TUCSON UNIFIED SCHOOL DISTRICT
MATHEMATICS EXCEPTIONAL EDUCATION STANDARDS
Second Grade
(Approved May 2006)

Every student should understand and use all concepts and skills from the previous grade levels. The standards are designed so that new learning builds on preceding skills and are needed to learn new skills. Communication, Problem-solving, Reasoning & Proof, Connections, and Representation are the process standards that are embedded throughout the teaching and learning of mathematical strands.

Strand 1: Number Sense and Operations

Number Sense is the understanding of numbers and how they relate to each other and how they are used in specific context or real-world application. It includes an awareness of the different ways in which numbers are used, such as, counting, measuring, labeling, and locating. It includes an awareness of the different types of numbers, such as, whole numbers, integers, fractions, and decimals and the relationships between them, and when each is most useful. Number sense includes an understanding of the size of numbers, so that students should be able to recognize that the volume of their room is closer to 1,000 than 10,000 cubic feet.

Students develop a sense of what numbers are: to use numbers and number relationships, to acquire basic facts, to solve a wide variety of real-world problems, and to estimate to determine the reasonableness of results.

Concept 1: Number Sense

• Understand and apply numbers, ways of representing numbers, the relationships among numbers and different number systems. (M02-S1C1)

PO 1. Make a model to represent a given whole number 0 through 999.
- **Alternate:** 1. Make a model to represent a given whole number with a word name through 20.
2. Make sets to match a model to represent a given whole number with a word name through 10.
3. Make sets to match a model to represent a given whole number to 3.

PO 2. Identify a whole number represented by a model with a word name and symbol 0 through 999.
- **Alternate:** 1. Identify a whole number represented by a model with a word name and symbol through 20.
2. Identify a whole number represented by a model with a word name and symbol through 10.
3. Identify a whole number represented by a model with a word name and symbol through 3.

PO 3. Count aloud, forward or backward, in consecutive order (0 through 999).

PO 4. Identify whole numbers through 999 in or out of order.
- **Alternate:** 1. Identify whole numbers through 20 in or out of order.
2. Identify whole numbers through 10 in or out of order.
3. Identify whole numbers through 3 in or out of order.

PO 5. Write whole numbers through 999 in or out of order.

PO 6. State equivalent forms of whole numbers using multiples of 10 through 1,000 (430 + 200 = 600 + 30).

PO 7. State verbally whole numbers, through 999, using correct place value (e.g., a student will read 528 as five hundreds, two tens and eight ones).

PO 8. Construct models to represent place value concepts for the one's, ten's, and hundred's places.

PO 9. Apply expanded notation to model place value through 999 (e.g., 378 = 3 hundreds + 7 tens + 8 ones).

PO 10. Identify odd and even (including 0) whole numbers through 999.

PO 11. Compare two whole numbers through 999.
- **Alternate:** 1. Given a number line paired with the word name and symbol representing two numbers between 1 and 10, indicate the number which is bigger.
2. Given a model paired with the word name and symbol representing two numbers between 1 and 5, indicate the number which is bigger.
3. Given a model paired with the word name and symbol representing two numbers between 1 and 3, indicate the number which is bigger.

TUCSON UNIFIED SCHOOL DISTRICT
MATHEMATICS EXCEPTIONAL EDUCATION STANDARDS
Second Grade
(Approved May 2006)

Strand 1: Number Sense and Operations (contd.)

Concept 1: Number Sense (contd.)

PO 12. Use ordinal numbers.
- **Alternate:** 1. Recognize the ordinal numbers through fifth.
- 2. Recognize the ordinal positions through third.
- 3. Recognize the ordinal position through second.

PO 13. Order three or more whole numbers through 999 (least to greatest or greatest to least).

PO 14. Make models that represent given fractions (halves and fourths).

PO 15. Identify in symbols and words a model that is divided into equal fractional parts (halves and fourths).
- **Alternate:** 1. Identify a model paired with words and symbol divided into equal fractional parts representing halves and fourths.
- 2. Make a set to match a model paired with words and symbol divided into equal fractional parts representing halves and fourths.
- 3. Make a set to match a model paired with words and symbol divided into equal fractional parts representing halves.

