CATHOLIC DIOCESE OF MEMPHIS

K – 8 Mathematics Academic Content

Standards and Indicators
with Educator Support

FOREWORD

The mission statement of the Catholic schools in the Diocese of Memphis is:

> The Catholic Diocese of Memphis, Tennessee, System of Catholic Schools is committed to quality education in the spirit of Christ in accordance with the teachings of the Roman Catholic Church. Working in partnership with parents and families, we are dedicated to providing a safe and nurturing environment while preparing our students for the future through spiritual, intellectual, physical, emotional and moral formation.

The above mission statement requires that each school provide relevant, meaningful, and quality instruction, not only in the Catholic religion, but also in all academic subjects.

In promoting the implementation of the mission statement, the Assistant Superintendent of Catholic Schools, Sr. Angela T. Lydon, SBS, PhD, researched current trends in education and developed a curricular process and plan to involve principals and teachers.

A volunteer committee of principals was formed to establish curricular parameters. Utilizing the research of professional educational organizations, the committee agreed on the following curricular guidelines. The curriculum would be: systemic, Gospel-based, standards-based, flexible, usable, and adaptable to the needs of individual schools. The principal's committee also suggested the adoption of academic content standards and indicators for all grade levels, PreK – 12. We are sincerely grateful to the following principals for the initial input:

Kathy Brooks, Richard Bush, Sr. Trudy Foster, Gail Fox, Denise Mason, Sr. Noelita McDermott, Darren Mullis, Richard Orians, Barbara Pettit, Jim Pohlman, Sr. Lynn Marie Ralph, Br. Mark Snodgrass, Karen Stimart, George Valadie, and Patricia Wyckoff.

Throughout the 2004-2005 academic school year, curriculum meetings were held at each school. The sessions detailed what curriculum is, how curriculum is developed, what process would be used, and general information about contemporary objectives in

curriculum. Soliciting input was foundational to the meeting structure. All were encouraged to volunteer for the initial core committee that would develop the curriculum during the summer.

The next step in the process was to choose the standards and indicators best suited to our needs. The standards and indicators developed by the State of Ohio for its PreK – 12 schools were selected. The Ohio State Academic Content Standards are coherent and rigorous. They provide a set of clear expectations for students and teachers and they are user-friendly for parents and others. The standards and indicators delineate expectations at each grade level and facilitate the integration of subjects during instruction. Even further, standards and indicators promote educational equity and opportunity for all students.

Developing a systemic curriculum is an enormous undertaking and requires the commitment, hard work, and dedication of skilled professionals who possess a strong knowledge-base in multiple disciplines. The present curriculum document is testimony to this reality and affirms the dedication of the Catholic school educators who gave freely of their time to align the standards, organizers, and grade-level indicators with realistic classroom instructional modes. We extend our deepest gratitude and appreciation to the dedicated educators of the Diocese of Memphis who gave of their time, energy, and expertise to undertake this curriculum project. We cannot thank them enough.

They are:

Jean Rae Bowers, Catherine Mary Brickhill, Alicia A. Brown, Maureen Conley, Sandra S. M. Dawkins, Sr. Judy Franz, SBS, Nancy Gronostaj, Teddi Niedzwiedz, Linda D. Padawer, Barbara Pettit, Susan S. Powell, Jennifer Styers, and Lou Tansey.

We also wish to thank **St. Benedict High School and Christian Brothers High School** for their assistance in helping us complete this project. They willingly shared expertise and resources with us. For their gracious and generous help, we are greatly indebted.

In August of 2005, elementary and middle schools received draft copies of the PreK – 8 language arts, mathematics, social studies, and science curricula. Grade-level meetings at each school were held in September and October. The purpose of these meetings was to explain the curricular format, answer any questions, and solicit input from the teachers and principals. A process for teacher and principal input to take place in the spring of 2006 was developed at these meetings.

