

MATHEMATICS CONTENT STANDARDS GRADE 2

By the end of second grade, students understand place value and number relationships as they add and subtract to 1,000. They use simple concepts of multiplication and division using concrete examples. They estimate and measure quantities with appropriate units. They classify and see relationships among shapes by paying attention to the elements that compose them. They collect and analyze data and then verify answers. Students demonstrate an understanding of patterns to solve problems. They decide the approach, materials and strategies to use to solve problems.

NUMBER SENSE - Numbers determine and define quantities and relationships. They are used to make comparisons, interpret information, solve problems, and make decisions. Number sense is an understanding of number relationships. Students use estimation to make good judgments about the reasonableness of results and make sense of the many ways in which numbers are used. Number sense offers rich opportunities for investigating real-life applications and developing mathematical concepts and connections through problem solving. The number system has power that is deeper than counting, collecting and computing. Through exploration, usage and reflective thought, students construct number meaning and interpret the multiple uses encountered in the real world.

As students work with each new family of numbers (whole numbers, fractions, decimals, percents, integers, real numbers) they engage in three major tasks. First, they must develop a conceptual understanding of the number family and its relationships to other sets of numbers previously studied. Then, students develop meaning for the operations of addition, subtraction, multiplication and division for each family of numbers. Finally, after building a strong conceptual foundation, students must work to acquire fluency and facility with both numbers and their operations.

The acquisition of proficiency with basic facts must be encouraged and mastered, because it allows students to work confidently as they progress in their mathematical studies. However, brain research shows that rote rehearsal may not be the best method of developing this kind of proficiency. Teachers are encouraged to use a wide variety of experiences and tasks to develop this fluency with number, while maintaining student interest and enthusiasm.

In addition, it is important for students to experience meaningful computational algorithms. Many of our standard algorithms are not consistent with the mathematical principles of place value. Students need to develop meaning during their early experiences with addition, subtraction, multiplication and division algorithms. Over time, many students will adopt the standard algorithms for convenience and efficiency. However, students using non-standard algorithms that they understand will remember and be able to use them much more effectively than students using standard algorithms that they have simply memorized. The understanding of multiplication, for example, should not be confused with fluency in using a multiplication algorithm.

Finally, while computation is a powerful part of mathematics, we need to recognize the importance of all five strands. All students must have opportunities to grow in all areas of mathematics as they continue to become proficient in computational skills.

- **Students understand the relationship among numbers, quantities and place value in whole numbers up to 1,000.**
 - Count, read, write whole numbers to 1,000 and identify the place value for each digit.
 - Use words, models, and expanded form to represent numbers (to 1,000).
 - Order and compare whole numbers up to 1,000 using the symbols $<$, $=$, $>$.
 - Identify odd and even numbers.
 - Identify ordinal numbers to 100.

- Students estimate, calculate and solve problems involving addition and subtraction of two- and three-digit numbers including regrouping.
 - Understand and use the inverse relationship between addition and subtraction (e.g., an opposite number sentence for $8 + 6 = 14$ is $14 - 6 = 8$) to solve problems and check solutions.
 - **Find the sum or difference of two whole numbers up to three digits long.**
 - Find the sum of three or more whole numbers containing two digits.
 - Students use a variety of strategies to solve mental math problems with the sum or difference of two 2-digit numbers.

- **Students model using concrete materials and solve simple multiplication and division problems.**
 - Use repeated addition, arrays, counting by multiples to do multiplication.
 - Use repeated subtraction, equal sharing, and forming equal groups to do division with remainders.
 - **Know the multiplication tables of 2's, 5's and 10's (to "times 10") and commit to memory.**

- Students understand that fractions and decimals can refer to parts of a set and parts of a whole.
 - Recognize, name and compare unit fractions up to $1/12$.
 - **Recognize fractions of a whole and parts of a group (e.g., $1/4$ th of a pie, $2/3$ rd of 15 balls).**
 - Know that when all fractional parts are included, such as four-fourths, the result is equal to the whole and to one.

- **Students model and solve problems by representing, adding, and subtracting amounts of money.**
 - Solve problems using combinations of coins and bills to \$10.00.
 - Know and use the decimal notation and the dollar and cents symbols for money.

- Students use estimation strategies in computation and problem solving that involve numbers that use the ones, tens, hundreds and thousands places.
 - Recognize when an estimate is reasonable in problems involving numbers up to the thousands place.

- **Students use a variety of strategies to estimate and compute mentally.**

ALGEBRA AND FUNCTIONS

Algebra is the language of all mathematics and science, and a tool for solving problems. It is the language of operation, symbol manipulation, and variables. It describes and interprets relationships among quantities. Algebra is generalized arithmetic interwoven through all strands, and is closely

connected to functions. A function is a relationship among quantities and can be represented using tables, graphs and algebraic symbols. Functions often represent a way of generalizing a numerical pattern. When there is a functional relationship between two quantities, the value of the first quantity determines the corresponding value of the second. The study of functions enables students to see relationships and to make predictions based on those relationships.