PO 16. Count money through $5.00 using manipulatives and pictures of bills and coins.

PO 17. Identify the value of a collection of money using the symbols ¢ and $ through $5.00.

PO 18. Use decimals through hundredths in contextual situations with money.
- **Alternate:** 1. Using all quarters and all dimes match each to a visual representation equaling one dollar.
- 2. Using all quarters, match to a visual representation equaling one dollar.
- 3. Use money or a representation of money (e.g., lunch ticket) to make a purchase.

PO 19. Compare two decimals using money, through hundredths, using models, illustrations, or symbols.

PO 20. Distinguish the equivalency among decimals, fractions and percents (e.g., half-dollar = 50¢ = 50%).

Concept 2: Numerical Operations

• Understand and apply numerical operations and their relationship to one another. (M02-S1C2)

PO 1. Demonstrate the process of addition through two three-digit whole numbers, using manipulatives.

PO 2. Demonstrate the process of subtraction using manipulatives with two-digit whole numbers.

PO 3. State addition and subtraction facts.

PO 4. Add one- and two-digit whole numbers with regrouping.

PO 5. Subtract one- and two-digit whole numbers with regrouping.

PO 6. Add 3 one- or two-digit addends.

PO 7. Select the grade-level appropriate operation to solve word problems.

PO 8. Solve word problems using addition and subtraction of two 2-digit numbers, with regrouping AND two 3-digit numbers without regrouping.
- **Alternate:** 1. Solve word problems presented orally supported with visual representation using addition or subtraction with numbers through 10.
- 2. Solve word problems presented orally supported with visual representation using addition or subtraction with numbers through 5.
- 3. Solve word problems presented orally supported with visual representation using addition or subtraction with numbers through 3.

PO 9. Count by multiples of three.

PO 10. State multiplication facts: 2s, 5s and10s.
- **Alternate:** 1. Use multiplication tables to state multiplication facts by 10s.
- 2. Use multiplication tables to state multiplication facts by 5s.
- 3. Make sets to match a model to represent a given whole number through 5.

PO 11. Demonstrate the associative property of addition (e.g., (3 + 5) + 4 = 3 + (5 + 4)).

PO 12. Apply grade-level appropriate properties to assist in computation.

PO 13. Apply the symbols: +, -, x, ÷, =, ≠, <, >, %.

PO 14. Use grade-level appropriate mathematical terminology.

PO 15. Demonstrate addition of fractions with like denominators (halves and fourths) using models.

TUCSON UNIFIED SCHOOL DISTRICT
MATHEMATICS EXCEPTIONAL EDUCATION STANDARDS
Second Grade
(Approved May 2006)

Strand 1: Number Sense and Operations (contd.)

Concept 2: Numerical Operations (contd.)

PO 16. Demonstrate subtraction of fractions with like denominators (halves and fourths) using models.

PO 17. Add and subtract money without regrouping using manipulatives and paper and pencil, through $5.00.

Concept 3: Estimation

• Use estimation strategies reasonably and fluently. (M02-S1C3)

PO 1. Solve problems using a variety of mental computations and reasonable estimation.

PO 2. Estimate the measurement of an object using U.S. customary standard and non-standard units of measurement.

PO 3. Compare an estimate to the actual measure.

PO 4. Evaluate the reasonableness of an estimate.

Strand 2: Data Analysis, Probability, and Discrete Mathematics

This strand requires students to use data collection, data analysis, statistics, probability, systematic listing and counting, and the study of graphs. This prepares the student for the study of discrete functions, fractals and chaos, and to make valid inferences, decisions, and arguments.

Discrete mathematics is a branch of mathematics that is widely used in business and industry. Combinatorics is the mathematics of systematic counting. Vertex-edge graphs are used to model and solve problems involving paths, networks, and relationships among a finite number of objects.

Concept 1: Data Analysis (Statistics)

• Understand and apply data collection, organization, and representation to analyze and sort data. This is considered to be the analysis and interpretation of numerical data in terms of samples and populations. (M02-S2C1)

PO 1. Formulate questions to collect data in contextual situations.