During the 2005-2006 academic school year, a process for developing a standards-based curriculum for the high schools was formulated. High school chairpersons and teachers met to structure and plan a standards-based curriculum for required courses. At

present, a draft curriculum has been formulated and will be used during the 2006-2007 academic school year. Input and evaluation will be ongoing as part of the process. We are most grateful for the hard work and dedication of the high school teachers and thank each of them. We thank especially the following chairpersons:

Adrien Alsobrook, Betsy Baker, Sr. Mary Louis Baltz, OP, Cornelius Barnes, Sr. Mary Brigid Burnham, OP, Wesley Corzine, Annette Dabaldo, Jack Grannin, Eileen Huey, John Juniker, Frank Maranise, Loretta McGrail, Patsy Rush, Sam Sharpe, and Peggy Steffan.

The curriculum project of the Diocese of Memphis is truly in its beginning stages. More meetings will occur and more committees will be rallied. The ultimate goal of the project is to provide systemic academic content standards in all major areas of learning -- religion, math, language arts, science, social studies, technology, foreign language, speech, art, music, library and physical education. Agreed upon standards, organizers, and indicators guiding standards-based teaching plans and outcome reporting will change how we deliver instruction and how we assess learning.

As a living document, the curriculum of the Diocese of Memphis will continue to develop and evolve. Above all, it will challenge educators to rethink curriculum and more appropriately meet the needs of the community of children and families we serve in the Diocese of Memphis.

General Information

The following is general information which may be helpful in understanding our curriculum and the terminology used.

Standards are general statements of content that all students should know in order to be considered literate in a discipline or subject.
(In our curriculum document, the standards are in bold print and numbered in Roman Numerals)

Organizers categorize the standards; they break down the standards into smaller subgroups.
(In our curriculum document, organizers are italicized)

Indicators are grade-level specific statements of knowledge that all students should demonstrate at their particular grade level. Indicators serve as checkpoints; they monitor progress for each grade level.
(In our curriculum document, the indicators are numbered in Hindu-Arabic numbers)

The standards for language arts, mathematics, social studies and science are listed below.

Language Arts has 10 standards; Mathematics has 5 standards; Social Studies has 7 standards; and Science has 6 standards.

LANGAUGE ARTS STANDARDS
Phonemic Awareness, Word Recognition, & Fluency
Acquisition of Vocabulary
Reading Process: Concepts in Print, Comprehension Strategies, & Self-Monitoring Strategies
Reading Application: Informational, Technical, & Persuasive Text
Reading Application: Literary Text
Writing Process
Writing Application
Writing Convention
Research
Communication: Oral & Visual

MATH
Number, Number Sense, and Operations
Measurement
Geometry and Spatial Sense
Patterns, Functions, and Algebra
Data Analysis and Probability

SOCIAL STUDIES

History
People in Society
Geography
Economics
Government
Citizenship Rights
Social Studies Skills & Methods

SCIENCE
Earth & Space Science
Life Science
Physical Science
Science and Technology
Scientific Inquiry
Scientific Ways of Knowing

CONTENT STANDARDS

The content standards of the Catholic Diocese of Memphis describe essential concepts and skills for students to learn and do in the areas of English language arts, mathematics, social studies, and science. The standards and indicators serve as a framework for designing and implementing meaningful curricula and intentional learning experiences within all school settings. Based on research, these achievable indicators serve as checkpoints for the specific knowledge and the understandings and skills students can demonstrate as a result of their learning at the end of the school year. Therefore, educators must understand the range and scope of content represented by the indicators.

