

Mathematics Grade 2 Curriculum
AUGUST 2008

COURSE DESCRIPTION:

Second graders are ready, willing, and able to apply and learn more about math skills. This course is designed for students to work on basic mathematical concepts: numeration, addition, subtraction, shapes, patterns, measurement, time, money, graphing, etc. and extend the application. Children will be exposed to a variety of mathematical ideas, not just arithmetic. Each lesson contains standards-based content that stimulate higher-level student thinking, forming the foundation for clear mathematics development.

Students will be actively engaged in mathematic experiences that invite problem solving, reasoning, and communicating. Students will explore, conjecture, analyze, make decisions, and think logically using a variety of mathematical methods. Students will also make connections between math and other subjects, and between math and daily life. Children will demonstrate and apply their understanding. They will develop positive attitudes about mathematics and confidence in their mathematical abilities.

This course will provide students with meaningful strategies, activities, and experiences that support the various strands identified in the math standards to stimulate their minds and help them master the skills with which they may build success and rewarding lives. Interesting activities will make math meaningful for students, and they will help students see the important role math plays in their lives every day. The activities will engage children in concrete mathematical experiences. They will enable you to teach mathematical concepts and skills, assess children's progress within authentic contexts, and extend mathematics to other areas of the curriculum.

CORE CURRICULUM CONTENT STANDARDS:

4.1 (NUMBER AND NUMERICAL OPERATIONS) ALL STUDENTS WILL DEVELOP NUMBER SENSE AND WILL PERFORM STANDARD NUMERICAL OPERATIONS AND ESTIMATIONS ON ALL TYPES OF NUMBERS IN A VARIETY OF WAYS.

4.2 (GEOMETRY AND MEASUREMENT) ALL STUDENTS WILL DEVELOP SPATIAL SENSE AND THE ABILITY TO USE GEOMETRIC PROPERTIES, RELATIONSHIPS, AND MEASUREMENT TO MODEL, DESCRIBE AND ANALYZE PHENOMENA.

4.3 (PATTERNS AND ALGEBRA) ALL STUDENTS WILL REPRESENT AND ANALYZE RELATIONSHIPS AMONG VARIABLE QUANTITIES AND SOLVE PROBLEMS INVOLVING PATTERNS, FUNCTIONS, AND ALGEBRAIC CONCEPTS AND PROCESSES.

4.4 (DATA ANALYSIS, PROBABILITY, AND DISCRETE MATHEMATICS) ALL STUDENTS WILL DEVELOP AN UNDERSTANDING OF THE CONCEPTS AND TECHNIQUES OF DATA ANALYSIS, PROBABILITY, AND DISCRETE MATHEMATICS, AND WILL USE THEM TO MODEL SITUATIONS, SOLVE PROBLEMS, AND ANALYZE AND DRAW APPROPRIATE INFERENCES FROM DATA.

4.5 (MATHEMATICAL PROCESSES) ALL STUDENTS WILL USE MATHEMATICAL PROCESSES OF PROBLEM SOLVING, COMMUNICATION, CONNECTIONS, REASONING, REPRESENTATIONS, AND TECHNOLOGY TO SOLVE PROBLEMS AND COMMUNICATE MATHEMATICAL IDEAS.

8.1 (COMPUTER AND INFORMATION LITERACY) ALL STUDENTS WILL USE COMPUTER APPLICATIONS TO GATHER AND ORGANIZE INFORMATION AND TO SOLVE PROBLEMS.

CUMULATIVE PROGRESS INDICATORS:

By the end of **Grade 2**, students will:

4.1 Number and Numerical Operations

A. Number Sense

1. Use real-life experiences, physical materials, and technology to construct meanings for numbers (**unless otherwise noted, all indicators for grade 2 pertain to these sets of numbers as well**).
 - * Whole numbers through hundreds
 - * Ordinals
 - * Proper fractions (denominators of 2, 3, 4, 8, 10)
2. Demonstrate an understanding of whole number place value concepts.
3. Understand that numbers have a variety of uses.
4. Count and perform simple computations with coins.
 - * Amounts up to \$1.00 (using cents notation)
5. Compare and order whole numbers.

B. Numerical Operations

1. Develop the meanings of addition and subtraction by concretely modeling and discussing a large variety of problems.
 - * Joining, separating, and comparing
2. Explore the meanings of multiplication and division by modeling and discussing problems.

3. Develop proficiency with basic addition and subtraction number facts using a variety of fact strategies (such as counting on and near doubles.) and then commit them to memory.
4. Construct, use, and explain procedures for performing addition and subtraction calculations with:
 - * Pencil-and-paper
 - * Mental math
 - * Calculator
5. Use efficient and accurate pencil-and-paper procedures for computation with whole numbers.
 - * Addition of 2-digit numbers
 - * Subtraction of 2-digit numbers
6. Select pencil-and-paper, mental math, or a calculator as the appropriate computational method in a given situation depending on the context and numbers.
7. Check the reasonableness of results of computations.
8. Understand and use the inverse relationship between addition and subtraction.