- Students model, represent, and interpret number relationships to create and solve problems involving addition and subtraction.
 - **Use the commutative and associative rules to simplify mental calculations and check results.**
 - **Relate problem situations and number sentences involving addition and subtraction.**
 - Solve addition and subtraction problems using data from simple charts, picture graphs and number sentences.
- Students demonstrate an understanding of patterns and how they grow, and describe them in general ways.
 - **Recognize, describe, extend, and explain how to get the next term in linear patterns (e.g., 4, 8, 12,...the numbers of ears on 1, 2, 3, 4,...horses).**
 - Create and solve problems involving simple number patterns.

MEASUREMENT AND GEOMETRY - Through the study of geometry, students link mathematics to space and form in the world around them and in the abstract. In this strand, the students are exposed to and investigate one-dimensional, two-dimensional and three-dimensional space by exploring shape, area, and volume; studying lines, angles, points and surfaces; and engaging in other visual and concrete experiences.

- Students understand that measurement is accomplished by identifying a unit of measure, iterating (repeating) that unit and comparing it to the item to be measured.
 - Measure the length of objects by iterating (repeating) a non-standard or standard unit.
 - Use different units to measure the same object and predict whether the measure will be greater or smaller when a different unit is used.
 - Recognize when an estimate is reasonable in measurement (e.g. closest inch).
 - **Measure the length of an object to the nearest 1/4 inch and/or centimeter.**
 - **Tell time to the nearest 5 minute interval.**
 - Determine the duration of time intervals in hours (e.g., 11:00 a.m. to 4:00 p.m.).
 - **Know time relationships (e.g., minutes in an hour, days in a month, weeks in a year).**
- Students identify and describe the elements that compose common figures in the plane and common objects in space.
 - **Describe and classify plane and solid geometric shapes (e.g., circle, triangle, square, rectangle, sphere, pyramid, cube, rectangular prism) according to the number and shape of faces, edges, and vertices.**
 - **Put shapes together and take them apart to form other shapes (e.g., two congruent right triangles can form a rectangle).**
 - Investigate perimeter, circumference, and area of two-dimensional shapes using standard and non-standard units of measurement.

STATISTICS, DATA ANALYSIS, AND PROBABILITY

The study of statistics helps students learn to collect and organize information in a variety of graphs, charts, and tables to make the data easier for the students and others to understand. Students learn to interpret data and to make decisions based on their interpretations. Students learn probability, the study of chance, so that numerical data can be used to predict future events and outcomes.

- **Students collect, record, organize, display, and interpret numerical data on bar graphs and other representations.**
 - Record numerical data in systematic ways, keeping track of what/who has been counted.
 - Represent the same data set in more than one way (e.g., charts with tallies, and bar graphs).
 - Identify features of data sets (range and mode).
 - Ask and answer simple questions related to data representations.
- Students conduct simple probability experiments, predict possible outcomes, and record and discuss results.
 - Conduct simple probability experiments, predict, record and discuss results.

MATHEMATICAL REASONING, PROBLEM SOLVING, AND COMMUNICATION STANDARDS

The study of mathematics is much more than following procedures to determine answers to math computations and word problems. The student of mathematics is learning how to think clearly while solving problems that don't necessarily have predetermined single solutions. This skill is not only essential across all academic subject areas, but extends into virtually every career and job. More often than not, this thinking clearly must be done while working with and getting along with others, sharing information, expertise, and ideas. Frequently, reasoning has to be communicated to others, formally and informally, in writing and orally. Mathematical Reasoning is the study of thinking clearly.

Students solve problems using a 4-step process:

- **Students make decisions about how to approach problems.**
 - Clarify the information given in the problem and the question to be solved.
 - Identify missing information.
 - Look for connections and think ahead:
 - “Have I done something like this before?”
 - “What do I think I’m going to have to do?”
 - “What type of answer am I expecting?”
 - “I have an idea about the mathematical steps I need to take”
 - “How am I going to overcome the obstacles?”
- **Students use strategies, skills and concepts in finding solutions.**
 - Predict outcomes and make reasonable estimates.
 - Use tools and strategies such as manipulatives or sketches to model problems.
 - Make precise calculations and check the validity of the results from the context of the problem.

- **Students communicate results by explaining their process and solution.**
 - Explain the reasoning used with concrete objects and pictorial representations.
- **Students determine a solution is complete and make connections to similar problems.**
 - Evaluate the reasonableness of the solution in the context of the original situation.
 - Discuss similarities and differences with other problems.
 - Create and solve new problems similar to the original by either changing the story while keeping the numbers the same, or by changing the numbers while keeping the story the same.