The **design of these standards**, which is the same for all grade levels, **is a continuum from which educators can implement curricula** – taking into account the wide variability of children's learning experiences, pace of learning, learning styles, knowledge, etc. – **to meet the needs of all students no matter where they fall on the continuum**. Educators must start with a very basic interpretation of the indicators which sometimes involves no more than exposure or introduction to a concept. Since **indicators are grade-appropriate and developmental**, a firm foundation is continually formed on which the educator can then build as the children's knowledge grows. The skilled educator adds detail and complexity to building children's knowledge as a higher level of interpretation of the indicators is explored in the curriculum. Through varied learning experiences and opportunities, **educators support individual children's construction of conceptual knowledge and skills along their developmental path of learning from the point of entry into the content toward the point of performance levels in the indicators.**

It is essential for any successful school program that educators work together in an effort to create a comprehensive and fluid curriculum from the standards. The purpose of this document is to assist educators in the design and implementation of meaningful curricula and intentional learning experiences and practices aligned to standards-based indicators. The list of strategies and ideas to support learners is not comprehensive but serves as a starting point for thoughtful curriculum design and teaching practices.

CATHOLIC DIOCESE OF MEMPHIS

MATHEMATICS STANDARDS for KINDERGARTEN

Students will	Educator can support organizer and indicator	Teacher notes

I. Number, Number Sense and Operations Standard *Number and Number Systems*		
1. Compare and order whole numbers up to 10.	• Singing and saying counting songs and rhymes that provide an order to whole numbers (e.g. 5 Little Monkeys, 10 Little Indians, Hey Bus Driver, Speed Up A Little Bit). • Modeling and providing access to interactive charts using quantity (e.g. 5 Green and Speckled Frogs). Demonstrate use of number by adding numbers to each frog and adding to the chart in order, "Here's where the number 1 frog goes"). • Reading counting books with children. • Modeling counting in appropriate situation (e.g. counting number of children in attendance, cups needed for snacks) • Counting, recognizing, modeling and naming one to ten and learn to write 1 to 10. • Connecting number words and numerals to the quantities they represent.	
2. Explain rules of counting, such as each object should be counted once and that order does not change the number.	• Providing multiple opportunities and variety of materials/manipulatives for counting (e.g. blocks collection of small things, materials with numerals, board games). • Listening and encouraging children's counting through out the day when appropriate (calendar, counting out cups, spoons,. body parts, and manipulatives). • Matching numbers to corresponding groups of objects.	
3. Count to twenty; e.g., in play situations or while reading number books.	• Using a number line to help with order of numbers and fill in missing numbers. • Solidifying children's knowledge of number 10 – 20 by ordering numbers 10 – 20. • Reading story: Counting Our Way to Maine; Bears at the Beach Counting 10-20.	
4. Determine "how many" in sets (groups) of 10 or fewer objects.	• Playing games that include either dice or spinner (with dots rather that numerals and interesting	

II. Measurement Standard *Measurement Units* 1. Identify units of time (day, week, month, year) and compare calendar elements; e.g., weeks are longer than days.	• Establishing and following a consistent daily routine. • Discussing classroom routines using language-related time. • Exploring how the day is divided into morning, afternoon, and evening periods. • Naming days of week and learn there are twelve months in a year. • Learning to find the name of month, the days, and dates on calendar. • Gauging time in terms of which activity takes more time or less time. • Ordering days of week and months of year using activity cards.	
Use Measurement Techniques and Tools 1. 2. Compare and order objects of different lengths, areas, weights and capacities; and use relative terms, such as longer, shorter, bigger, smaller, heavier, lighter, more and less.	• Comparing lengths and identify time with (e.g., long, longer, tall, taller, short, shorter). • Making comparisons by comparing objects side by side and indirect comparisons by using body measurements and string measurements. • Giving children opportunities to order objects by length. • Using the comparative and superlative forms of words: long, tall, short to compare two and three objects.	
3. Measure length and volume (capacity) using uniform objects in the environment. For example, find: a. how many paper clips long is a pencil;	• Exploring measurement by having children measure objects using non-standard units. • Providing and posing problem situations/questions, with a variety of materials that encourage use of non-standard.measurement tools (e.g., child's shoe or hand, large paper clips, blocks, string, yarn) the children select.	
b. how many small containers it takes to fill one big container using sand, rice, beans.	• Providing a variety of materials and containers in the sensory table to compare how much each holds (volume). • Developing common referents for measures to	