C. Estimation

1. Judge without counting whether a set of objects has less than, more than, or the same number of objects as a reference set.
2. Determine the reasonableness of an answer by estimating the result of computations (e.g., $15 + 16$ is not 211).
3. Explore a variety of strategies for estimating both quantities (e.g., the number of marbles in a jar) and results of computations

4.2 Geometry and Measurement

A. Geometric Properties

1. Identify and describe spatial relationships among objects in space and their relative shapes and sizes.
 - * Inside/outside, left/right, above/below, between
 - * Smaller/larger/same size, wider/ narrower, longer/shorter
 - * Congruence (i.e., same size and shape)
2. Use concrete objects, drawings, and computer graphics to identify, classify, and describe standard three-dimensional and two-dimensional shapes.
 - * Vertex, edge, face, side
 - * 3D figures, cube, rectangular prism, sphere, cone, cylinder, and pyramid
 - * 2D figures, square, rectangle, circle, triangle
 - * Relationships between three- and two-dimensional shapes (i.e., the face of a 3D shape is a 2D shape)
3. Describe, identify and create instances of line symmetry.
4. Recognize, describe, extend and create designs and patterns with geometric objects of different shapes and colors.

B. Transforming Shapes

1. Use simple shapes to make designs, patterns, and pictures.
2. Combine and subdivide simple shapes to make other shapes.

C. Coordinate Geometry

1. Give and follow directions for getting from one point to another on a map or grid.

D. Units of Measurement

1. Directly compare and order objects according to measurable attributes.
 - * Attributes length, weight, capacity, time, temperature
2. Recognize the need for a uniform unit of measure.
3. Select and use appropriate standard and non-standard units of measure and standard measurement tools to solve real-life problems.
 - * Length, inch, foot, yard, centimeter, meter
 - * Weight, pound, gram, kilogram
 - * Capacity, pint, quart, liter
 - * Time, second, minute, hour, day, week, month, year
 - * Temperature, degrees Celsius, degrees Fahrenheit
4. Estimate measures.

E. Measuring Geometric Objects

1. Directly measure the perimeter of simple two-dimensional shapes.
2. Directly measure the area of simple two-dimensional shapes by covering them with squares.

4.3 Patterns and Algebra

A. Patterns

1. Recognize, describe, extend, and create patterns.
 - * Using concrete materials (manipulatives), pictures, rhythms, & whole numbers
 - * Descriptions using words and symbols (e.g., add two or + 2)
 - * Repeating patterns
 - * Whole number patterns that grow or shrink as a result of repeatedly adding or subtracting a fixed number (e.g., skip counting forward or backward)

B. Functions and Relationships

1. Use concrete and pictorial models of function machines to explore the basic concept of a function.

C. Modeling

1. Recognize and describe changes over time (e.g., temperature, height).

2. Construct and solve simple open sentences involving addition or subtraction.
Result unknown (e.g., $6 + 2 = \underline{\quad}$ or $n = 3 + 5$)
Part unknown (e.g., $3 + \square = 8$)

D. Procedures

1. Understand and apply (but don't name) the following properties of addition:
 - * Commutative (e.g., $5 + 3 = 3 + 5$)
 - * Zero as the identity element (e.g., $7 + 0 = 7$)
 - * Associative (e.g., $7 + 3 + 2$ can be found by first adding either $7 + 3$ or $3 + 2$)

4.4 Data Analysis, Probability, and Discrete Mathematics

A. Data Analysis

1. Collect, generate, record, and organize data in response to questions, claims, or curiosity.
 - * Data collected from students, everyday experiences
 - * Data generated from chance devices, such as spinners and dice
2. Read, interpret, construct, and analyze displays of data.
 - * Pictures, tally chart, pictograph, bar graph, Venn diagram
 - * Smallest to largest, most frequent (mode)

B. Probability

1. Use chance devices like spinners and dice to explore concepts of probability.
 - * Certain, impossible
 - * More likely, less likely, equally likely
2. Provide probability of specific outcomes.
 - * Probability of getting specific outcome when coin is tossed, when die is rolled, when spinner is spun (e.g., if spinner has five equal sectors, then probability of getting a particular sector is one out of five)
 - * When picking a marble from a bag with three red marbles and four blue marbles, the probability of getting a red marble is three out of seven

C. Discrete Mathematics Systematic Listing and Counting

1. Sort and classify objects according to attributes.
 - * Venn diagrams
2. Generate all possibilities in simple counting situations (e.g., all outfits involving two shirts and three pants).

D. Discrete Mathematics Vertex-Edge Graphs and Algorithms

1. Follow simple sets of directions (e.g., from one location to another, or from a recipe).
2. Color simple maps with a small number of colors.

3. Play simple two-person games (e.g., tic-tac-toe) and informally explore the idea of what the outcome should be.
4. Explore concrete models of vertex-edge graphs (e.g. vertices as islands and edges as bridges.).
 - * Paths from one vertex to another

4.5 Mathematical Processes

A. Problem Solving

1. Learn mathematics through problem solving, inquiry, and discovery.
2. Solve problems that arise in mathematics and in other contexts (cf. workplace readiness standard 8.3).
 - * Open-ended problems
 - * Non-routine problems
 - * Problems with multiple solutions
 - * Problems that can be solved in several ways
3. Select and apply a variety of appropriate problem-solving strategies (e.g., .try a simpler problem or make a diagram.) to solve problems.
4. Pose problems of various types and levels of difficulty.
5. Monitor their progress and reflect on the process of their problem solving activity.

B. Communication

1. Use communication to organize and clarify their mathematical thinking.
 - * Reading and writing
 - * Discussion, listening, and questioning
2. Communicate their mathematical thinking coherently and clearly to peers, teachers, and others, both orally and in writing.
3. Analyze and evaluate the mathematical thinking and strategies of others.
4. Use the language of mathematics to express mathematical ideas precisely.