PO 2. Make a simple pictograph or tally chart with appropriate labels from organized data.

Alternate: 1. Given labels and pictures, create a pictograph showing one-to-one correspondence.
2. Given labels, place tally marks under correct label.
3. Make sets of up to three objects to match a model.

PO 3. Interpret pictographs using terms such as most, least, equal, more than, less than, and greatest.

PO 4. Answer questions about a pictograph using terms such as most, least, equal, more than, less than, and greatest.

PO 5. Formulate questions based on graphs, charts, and tables.

PO 6. Solve problems using graphs, charts, and tables.

Alternate: 1. Answer questions related to the context of the school community using graphs, charts, and tables.
2. Answer questions related to the context of the classroom using graphs, charts, and tables.
3. Participate in the collection of data to solve a problem or answer a question using graphs, charts, and tables.

Concept 2: Probability

• Understand and apply the basic concepts of probability. This is the field of mathematics that deals with the likelihood that an event will occur expressed as the ratio of the number of favorable outcomes in the set of outcomes divided by the total number of possible outcomes. (M02-S2C2)

PO 1. Name the possible outcomes for a probability experiment.

PO 2. Predict the most likely or least likely outcome in probability experiments (e.g., Predict the chance of spinning one of the 2 colors on a 2-colored spinner.).

PO 3. Predict the outcome of a grade-level appropriate probability experiment.

PO 4. Record the data from performing a grade-level appropriate probability experiment.

TUCSON UNIFIED SCHOOL DISTRICT
MATHEMATICS EXCEPTIONAL EDUCATION STANDARDS
Second Grade
(Approved May 2006)

Strand 2: Data Analysis, Probability, and Discrete Mathematics (contd.)

Concept 2: Probability (contd.)

PO 5. Compare the outcome of an experiment to predictions made prior to performing the experiment.

PO 6. Compare the results of two repetitions of the same grade-level appropriate probability experiment.

Concept 3: Discrete Mathematics – Systematic Listing and Counting

• Understand and demonstrate the systematic listing and counting of possible outcomes. This field of mathematics is generally referred to as Combinatorics. (M02-S2C3)

PO 1. Make arrangements that represent the number of combinations that can be formed by pairing items taken from 2 sets, using manipulatives (e.g., how many types of sandwiches can one make with 3 different types of fillings and 2 types of bread if only one type of bread and 1 kind of filling is used for each sandwich.).

Concept 4: Vertex-Edge Graphs

• Understand and apply the concepts vertex-edge graphs and networks. This field ties in graph theory with practical problems. (M02-S2C4)

PO 1. Color pictures with the least number of colors so that no common edges share the same color (increased complexity throughout grade levels).

Strand 3: Patterns, Algebra and Functions

Patterns occur everywhere in nature. Algebraic methods are used to explore, model and describe patterns, relationships, and functions involving numbers, shapes, iteration, recursion, and graphs within a variety of real-world problem solving situations. Iteration and recursion are used to model sequential, step-by-step change.

Algebra emphasizes relationships among quantities, including functions, ways of representing mathematical relationships, and the analysis of change.

Concept 1: Patterns

• Identify patterns and apply pattern recognition to reason mathematically. Students begin with simple repetitive patterns of many iterations. This is the beginning of recursive thinking. Later, students can study sequences that can best be defined and computed using recursion. (M02-S3C1)

PO 1. Communicate a grade-level appropriate pattern, using symbols or numbers (e.g., ∇, O, Δ, ∇, O, Δ, ∇, ___, ___, ___).

PO 2. Extend a grade-level appropriate repetitive pattern (e.g., 12, 22, 32, ___, ___, ___).

Alternate:
1. Extend a repeating pattern of two or more symbols or numbers.
2. Recognize and demonstrate understanding of regularity in a pattern by adding on the next object, shape, design, or number to a continuing pattern (e.g., spoon, spoon, spoon).
3. Anticipate and respond to an event that occurs routinely (e.g., repeated ringing of bell).

PO 3. Create grade-level appropriate patterns.