III. Geometry and Spatial Sense Standard *Characteristics and Properties*		
1. Identify and sort two-dimensional shapes and three-dimensional objects. For example:	• Providing materials for sorting and matching of shapes. • Using regularly shaped materials in small group. • Providing activities, center, various manipulative materials where children can explore, predict and reason about geometric ideas in their own vocabulary (e.g. find social and geometric shapes in snacks, finding shapes that match a given shape).	
a. Identify and describe two-dimensional figures and three-dimensional objects from the environment using the child's own vocabulary.		
b. Sort shapes and objects into groups based on student-defined categories.	• Sorting plane fingers to tell which do or do not belong to a designated set. • Placing shapes in bag and drawing from bag and by touch tell what shape was chosen and how they know.	
c. Select all shapes or objects of one type from a group.	• Using attribute blocks, children hold up blocks of same shape in two different sizes. • Reading, through song, "Please Draw One With Me", the students are encouraged to draw one in air or on paper as closed figures with appropriate straight sides and corners.	
d. Build two-dimensional figures using paper shapes or tangrams; build simple three-dimensional objects using blocks.	• Using attributes blocks, newsprint, rub blocks in different positions under newsprint, no matter how shape is positioned, its name stays the same. • Building and gluing (on paper), students use pre-cut shapes to form other 3 dimensional objects.	
Spatial Relationships		
2. Name and demonstrate the relative position of objects as follows:	• Selecting books that make use of "spatial" language (e.g., Going on a Bear Hunt: Inside, Outside, Upside Down).	
a. place objects over, under, inside, outside, on, beside, between, above, below, on top of, upside-down, behind, in back of, in front of;	• Providing materials (e.g. blocks, paper, pipe cleaners, and yarn) to shape and arrange by stacking, gluing, and building. • Providing opportunities for children to explore their	

V. Data Analysis and Probability Standard *Data Collection* 1. Gather and sort data in response to questions posed by teacher and students; e.g., how many sisters and brothers, what color shoes.	• Providing interesting materials for sorting and comparing (e.g. imitation vegetables, fruits, cubes bears etc.) • Playing games, such as "alike and different" where children describe and compare objects or pictures according to distinct attributes. • Reading and sharing stories, Five Creatures, to tell how two creatures or objects in pictures are alike or different. • Providing opportunities for responses to question about environmental situations, personal data, etc.	
2. Arrange objects in a floor or table graph according to attributes, such as use, size, color or shape.	• Using floor graph to compare objects. • Planning opportunities within real situations to explore graphing by creating floor and/or table graphs by arranging actual objects (e.g. voting for favorite kind of apples, after apple tasting activity) • Graphing scientific predictions (e.g. where pumpkins grow, on a vine, from a tree, underground? prior to seeing them on a trip to the pumpkin farm.	
Statistical Methods 3. Select the category or categories that have the most or fewest objects in a floor or table graph.	• Engaging children in discussions where graphing is a tool to collect class information as a voting mechanism to compare sets of the same or different objects and/or ideas (e.g., "Which flavor of ice cream is the favorite? How do most children come to school?)	