C. Connections

1. Recognize recurring themes across mathematical domains (e.g., patterns in number, algebra, and geometry).
2. Use connections among mathematical ideas to explain concepts (e.g., two linear equations have a unique solution because the lines they represent intersect at a single point).
3. Recognize that mathematics is used in a variety of contexts outside of mathematics.
4. Apply mathematics in practical situations and in other disciplines.
5. Trace the development of mathematical concepts over time and across cultures (cf. world languages and social studies standards).
6. Understand how mathematical ideas interconnect and build on one another to produce a coherent whole.

D. Reasoning

1. Recognize that mathematical facts, procedures, and claims must be justified.
2. Use reasoning to support their mathematical conclusions and problem solutions.
3. Select and use various types of reasoning and methods of proof.
4. Rely on reasoning, rather than answer keys, teachers, or peers, to check the correctness of their problem solutions.
5. Make and investigate mathematical conjectures.
 - * Counterexamples as a means of disproving conjectures
 - * Verifying conjectures using informal reasoning or proofs.
6. Evaluate examples of mathematical reasoning and determine whether they are valid.

E. Representations

1. Create and use representations to organize, record, and communicate mathematical ideas.
 - * Concrete representations (e.g., base-ten blocks or algebra tiles)
 - * Pictorial representations (e.g., diagrams, charts, or tables)
 - * Symbolic representations (e.g., a formula)
 - * Graphical representations (e.g., a line graph)
2. Select, apply, and translate among mathematical representations to solve problems.
3. Use representations to model and interpret physical, social, and mathematical phenomena.

F. Technology

1. Use technology to gather, analyze, and communicate mathematical information.
2. Use computer spreadsheets, software, and graphing utilities to organize and display quantitative information.
3. Use graphing calculators and computer software to investigate properties of functions and their graphs.
4. Use calculators as problem-solving tools (e.g., to explore patterns, to validate solutions).
5. Use computer software to make and verify conjectures about geometric objects.
6. Use computer-based laboratory technology for mathematical applications in the sciences.

8.1 Technological Literacy

By the end of **Grade 4**, students will:

A. Basic Computer Skills and Tools

1. Use basic technology.

2. Use basic features of an operating system (e.g., accessing programs, identifying and selecting a printer, finding help).
3. Input and access text and data, using appropriate keyboarding techniques or other input devices.
4. Produce a simple finished document using word processing software.
5. Produce and interpret a simple graph or chart by entering and editing data on a prepared spreadsheet template.
6. Create and present a multimedia presentation using appropriate software.
7. Create and maintain files and folders.
8. Use a graphic organizer.
9. Use basic computer icons.

B. Application of Productivity Tools

Social Aspects

1. Discuss the common uses of computer applications and identify their advantages and disadvantages.
2. Recognize and practice responsible social and ethical behaviors when using technology, and understand the consequences of inappropriate use including:
 - o Internet access
 - o Copyrighted materials
 - o On-line library resources
 - o Personal security and safety issues
3. Practice appropriate Internet etiquette.
4. Recognize the ethical and legal implications of plagiarism of copyrighted materials.

Information Access and Research

5. Recognize the need for accessing and using information.
6. Identify and use web browsers, search engines, and directories to obtain information to solve real world problems.
7. Locate specific information by searching a database.
8. Recognize accuracy and/or bias of information.

Problem Solving and Decision Making

9. Solve problems individually and/or collaboratively using computer applications.
10. Identify basic hardware problems and solve simple problems.

SUGGESTED ACTIVITIES THAT ADDRESS THESE STANDARDS MAY INCLUDE BUT ARE NOT LIMITED TO:

4.1 Number and Numerical Operations

4.1 A Number Sense

Students use numbers throughout the school day as they discuss the date, attendance, time, snacks, money, etc.

Second-graders record prices as decimals (\$0.39) and use this notation to find totals over \$1 on a calculator.

Students find half of a sheet of paper by folding horizontally, by folding vertically, and by folding diagonally. They compare the results and discuss how they are alike and how they are different.

Children use base-ten blocks to discover the connection between tens and ones.

Children show different ways to represent numbers.

Children create a frieze to illustrate counting by 2's, 3's, 4's, or 5's.

Children use a hundreds chart to skip-count.

Children act out counting methods.

Children determine counting methods and then diagram each of their own methods on a piece of paper by using tally marks and circling them.

Children brainstorm a list of the uses of math in their everyday lives.

Children will examine newspaper for uses of math.

Each child interviews an adult to find out how that person uses math in his or her occupation.

Children identify and classify numbers as even or odd.

Children compare numbers using the symbols $>$, $<$, and $=$ and their verbal equivalents.

Children use a number line to compare, order, and round numbers.

Children find number patterns that are found when skip-counting.

Children count out two-digit amounts using ten frames.

Children build three-digit numbers by rolling number cubes and recording numerals in the hundred's, ten's, and one's place.

Children identify place value.

Children count by hundreds to 1000.

Children write numbers through 1000.

Children compare three-digit numbers.

Children order three-digit numbers.

Children count dollars and cents.

Children use place value to find the value of a digit.

Children use words, models, and expanded form to show three-digit numbers in different ways.

Children count combinations of half-dollars, quarters, dimes, nickels, and pennies to find total amounts.

Children create unique piggy banks and add up their contents.

Children count and compare the value of two sets of coins.

Children trade coins in a race to be the first to trade their change for a dollar.

Children trade coins to an equivalent number of pennies.

4.1 B Numerical Operations

Second graders regularly use the *doubles* and *near doubles*, the *make ten*, and the *counting on* and *counting back* strategies for addition and subtraction. Practice sets of problems are structured so that use of all of these strategies is encouraged and the students are regularly asked to explain the procedures they are using.