Concept 2: Functions and Relationships

• Describe and model functions and their relationships. For example, distribution and communication networks, laws of physics, population models, and statistical results can all be represented in the symbolic language of algebra. (M02-S3C2)

PO 1. Describe the rule used in a simple grade-level appropriate function (e.g., T-chart, input/output model, and frames and arrows).

TUCSON UNIFIED SCHOOL DISTRICT
MATHEMATICS EXCEPTIONAL EDUCATION STANDARDS
Second Grade
(Approved May 2006)

Strand 3: Patterns, Algebra and Functions (contd.)

Concept 3: Algebraic Representations

• Represent and analyze mathematical situations and structures using algebraic representations. Algebraic representation is about abstract structures and about using the principles of those structures in solving problems expressed with symbols. (M02-S3C3)

PO 1. Use variables in contextual situations.

Alternate: 1. Create a repeating pattern using objects, shapes, designs, or sets and numbers.
2. Extend a repeating pattern of two or more objects, shapes, designs, or numbers (e.g., cup, spoon, cup, spoon, _____, _____).
3. Reproduce a repeated event (e.g., clapping sequence).

PO 2. Find the missing element (addend, subtrahend, minuend, sum, and difference) in addition and subtraction number sentences for sums through 18 and minuends through 9 (e.g., 13 - _ = 8).

Alternate: 1. Supported with visual representation, find the missing sum or difference in number sentences for sums and minuends through 10.
2. Supported with visual representation, find the missing sum or difference in number sentences for sums and minuends through 5.
3. Supported with visual representation, find the missing sum or difference in number sentences for sums and minuends through 3.

Concept 4: Analysis of Change

• Analyze change in a variable over time and in various contexts such as, qualitative change, quantitative change, and the idea that slope represents the constant rate of change in linear functions, and functions that have non-constant rates of change. (M02-S3C4)

PO 1. Identify the change in a variable over time (e.g., an object gets taller, colder, heavier, etc.).

PO 2. Make simple predictions based on a variable (e.g., a child's height from year to year).

Strand 4: Geometry and Measurement

Geometry is a natural place for the development of students' reasoning, higher thinking, and justification skills, culminating in work with proofs. Geometric modeling and spatial reasoning offer ways to interpret and describe physical environments and can be important tools in problem solving. Students use geometric methods, properties and relationships, transformations, and coordinate geometry as a means to recognize, draw, describe, connect, analyze, and measure shapes and representations in the physical world.

Measurement is the assignment of a numerical value to an attribute of an object, such as the length of a pencil. At more-sophisticated levels, measurement involves assigning a number to a characteristic of a situation, as is done by the consumer price index. Understanding what a measurable attribute is and becoming familiar with the units and processes that are used in measuring attributes, is a major emphasis in this strand.

Concept 1: Geometric Properties

• Analyze the attributes and properties of two- and three-dimensional shapes and develop mathematical arguments about their relationships (in conjunction with Strand 5, Concept 2). (M02-S4C1)

PO 1. Compare attributes of two-dimensional shapes (square, rectangle, triangle, and circle).

PO 2. Recognize congruent shapes.

PO 3. Recognize line(s) of symmetry for a two-dimensional shape.

Concept 2: Transformation of Shapes

• Apply spatial reasoning to create transformations and use symmetry to analyze mathematical situations. (M02-S4C2)

PO 1. Recognize same shape in different positions (flip/reflection).

TUCSON UNIFIED SCHOOL DISTRICT
MATHEMATICS EXCEPTIONAL EDUCATION STANDARDS
Second Grade
(Approved May 2006)

Strand 4: Geometry and Measurement (contd.)

Concept 3: Coordinate Geometry

• Specify and describe spatial relationships using coordinate geometry and other representational systems. (M02-S4C3)

No PO's listed for this grade level.

Concept 4: Measurement - Units of Measure - Geometric Objects

• Understand and apply appropriate units of measure, measurement techniques, and formulas to determine measurements. (M02-S4C4)

PO 1. Identify the type of measure (e.g., weight, height, and time) for each attribute of an object.