MATH EMATICS STANDARDS for GRADE 1

I. Number, Number Sense and Operations Standard

Students will	**Educator can support organizer & indicator**	**Teacher notes**

Number and Number Systems 1. Use ordinal numbers to order objects; e.g., first, second, third. 2. Recognize and generate equivalent forms for the same number using physical models, words and number expressions; e.g., concept of ten is described by "10 blocks," full tens frame, numeral 10, 5 + 5, 15 - 5, one less than 11, my brother's age. 3. Read and write the numerals for numbers to 100. 4. Count forward to 100, count backwards from 100, and count or backward starting at any number between 1 and 100. 5. Use place value concepts to represent whole numbers using numerals, words, expanded notation and physical models with ones and tens. For example: a. Develop a system to group and count by twos, fives and tens. b. Identify patterns and groupings in a 100's chart and relate to place value concepts. c. Recognize the first digit of a two-digit number as the most important to indicate size of a number and the nearness to 10 or 100. 6. Identify and state the value of a penny, nickel, dime, quarter and dollar. 7. Determine the value of a small collection of coins (with a total value up to one dollar) using 1 or 2 different type coins, including pennies, nickels, dimes and quarters. 8. Show different combinations of coins that have the same value. 9. Represent commonly used fractions using words and physical models for halves, thirds and fourths, recognizing fractions are represented by equal size parts of a whole and of a set of objects.	• Have a number line and hundreds chart posted visibly in the classroom and refer to it often. • Use essential hands-on manipulatives; for example: two sided counters, base ten blocks, beans, snap cubes or any other group of small things that can be counted. • Use children's literature to work on number sense. A few titles that would be appropriate are: Ten Black Dots by Donald Crews One Sun Rises by W. Hartmann 12 Ways to Get to 11 by Eve Merriam. • Practice counting skills daily in morning math activities. • Use a pocket chart which has 100's, 10's, and 1's to reinforce place value. Use small straws for each day of the week when you get a bundle of ten, move the bundle to the tens pouch. • Make rhythms or songs as you count to help the students remember the concept. • Have students work with baggies of real coins. Create a "store" in the classroom and have students "buy" items giving exact amounts. • Use the overhead and have students drop amounts of overhead coins on the surface. With dry erase boards have students count and write the amounts. • Have students work in groups to figure out all the ways they can create an amount of many. • Have students draw pictures of math stories.	

Meaning of Operations 10. Model, represent and explain addition as combining sets (part + part = whole) and counting on. For example: a. Model and explain addition using physical materials in contextual situations. b. Draw pictures to model addition. c. Write number sentences to represent addition. d. Explain that adding two whole numbers yields a larger whole number. 11. Model, represent and explain subtraction as take-away and comparison. For example: a. Model and explain subtraction using physical materials in contextual situations. b. Draw pictures to model subtraction. c. Write number sentences to represent subtraction. d. Explain that subtraction of whole numbers yields an answer smaller than the original number. 12. Use conventional symbols to represent the operations of addition and subtraction. 13. Model and represent multiplication as repeated addition and rectangular arrays in contextual situations; e.g., four people will be at my party and if I want to give 3 balloons to each person, how many balloons will I need to buy? 14. Model and represent division as sharing equally in contextual situations; e.g., sharing cookies. 15. Demonstrate that equal means "the same as" using visual representations.	• Practice putting beans, buttons, etc... in sets of 3's, 2's, and a variety of other size groups. • Model and verbalize for students the thinking process of deciding which math strategy to use. • Try to work from concrete (manipulatives) to drawing pictures, to memorizing and understanding the process. • Use morning math every day or math journals to practice the processes.	

Computation and Estimation 16. Develop strategies for basic addition facts, such as: a. counting all; b. counting on; c. one more, two more; d. doubles; e. doubles plus or minus one; f. make ten; g. using tens frames; h. identity property (adding zero). 17. Develop strategies for basic subtraction facts, such as: a. relating to addition (for example, think of 7 - 3 = ? as "3 plus ? equals 7"); b. one less, two less; c. all but one (for example, 8 - 7, 5 - 4); d. using tens frames; e. missing addends.	• Use snap cubes to solve addition and subtraction problems. • Drill basic facts daily. • Use dice for a center or partner activity. Students can make subtraction, and addition facts using the dice. Make sure they write a math sentence after rolling the dice. • Use beans, counters, or cubes and a cup. Have students randomly hide part of the set under a cup and have their partner figure out how many beans are hiding under the cup.	