Students play games like *addition war* to practice their basic facts. Each of two children has half of a deck of playing cards with the face cards removed. They each turn up a card and the person who wins the trick is the first to say the sum (or difference) of the two numbers showing. Calculators may be used to check answers, if necessary.

Students use the calculator to count *one more than* by pressing $+ 1 = =$. The display will increase by one every time the student presses the $=$ key. Any number can replace the 1 key.

Students use two dice to play board games (*Chutes and Ladders* or home-made games). These situations encourage rapid recall of addition facts in a natural way. In order to extend practice to larger numbers, students may use 10-sided dice.

Students use online computer games such as to practice basic facts.

Children create stories using math mats and manipulatives to illustrate number sentences.

Children manipulate buttons to create different combinations for the same number.

Children add two and three numbers with sums through 20.

Children add three numbers using the grouping property.

Children subtract a number from 20 or less.

Children write fact families for sums to 20 and different names for the same number.

Children identify fact families.

Children analyze and solve problems using skills and strategies.

Children use the order property to find the sum.

Children use a number line to add or subtract.

Children use the inverse relationship between addition and subtraction to subtract.

Children use dominoes to record addition and subtraction number sentences.

Children work in pairs to create a variety of story problems.

Children add and subtract pairs of numbers from the set of even numbers or the set of odd numbers to discover some rules about what happens when you add and subtract odd and even numbers.

Children will count the items and write an addition or subtraction number sentence to show the total number of items pictured.

Children solve number riddles.

Children choose the operation to solve problems involving addition and subtraction.

Children add and subtract one- and two-digit numbers with and without regrouping.

Children add and subtract money amounts.

Children rewrite horizontal addition and subtraction sentences into vertical form.

Children use mental math to add and subtract.

4.1 C. Estimation

Students are regularly asked if their answer makes sense in the context of the problem they were solving. They respond with full sentences explaining what they were asked to find and why the numerical answer they found fits the context reasonably, that is, why it *could be* the answer.

Students estimate *reasonable* numbers of times that particular physical feats can be performed in one minute. Other students judge whether the estimates are reasonable or unreasonable and then the tasks are performed and the actual counts made.

Second-grade students are given a set of thirty cards with two-digit addition problems on them. In one minute, they must sort the cards into two piles: those problems whose answers are greater than 100 and those less than 100. The correct answers can be on the backs of the cards to allow self-checking after the task is completed.

Second-grade students are given a page of addition or subtraction problems in a multiple choice format with 4 possible answers for each problem. Within some time period which is much too short for them to do the computations, students are asked to choose the most reasonable answer from each set of four.

Students are asked if a sixty-seat bus will be adequate to take the two first grade classes on their field trip. After it is known that there are 23 children in one class and 27 in the other, individuals volunteer their answers and give a rationale to support their thinking; *front end estimation* should lead to the conclusion that the total number of students is between 40 and 60. A discussion might be directed to the question of whether an exact answer to the computation was needed for the problem.

Students are shown a glass jar filled with about eighty marbles and asked to estimate the number in the jar. In small groups, they discuss various approaches to the problem and strategies they can use. Each group shares one strategy with the class, and the estimate that resulted.

Children estimate length, height, or circumference of each object, and record their estimates.

Children measure objects and compare their estimates with their results.

LITERATURE CONNECTIONS

The Tenth Good Thing About Barney by Judith Viorst.

One Green Island by Charlotte Harol.

Sea Sums by Joy N. Hulme.
The King's Commissioners by Aileen Friedman. Scholastic, 1994.
100th Day Worries by Margery Cuyler. Simon & Schuster, 2000.
How Much Is A Million? By David Schwartz. Greenwillow Books, 1993.
The 329th Friend by Marjorie W. Sharmat, Four Winds Press, 1992.
One Hundred Hungry Ants by Elinor Pinczes. Houghton Mifflin Company, 1995.
The 500 Hats of Bartholomew Cubbins by Dr. Seuss. Random House, 1989.
Math Curse by Jon Scieska. Viking, 1995.
Imogene's Antlers by David Small. Crown, 1985.
Domino Addition by Lynette Long. Charlesbridge, 1996.
Rooster's Off to See the World by Eric Carle. Simon & Schuster, 1997.
So Many Cats! by Beatrice Schenk. Houghton Mifflin, 1998.
Stone Soup by Marcia Brown. Simon & Schuster, 1997.
Always Room for One More by Sorche Leodhas. Henry Holt, 1995.
Bat Jamboree by Kathi Appelt. William Morrow, 1998.
The Relatives Came by Cynthia Rylant. Demco Media, 1993.
Too Many Tomales by Gary Soto. Putnam Publishing, 1996.
Erandi's Braids by Antonio Madrigal. Putnam Publishing, 1999.
Monster Math by Anne Miranda. Harcourt Brace, 1999.
Saturday Night at the Dinosaur Stomp by Carol Shields. Candlewick Press, 1997.
Fraction Action by Loreen Leedy. Holiday House, 1994.
Give Me Half by Stuart J. Murphy
Ed Emberley's Picture Pie by Ed Emberley. Little Brown, 1984.
Eating Fractions by Bruce McMillan. Scholastic, 1991.
Fraction Fun by David Adler. Holiday House, 1994.
Alexander Who Used To Be Rich Last Sunday by Judith Viorst. Atheneum, 1978.
Pigs Will Be Pigs by Amy Axelrod. Four Winds Press, 1994.
The Baker's Dozen by Aaron Shepard. Atheneum, 1995.
Benny's Pennies by Pat Brisson. Bantam Doubleday, 1993.
How the 2nd Grade Got \$8205.50 by Nathan Zimelman. Albert Whitman & Co., 1992
If You Made a Million by David Schwartz. Lothrop, Lee & Shepard, 1989.
A Chair For My Mother by Vera Williams. Greenwillow, 1982.
Irene and the Big, Fine Nickel by Irene Hector. Little Brown, 1996.
Jelly Beans for Sale by Bruce McMillan. Scholastic, 1996.

