage probability experiments;

(i) Design, construct, analyze and select an appropriate type of graphical representation to communicate the results of a statistical experiment; and

(j) Formulate and justify inferences based on a valid data sample.

6. For the area of problem solving, to develop the ability to solve problems, a pupil must engage in developmentally appropriate opportunities for problem solving in which there is a need to use various approaches to investigate and understand mathematical concepts to formulate problems, find solutions to problems, develop and apply strategies to solve problems, and integrate mathematical reasoning, communication and connections. A pupil must demonstrate the ability to:

(a) ~~[Use efficient approaches to investigate and understand mathematical concepts;~~

~~(b) Find solutions to problems that occur in everyday situations;~~

~~(c) Select, modify, develop and apply strategies to solve a wide variety of problems;~~

~~(d) Transfer and generalize previous experience to new problem-solving situations;~~

~~(e) Demonstrate persistence in problem solving;~~

~~(f) Explain and verify results; and~~

~~(g) Use~~] ***Generalize solutions and apply previous knowledge to new problem-solving situations;***

(b) Determine an efficient problem-solving strategy and verify, interpret and evaluate the results with respect to the original problem;

(c) Apply problem-solving strategies until a solution is found or it is clear that no solution exists;

(d) Interpret and solve a variety of mathematical problems by paraphrasing;

(e) Identify necessary and extraneous information;

(f) Check the reasonableness of a solution;

(g) Apply technology as a tool in problem solving ~~[.]~~ ***situations; and***

(h) Apply combinations of proven strategies and previous knowledge to solve nonroutine problems.

7. For the area of mathematical communication, to develop the ability to communicate mathematically, a pupil must solve problems in which there is a need to obtain information ~~[, translate the]~~ ***in everyday life by reading, listening and observing to translate*** information into mathematical language and symbols, process ~~[the]~~ information mathematically ***, discuss and exchange ideas about mathematics as part of learning, read various fiction and nonfiction texts to learn about mathematics*** and present the results in written, oral and visual formats. A pupil must demonstrate the ability to:

(a) ~~[Obtain information by reading, listening, observing and inquiring and using that information to solve mathematical problems;~~

~~(b) Use mathematical language and symbols to explain thinking and processes and translate those ideas into everyday language;~~

~~(c) Present mathematical ideas and solutions in written, oral and visual forms;~~

~~(d) Discuss, explain, justify and evaluate mathematical ideas and solutions;~~

~~(e) Use physical, pictorial and symbolic forms to represent mathematical ideas and relationships; and~~

~~(f) Make conjectures, present arguments and evaluate discussions concerning mathematical ideas presented in various written and oral forms.~~] ***Use a variety of techniques to solve mathematical problems;***

(b) Evaluate written and oral presentations in mathematics;

(c) Model and explain mathematical relationships using oral, written, graphic and algebraic methods;

(d) Communicate and evaluate mathematical thinking based on the use of definitions, properties, rules and symbols in problem solving; and

(e) Communicate strategies and solutions to mathematical problems using oral and written expression of everyday language.

8. For the area of mathematical reasoning, to develop the ability to reason mathematically, a pupil must solve problems in which there is a need to investigate [~~significant~~] mathematical ideas and construct his own learning in all content areas to [~~justify and enhance~~] ***reinforce and extend*** his ability to [~~think and~~] reason logically [~~.~~] ***, reflect on, clarify and justify his thinking, ask questions to extend his learning, use patterns and relationships to analyze mathematical situations, and determine relevant, irrelevant and sufficient information to solve mathematical problems.*** A pupil must demonstrate the ability to:

(a) Construct [~~meaning and justify thinking by investigating mathematical ideas, patterns and relationships;~~

~~(b) Reinforce and extend abilities for logical reasoning;~~

~~(c) Ask questions to reflect on, clarify and extend thinking;~~

~~(d) Review, refine, explain and justify mathematical processes, arguments and solutions by using manipulatives, physical models and abstract ideas;~~

~~(e) Determine the relevancy and sufficiency of information to solve mathematical problems;~~

~~(f) Follow, create and defend valid logical mathematical arguments; and~~

~~(g)~~] ***a valid argument;***

(b) Recognize and apply inductive and deductive reasoning ~~[in both concrete and abstract contexts.]~~ ***;***

(c) Review and refine the assumptions and steps used to derive conclusions in mathematical arguments;

(d) Make and test conjectures about algebraic and geometric properties based on mathematical principles; and

(e) Justify the validity of an argument.

9. For the area of mathematical connections, to develop the ability to make mathematical connections, a pupil must solve problems in which there is a need to view mathematics as an integrated whole, including ***linking new concepts to prior knowledge,*** identifying relationships between content strands and integrating mathematics with other disciplines, thereby allowing the flexibility to approach problems in a variety of ways within and beyond the field of mathematics. A pupil must demonstrate the ability to:

(a) ~~[View mathematics as an integrated whole and identify relationships between content strands;~~

~~(b) Identify practical applications of mathematical principles that can be applied to other disciplines;~~

~~(c) Use and analyze the connections within and beyond the field of mathematics in a variety of ways to solve problems;~~

~~(d) Link new concepts to prior knowledge;~~

~~(e) Explain the relationship of concepts to procedures by using models; and~~

~~(f)~~] ***Use mathematical ideas from one area of mathematics to explain an idea from another area of mathematics;***

(b) Explain the relationship between concepts and procedures;

(c) Use the connections among mathematical topics to develop multiple approaches to problems;

(d) Apply mathematical thinking and modeling to solve problems that arise in other disciplines ***, including, without limitation, rhythm in music and motion in science;*** and

(e) Identify, explain and apply mathematics in everyday life.