II. Measurement Standard

Measurement Units 1. Recognize and explain the need for fixed units and tools for measuring length and weight; e.g., rulers and balance scales. 2. Tell time to the hour and half hour on digital and analog (dial) timepieces. 3. Order a sequence of events with respect to time; e.g., summer, fall, winter and spring; morning, afternoon and night.	• Brainstorm different ways to measure things using nonstandard units of measure. Have students estimate the length of their desks in paperclips then actually measure to see the accuracy of their estimates. • Have students create a chart that sequences one day of activity in their daily lives.	
Use Measurement Techniques and Tools 4. Estimate and measure weight using non-standard units; e.g., blocks of uniform size. 5. Estimate and measure lengths using non-standard and standard units; i.e., centimeters, inches and feet.	• Give students many opportunities to work with rulers, tape measures, and yard sticks.	

III. Geometry and Spatial Sense Standard

Characteristics and Properties 1. Identify, compare and sort two-dimensional shapes; i.e., square, circle, ellipse, triangle, rectangle, rhombus, trapezoid, parallelogram, pentagon and hexagon. For example: a. Recognize and identify triangles and rhombuses independent of position, shape or size; b. Describe two-dimensional shapes using attributes such as number of sides and number of vertices (corners or angles). 2. Create new shapes by combining or cutting apart existing shapes. 3. Identify the shapes of the faces of three-dimensional objects.	• Use children's literature to begin discussion on the different attributes of shapes. Read Triangle, Square, Circle by William Wegman. • Create a sorting center with solid and 2 dimensional shapes. • Have students create sculptures with solid shaped items such as paper towel rolls, toilet paper rolls, boxes, glue and tape. • Create a class quilt using a variety of shapes in each student's square. • Read with the students the book Shapes, Shapes, Shapes by Tana Hoban. • Play games for students. The teacher describes the attributes of a shape and students have to guess which one it is. • Have students bring from home an assortment of 3 D shaped items (i.e. cereal boxes, toilet paper rolls, cans, etc...) have the students sort the shapes.	
Spatial Relationships 4. Extend the use of location words to include distance (near, far, close to) and directional words (left, right). 5. Copy figures and draw simple two-dimensional shapes from memory.	• Use location and directional words to make imaginary treasure maps and adventures. • Find stencils and shapes for students to trace and create pictures.	

IV. Patterns, Functions and Algebra Standard

Use Patterns, Relations and Functions 1. Sort, classify and order objects by two or more attributes, such as color and shape, and explain how objects were sorted. 2. Extend sequences of sounds, shapes or simple number patterns, and create and record similar patterns. For example: a. Analyze and describe patterns with multiple attributes using numbers and shapes; e.g., AA, B, aa, b, AA, B, aa, b,… b. Continue repeating and growing patterns with materials, pictures and geometric items; e.g., XO, XOO, XOOO, XOOOO. 3. Describe orally the basic unit or general plan of a repeating or growing pattern.	• Collect little pieces of things and put them into bags. Have students select the bags and sort the items into groups. • Have students listen to songs or poetry. Have them label every change in rhythm or melody. • Expose students to working with a variety of patterns. Have them create growing patterns and have other students identify the rules that go along with the patterns. • Use hundreds charts to identify different patterns.	
Use Algebraic Representations 4. Solve open sentences by representing an expression in more than one way using the commutative property; e.g., 4 + 5 = 5 + 4 or the number of blue balls plus red balls is the same as the number of red balls plus blue balls (R + B = B + R). 5. Describe orally and model a problem situation using words, objects or number phrase or sentence.	• Use concrete examples and hands on items before students use math statements. • Create a play that is based on a mathematical problem.	