4.2 Geometry & Measurement

4.2 A Geometric Properties

Children identify plane shapes, solid shapes, congruent shapes, and shapes with symmetry.

Children count and record the number of sides and corners found on shapes created from toothpicks.

Children identify sides and vertices for plane shapes.

Children identify the number of faces, edges, and vertices for solid shapes.

Children create a museum of 3-D shapes from toothpicks and marshmallows and discuss the properties of each shape.

Given various shapes, children color symmetrical designs and patterns.

Children make a variety of kinds of triangles, beginning with three toothpicks and then using different numbers of toothpicks to create the sides.

Children create congruent shapes.

Children play a game of “I Spy” to improve their ability to give oral descriptions using geometric shapes.

Children go on a scavenger hunt around the classroom looking for geometric shapes.

Children draw a line of symmetry on each picture to show where they placed the mirror to create a complete letter or picture.

Children classify collectible objects as symmetrical or not symmetrical.

4.2 B Transforming Shapes

Children make tangrams.

Students use tangram pieces to construct triangles, rectangles, squares, and other shapes.

Students investigate which pattern block shapes can be formed from the equilateral triangles, recording their results in pictures and on a chart.

Students work in groups to decide how to divide a rectangular candy bar among four people. The students then compare the various ways that each group solved the problem.

4.2 C Coordinate Geometry

Students use maps of their community to find various ways to get from school to the park. They use letters and numbers to describe the location of the school and that of the park.

Students create a map based on the familiar story of *The Little Gingerbread Man*, showing where each of the people in the story lives.

Students describe how to get from one point in the school to another and try to follow each other's directions.

Children solve problems using logical reasoning.

Children locate positions on a grid using ordered pairs.

Children read, interpret, and make glyphs.

Children follow blueprints to draw a house to scale.

Children use body measurements to create self-portraits.

4.2 D Units of Measurement

Children order or graph the objects from tallest to shortest using actual measurements.

Children show actual sizes of animals using reference books, rulers, and yarn.

Children measure lengths in customary and metric units.

Children estimate and weigh the weight of objects.

Children convert capacity (cups, pints, quarts) in the customary system.

Children identify equivalent measures of capacity.

Children identify temperature.

Children read a thermometer.

Children choose the appropriate units of measure and the best measuring tool.

Children use measurement to solve a problem.

Children measure the amount of time needed to complete 4 tasks.

Children match digital and analog clocks.

Children tell time.

Children determine elapsed time.

Children solve problems involving elapsed time.

Children read and interpret calendars.

Children read and use a schedule.

4.2 E Measuring Geometric Properties

Children measure to find the perimeter of a figure.

Children roll number cubes to determine the height and width of a box and then construct it on a centimeter grid.

Children estimate and weigh film canisters filled with various items.

Children measure objects with nonstandard units.

Children make their own rulers.

LITERATURE CONNECTIONS

Color Zoo by Lois Ehlert. Harper Collins, 1989.

Grandfather Tang's Story by Ann Tompert. Crown Publishers, 1990.

Picture Pie 2 by Ed Emberly. Little, Brown & Co., 1996.

The Secret Birthday Message by Eric Carle. Harper Trophy, 1986.

The Shape of Things by Dayle Ann Dodds. Candlewick Press, 1994.

The Greedy Triangle by Marilyn Burns. Scholastic, 1994.

A Cloak for a Dreamer by Aileen Friedman. Scholastic, 1994.

Sea Shapes by Sue MacDonald. Gulliver Books, 1994.

Space Race by Bob Barner. Bantam Doubleday, 1995.

Look at Annette by Marion Walter. M. Evans and Company, 1971.

Clocks and More Clocks by Pat Hutchins. Macmillan, 1970.

8 O'clock by Jill Creighton. Scholastic, 1995.

The Grouchy Ladybug by Eric Carle. Harper Trophy, 1986.

Nine O'Clock Lullaby by Marilyn Singer. Harper Trophy, 1991.

Telling Time with Big Mama Cat by Dan Harper. Harcourt & Brace, 1998.

Time To... by Bruce McMillan. Lothrop, Lee & Shepard, 1989.

Pigs On A Blanket by Amy Axelrod. Simon & Schuster, 1996.

How Big Is A Foot? by Rolf Myller. Bantam Doubleday Dell Publishing Group Inc., 1990.

Inch by Inch by Leo Lionni. Astor House, 1960.

Is A Blue Whale the Biggest Thing There IS? By Robert E. Wells. Albert Whitman & Co., 1993.

Measuring Penny by Loreen Leedy. Henry Holt, 1997.

Mr. Archimedes' Bath by Pamela Allen. Harper Collins, 1994.

Weighing the Elephant by Ting-xing Ye. Annick Press, 1998.

The Tangram Magician by Lisa Campbell. Harry N. Abrams, 1990.

4.3 Patterns & Algebra

4.3 A Patterns

Using fabric pieces of their own design, children create patterned fashions.

Children extend a pattern.

Children trace a page of tessellations and then create and color their own designs.