PO 2. Select the appropriate U.S. customary measure of accuracy:
- length – inches , feet, yards, miles
- capacity/volume – pints, quarts
- mass/weight – ounces

Alternate:
1. Measure the length of a given object using the appropriate measurement tool.
2. Given the appropriate measurement tool, measure the length of a given object.
3. Match two objects of differing lengths to the appropriate model.

PO 3. Tell time to the quarter hour using analog and digital clocks.

Alternate:
1. Demonstrate ability to respond to a familiar hand position on a clock as a cue for a specific event (e.g., 11:35 = lunch).
2. Sequence pictures (paired with print) or tactile symbols (paired with Braille) of at least three activities as they are to occur in a daily schedule.
3. Demonstrate behavior specific to certain contexts (e.g., when student enters gym, indicates desire to transfer from wheelchair to exercise mat or equipment).

PO 4. Determine the passage of time using units of days and weeks within a month using a calendar.

PO 5. Select the appropriate tool to measure the given characteristic of an object.

PO 6. Measure a given object using the appropriate unit of measure:
- length – inches, miles
- capacity/volume – pints, quarts
- mass/weight – ounces

PO 7. State equivalent relationships:
- 12 inches = 1 foot
- 60 minutes = 1 hour
- 24 hours = 1 day
- 7 days = 1 week
- 12 months = 1 year
- 100 pennies = 1 dollar
- 10 dimes = 1 dollar
- 4 quarters = 1 dollar

TUCSON UNIFIED SCHOOL DISTRICT
MATHEMATICS EXCEPTIONAL EDUCATION STANDARDS
Second Grade
(Approved May 2006)

Strand 4: Geometry and Measurement (contd.)

Concept 4: Measurement - Units of Measure - Geometric Objects (contd.)

PO 7. State equivalent relationships: (contd.)

Alternate: 1. State equivalent relationships:

100 pennies = 1 dollar

10 dimes = 1 dollar

4 quarters = 1 dollar

12 items = 1 dozen

2. Using all quarters and all dimes, match to a visual representation equaling one dollar and indicate how many quarters and how many dimes equal a dollar.

10 dimes = 1 dollar

4 quarters = 1 dollar

3. Use at least one other person as a resource to complete a task or obtain a goal (e.g., takes or otherwise purposely directs teacher's attention to object wanted).

Strand 5: Structure and Logic

This strand is unique to the Arizona Mathematics Standard and might be considered an extension of problem solving. Students draw from the content of the other four strands to devise algorithms and analyze algorithmic thinking. Strand One and Strand Three provide the conceptual and computational basis for these algorithms. Logical reasoning and proof draws its substance from the study of geometry, patterns, and analysis to connect remaining strands. Students use algorithms, algorithmic thinking, and logical reasoning, both inductive and deductive, as they make conjectures and test the validity of arguments and proofs. They evaluate situations, select problem solving strategies, draw logical conclusions, develop and describe solutions and recognize their applications.

Concept 1: Algorithms and Algorithmic Thinking

• Use reasoning to solve mathematical problems in contextual situations. Determine step-by-step series of instructions to explain mathematical processes. (M02-S5C1)

PO 1. Create contextual problems that require addition or subtraction with one- or two-digit numbers.

Concept 2: Logic, Reasoning, Arguments, and Mathematical Proof

• Evaluate situations, select problem solving strategies, draw logical conclusions, develop and describe solutions, and recognize and describe their applications. Develop mathematical arguments based on induction and deduction, and distinguish between valid and invalid arguments. (M02-S5C2)

PO 1. Identify the concepts *some*, *every* and *many* within the context of logical reasoning.

Alternate: 1. Identify the concepts *some* and *every* within the context of logical reasoning.

2. With visual support, identify the concepts *some* and *every* within the context of logical reasoning.

3. Indicate the desire for *more.*

PO 2. Identify the concepts *all* and *none* within the context of logical reasoning.

Alternate: 1. With visual support, identify the concepts *all* and *none* within the context of logical reasoning.

2. With visual support, identify the concept of *all* within the context of logical reasoning.

3. Indicate an understanding of *all gone* or *finished.*