Children create their own pattern quilt squares with construction paper shapes.

Children play a pattern guessing game.

Children create a row of objects by matching attributes.

Children sort classmates' photos using a Venn diagram.

Children find different ways to sort cereal.

4.3 B Functions & Relationships

Students study the pictures in *Anno's Math Games II* by Mitsumasa Anno. As they do, they try to figure out what happens to the objects as the elves put them into the magic machine. Sometimes the number of objects doubles, sometimes the objects grow eyes, and sometimes the objects turn into circles.

Students put numbers into *Max the Magic Math Machine* and read what comes out. (The teacher acts as Max.) Then they describe what Max is doing to each number. The teacher pays careful attention to the students' responses to assess their levels of understanding.

Students investigate a hole-making machine that puts 4 holes into buttons. They make a table that shows the number of buttons put into the machine and the total number of holes that must be made in them. Then they write a sentence that describes how the total number of holes changes as new buttons are added.

Students play *Guess my Rule*. The teacher gives them a starting number and the result after using the rule. She continues giving examples until students discover the rule.

Students count the number of pennies (or nickels) in 1 dime, 2 dimes, 3 dimes and record their results in chart form. They study the patterns and discuss the *rules* observed.

Students consider the cost of two or three candies if one candy costs one dime. They make a chart using the information.

Students count the number of lifesavers in an assorted pack. They make a table showing the number of each color and the total number in one pack. Then, assuming all of the

packs are the same, they make a table showing the total number of each color for 2 packs, 3 packs, 4 packs, and so on. They check their results with packs of lifesavers, which in general, have the same number of each color.

4.3 C Modeling

Children construct and solve open sentences (example: $3 + \blacksquare = 7$) that describe real life situations.

Students are given a bag with Unifix cubes. They are told that the bag and 2 cubes balance 7 cubes. They use a balance scale to find how many cubes are in the bag.

Children compare periods of time.

Children compare capacities.

Children identify and compare days, weeks, and months.

Children compare lengths.

Children use a schedule to solve real-life problems.

4.3 D Procedures

Students are given five computational problems to solve. They are permitted to use the calculator on only two of them. Two of the problems are related to another two by operation properties (e.g., $3 + 2$ and $4 + 6$ are related to $2 + 3$ and $6 + 4$ by the commutative property) and the last involves a property of number such as adding 0. Students share their thought processes in a follow up discussion.

The second grade teacher has a box containing slips of paper with open sentences such as $25 - 8 = \blacksquare$ or $15 + \blacksquare = 23$. Students draw out a slip and tell or write a story which would involve a situation modeled by the sentence.

Students discover that, since the order of the numbers when adding them is not important, they can solve a problem like $3 + 8$ by starting with 8 and counting up 3, as well as by starting with 3 and counting up 8.

In their math journals, students write their reactions to the following situation: *Sally just used her calculator to find out that $324 + 486$ was equal to 810. In another problem, she must find the answer to $486 + 324$. What should she do? Why?*

LITERATURE CONNECTIONS

The Amazing Books of Shapes by Lydia Sharman. Dorling-Kindersley, 1994.

The Boy and the Quilt by Shirley Kurtz. Good Books, 1991.

Eight Hands Round: A Patchwork Alphabet by Ann Paul. Harper Collins, 1991.

The Patchwork Quilt by Valerie Flourney. Scholastic, 1985.
Patterns by Ivan Bulloch. Thomson Learning, 1994.
Sam Johnson and the Blue Ribbon Quilt by Lisa Ernst. Lothrop, Lee, & Shepard, 1983.
The Crayon Counting Book by Pam Munoz. Charlesbridge, 1996
Billy's Button by Willian Accorsi. Greenwillow, 1992.
Caps for Sale by Esphyr Slobodkina. Harper & Row, 1947.
Jump, Frog, Jump by Robert Kalan. Greenwillow, 1981.
The Important Book by Margaret Brown. Harper & Row, 1949.
Jesse Bear, What Will You Wear? by Nancy Carlstrom. Macmillan, 1986.

4.4 Data Analysis, Probability, & Discrete Mathematics

4.4 A Data Analysis

Children record numerical data using tally marks.

Children interpret data in tables.

Children read, interpret, and make pictographs.

Children read and make bar graphs.

Children use data in a tally chart to make a graph.

Children identify range and mode of data sets.

Children represent the same data in more than one way.

Students collect objects such as buttons, books, blocks, counters, etc. which can be sorted by color, shape, or size. They classify the objects and color one square of a bar graph for each item using different colors for each category. Then they compare the categories and discuss the relationships among them.

As an assessment following activities such as the one described above, young students are given a sheet of picture stickers and a blank sheet of paper. They sort the stickers according to some classification scheme and then stick them onto the paper to form a pictograph showing the number in each category.

At the front of the room is a magnetic board and, for every child in the class, a magnet with that child's picture. At the start of each day, the teacher has a different question on the board and the children place their magnet in the appropriate area. It might be a bar graph tally for whether they prefer vanilla, chocolate or strawberry ice cream or a Venn diagram where students place their magnet in the appropriate area based on whether they have at least one brother, at least one sister, at least one of both, or neither.

Students survey their classmates to determine preferences for things such as food, flavors of ice cream, shoes, clothing, or toys. They analyze the data collected to develop a cafeteria menu or to decide how to stock a store.

Second graders record and graph the times of sunrise and sunset one day a week over the entire year. They calculate the time from sunrise to sunset, make a graph of the amount of daylight, and interpret these weekly results over the year.

A second grader, upset because she had wanted to watch a TV show the night before but had to go to bed instead, asks the teacher if the class can do a survey to find out when most children her age go to bed.

After collecting and sorting objects, children develop a pictograph or histogram showing the number of objects in each category.

Students design and make tallies and bar graphs to display data on information such as their birth months.

Students list all possible outcomes of probability experiments, such as tossing a penny, nickel, and dime together.

Working in cooperative groups, students are given six sheets of paper each containing an outline of a circle which has been divided into eight equal sectors. The students color each whole circle a different color and then cut their circles into individual sectors so each group has 8 sectors in each of 6 colors. Then they roll a die eight times keeping a tally of the results using orange for rolls of 1, blue for rolls of 2, and so on. They use these eight colored sectors to record their results in a circle graph, which they put aside. They repeat this twice and get two other circle graphs. Finally, as a whole class activity, they gather the circle graphs from all the groups, and rearrange the sectors to make as many solid color circles as they can. They discuss the results.

Students regularly read and interpret displays of data; they also read information from their classmates' graphs and discuss the differences in their results.

4.4 B Probability

Children experiment to see which number will appear most often when a number cube is tossed 25 times.

Children explore probability as they see how many blocks of each color they will use to build a structure.

Children predict and record the outcome of an event.

Children use tally marks to record the trials of a coin toss.

Children estimate total number of items in bag or jar.

Children compare the actual count to estimates they made.

Students roll a die, spin a spinner, or reach blindly into a container to select a colored marble, with replacement, a dozen times. They then color the appropriate square in a bar graph for each pick. *Did some results happen more often or less often than others? Do you think some results are more likely to happen than others?* They repeat the experiment, this time without replacement, and compare the results.

Students spill out the contents of cups containing five two-colored counters and record the number of red sides and the number of yellow sides. They perform the experiment twenty times, examine their data, and then discuss questions such as *Does getting four red sides happen more often than two red sides?* They explain their reasoning.

Each student has a 4-section spinner. Working in pairs, the students spin their spinners simultaneously and together they record whether they have a match. After doing this several times, they predict how many times they would have a match in 20 spins. Then they compare their prediction with what happens when they actually spin the spinners 20 times. They repeat the activity with a different number of equal sections marked on their spinners. Students in the second grade combine the results of all the students in the class, and compare their predictions with the class total.

Children roll a die ten times and record the number of times each number comes up. They combine their tallies and discuss the class results.

Children predict how often heads and tails come up when a coin is tossed. They toss a coin ten times and tally the number of heads and tails. *Are there the same number of heads and tails?* They combine their tallies and compare their class results with their predictions.

Children play traditional dreidel game.

4.4 C Discrete Mathematics- Listing & Counting

Students sort themselves by month of birth, and then within each group by height or birth date.

Each student is given a card with a different number on it. Students line up in a row and put the numbers in numerical order by exchanging cards, one at a time, with adjacent children. (After practice, this can be accomplished without talking.)

Students draw stick figures of members of their family and arrange them in order of size.

Students sort stuffed animals in various ways and explain why they sorted them as they did. Students can use the *Smart Board* to sort characters according to a variety of attributes.

Using attribute blocks, buttons, or other objects with clearly distinguishable attributes such as color, size, and shape, students develop a sequence of objects where each differs from the previous one in only one attribute.

Students use two Hula Hoops (or large circles drawn on paper so that a part of their interiors overlap) to assist in sorting attribute blocks or other objects according to two characteristics.

Students use teddy bear cutouts with, for example, shirts of two colors and shorts of three colors, and decide how many different outfits can be made. Students will make a list of all possibilities and arranging them systematically.

Students use paper faces or Mr. Potato Head type models to create a "regular face" given a nose, mouth, and a pair of eyes. Then they use another pair of eyes, then another nose, and then another mouth (or other parts) and explore and record the number of faces that can be made after each additional part has been included.

Students count the number of squares of each size (1 x 1, 2 x 2, 3 x 3) that they can find on the square grid below. They can be challenged to find the numbers of small squares of each size on a larger square or rectangular grid.

4.4 D Discrete Mathematics- Vertex, Edge, Graphs, & Algorithms

Students follow directions for a trip within the classroom - for example, students are asked where they would end up if they started at a given spot facing in a certain direction, took three steps forward, turned left, took two steps forward, turned right, and moved forward three more steps.

Students follow oral directions for going from the classroom to the lunchroom, and represent these directions with a diagram. (See K-2 Overview for a sample diagram.)

Students agree on a procedure for filling a box with rectangular blocks. For example, a box with dimensions 4"x4"x5" can be filled with 10 blocks of dimensions 1"x2"x4". (Linking cubes can be used to create the rectangular blocks.)

Students explore the question of finding the shortest route from school to home on a diagram laid out on the floor using masking tape, where students place a number of counters on each line segment to represent the length of that segment. (The shortest route will depend on the placement of the counters; what appears to be the most direct route may not be the shortest.)

Students play simple games and discuss why they make the moves they do. For example, two students divide a six-piece domino set (with 0-0, 0-1, 0-2, 1-1, 1-2, and 2-2) and take turns placing dominoes so that dominoes that touch have the same numbers and so that all six dominoes are used in the chain.

Students find a way of getting from one island to another laid out on the classroom floor with masking tape, by crossing exactly four bridges. They make their own graphs, naming each of the islands, and make a "from-to" list of islands for which they have found a four-bridge-route. (Note: it may not always be possible to find four-bridge-routes.)

Students count the number of edges at each vertex (called the **degree** of the vertex) of a network and construct graphs where all vertices have the same degree, or where all the vertices have one of two specified degrees.

On a pattern of islands and bridges laid out on the floor, students try to find a way of visiting each island exactly once; they can leave colored markers to keep track of islands already visited. Note that for some patterns this may not be possible!

LITERATURE CONNECTIONS

The M&M's Counting Book by Barbara McGrath. Charlesbridge Publishers, 1994.

A Three Hat Day by Laura Geringer. HarperCollins, 1985.

Hanukkah! by Roni Schotter. Little Brown, 1990.

Cloudy with a Chance of Meatballs by Judi Barrett. Atheneum, 1978.

Harriet's Halloween Candy by Nancy Carlson. Puffin Books, 1984.

Moira's Birthday by Robert Munsch. Annick Press, 1989.

Purple, Green and Yellow by Robert Munsch. Annick Press, 1992.

Chester's Way by Kevin Henkes. William Morrow, 1997.

The Little Red Hen by Philemon Sturges, 1999.

4.5 Mathematical Processes

4.5 A Problem Solving

Students write number sentences to solve problems.

Students identify unnecessary information in a word problem.

Students use patterns to solve problems.

Students interpret and solve problems with addition and subtraction.

Students use logical reasoning to solve a problem.

Students use a bar graph to solve a problem.

Students use data from a picture to solve problems.

Students use base-10 models to act out and solve problems.

Students use coins to act out problems.

Children use play money to act out paying and receiving change at a restaurant.

Children determine the coins needed to purchase items.

Children spend play money in classroom store.

Children make change.

Students solve 2-step problems using money.

Children create word problems from grocery store advertisements.

Students solve problems using data from a table.

Students use guess and check to solve problems.

Students identify, describe, and extend patterns.

Students use measurement to solve a problem.

Students use schedules to solve problems.

Students solve problems involving elapsed time.

Students choose the correct operation to solve a problem.

8.1 Technological Literacy

8.1 A Basic Computer Skills and Tools

www.eduplace.com- This is the Houghton Mifflin Mathematics website where textbook support materials and online computer review games.

www.themathworksheetsite.com- This web site will allow you to create printable math worksheets from your browser. (addition, subtraction, multiplication, division, mixed problems, fractions, measurement, fractions, graphing, telling time, and a one-hundred chart)

www.education.smarttech.com Training to show ways to customize the Smart Board to best fit teaching needs. Discover teacher created lesson activities, best practices, and tips for Smart Notebook software.

www.kenton.k12.ky.us Teachers can preview and download interactive integrated activities for use with the Smart Board to support math.

www.internet4classrooms.com -Helping teachers use the internet effectively and listing links for second grade mathematical skills and assessment assistance.

www.streamingdiscoveryeducation.com- Discovery Education *streaming* is a digital video-on-demand and online teaching service to help improve students' retention and test scores.

8.1 B Application of Productivity Tools

www.internet4classrooms.com- interactive and online practice games that are aligned to math standards.

Create your own tangrams using drag and drop shapes - just like Grandfather Tang's story. You may view a gallery of samples or just create on your own!

www.apples4theteacher.com

Click on the grid to draw one side of a square. Play against the computer. The object of the game is to be the player to complete the most squares. www.apples4theteacher.com

Color these interactive number charts to find patterns in numbers. Use them for counting exercises - counting by twos, fives, and tens. Also can be used as a multiplication visual aid. www.apples4theteacher.com

Students measure teddy bears in one half unit increments. For every correct answer, an animation will play. Scores are given as the game is played. www.apples4theteacher.com

Unlimited number of money problems randomly generated. Figure out how many coins are needed to make up the total dollar amount. www.apples4theteacher.com

Interactive math game that helps students find even numbers.

www.apples4theteacher.com

Students match a digital clock face to an analog clock to learn how to tell time. For every correct answer, an animation will play. Scores are given as the game is played.

www.apples4theteacher.com

INSTRUCTIONAL STRATEGIES:

Journal Writing

Problem of the Day
Cooperative Learning
Centers
Manipulatives
Trade Books
Overhead Projector
Transparencies
Technology
Problem Solving
Critical Thinking
Brainstorming
Reflective Thinking
Read, Write, Draw Word Problems
Teacher Presentations
Classroom Projects
Assessments
Role-Play
Games
Think-Pair-Share
Graphing
Graphic Organizers
Cross-Curricular Activities
Mini-lessons
Reproducibles & Templates
Shared Reading
Internet
Smart Board
Homework

EVALUATION/ASSESSMENT OF STUDENTS:

The following options are available for all activities:

FORMAL ASSESSMENT

Teacher made tests
End of unit tests
One to One task assessments
Performance checklists
Rubrics

INFORMAL ASSESSMENT

Cooperative group projects
Portfolios
Teacher Observations
Student work
Individual Conferences
Group Discussions

EVALUATION/ASSESSMENT OF CURRICULUM:

This course of study will be evaluated/assessed by instructional staff during the first year of implementation for the purpose of necessary revision at the end of the first year. In addition, this course of study will be reviewed according to the Five-Year Curriculum Review schedule (see attached).

RESOURCES/BIBLIOGRAPHY:

- * *Mathematics*. Houghton Mifflin, 2002.
- * *NJ Math Curriculum Framework*.
- * **National Standards Document: NJ Core Curriculum Content Standards.**
- * *Shoe Box Math Learning Centers* by Jacqueline Clarke. Scholastic, 2002.
- * *Teaching Math With Favorite Picture Books*. Scholastic, 1998.