V. Data Analysis and Probability Standard

Data Collection 1. Identify multiple categories for sorting data. 2. Collect and organize data into charts using tally marks. 3. Display data in picture graphs with units of 1 and bar graphs with intervals of 1. 4. Read and interpret charts, picture graphs and bar graphs as sources of information to identify main ideas, draw conclusions, and make predictions. 5. Construct a question that can be answered by using information from a graph.	• Use Excel to create class data charts. (i.e., favorite foods, games, boys and girls, color of eyes etc.). • Give students a variety of opportunities to answer questions and analyze data based on a variety of different kinds of graphs and charts. • Graph the weather for the first 12 days of a month. • Have students sort items in a bag and then create a graph based on the numbers of each item.	
Statistical Methods 6. Arrange five objects by an attribute, such as size or weight, and identify the ordinal position of each object. 7. Answer questions about the number of objects represented in a picture graph, bar graph or table graph; e.g., category with most, how many more in a category compared to another, how many altogether in two categories.	• Make individual bags of Lucky Charms cereal. (do not put many pieces in each bag) Have students sort and graph the shapes. M & M's or skittles can be used as well. • Use exaggerated examples of the words more and fewer. Practice comparing amounts of things. • Use attribute blocks and have students sort shapes, graph them and create questions that cause the students to compare the amounts on the chart. • Practice visually comparing the bars on a bar graph.	
Probability 8. Describe the likelihood of simple events as possible/impossible and more likely/less likely; e.g., when using spinners or number cubes in classroom activities.	• Use spinners and number cubes to guess the likelihood that a certain answer will be correct.	

MATH EMATICS STANDARDS for GRADE 2

I. Number, Number Sense and Operations Standard

Students will	Educator can support organizer & indicator	Teacher notes

Number and Number Systems 1. Use place value concepts to represent, compare and order whole numbers using physical models, numerals and words, with ones, tens and hundreds. For example: a. Recognize 10 can mean "10 ones" or a single entity (1 ten) through physical models and trading games. b. Read and write 3-digit numerals (e.g., 243 as two hundred forty three, 24 tens and 3 ones, or 2 hundreds and 43 ones, etc.) and construct models to represent each. 2. Recognize and classify numbers as even or odd. 3. Count money and make change using coins and a dollar bill. 4. Represent and write the value of money using the ¢ sign and in decimal form when using the $ sign. 5. Represent fractions (halves, thirds, fourths, sixths and eighths), using words, numerals and physical models. For example: a. Recognize that a fractional part can mean different amounts depending on the original quantity. b. Recognize that a fractional part of a rectangle does not have to be shaded with contiguous parts. c. Identify and illustrate parts of a whole and parts of sets of objects. d. Compare and order physical models of halves, thirds and fourths in relation to 0 and 1.	• Practice with tens and ones. The teacher can try using healthy foods to stand for ones (examples: raisins, popcorn, oyster crackers) and try using healthy vegetables to stand for tens (celery sticks, carrot sticks, spinach). • Group unsure children with those who understand place value in 2 digit numbers. One child takes a handful of tens and places them on the work mat. The other child takes a handful of ones and places them on the work mat. Together, the children count the number of tens and ones, and record and say the number. • Use journal portfolio. • Make a healthy soup. Students sort the vegetables and write addition sentences. They can add vegetables with seeds or those grown underground. They cut up vegetables; cook the soup on a hot plate in the classroom and serve for eating purposes. • The students make up verses about vegetables to go with the song Old MacDonald Had a Farm. Each verse should tell an addition story. For example ….and on his farm he had some beets….EIEIO….with 3 beets here and 4 beets there….7 beets everywhere….EIEIO. • Make cards for + and = and a set of cards for 0-12 and 1-6. One student will use counters of each color to tell an addition story about picking yellow and red apples. Have the other child use the cards to show an addition fact for the story, horizontally and then vertically. Children place the word cards below or beside each addend and sum. Have children repeat this procedure.	

Meaning of Operations 6. Model, represent and explain subtraction as comparison, take-away and part-to-whole; e.g., solve missing addend problems by counting up or subtracting, such as "I had six baseball cards, my sister gave me more, and I now have ten. How many did she give me?" can be represented as 6 + ? = 10 or 10 - 6 = ?. 7. Model, represent and explain multiplication as repeated addition, rectangular arrays and skip counting. 8. Model, represent and explain division as sharing equally and repeated subtraction. 9. Model and use the commutative property for addition.	• Collect 12 worms (pipe cleaners) for flower box and use pipe cleaners to tell an addition story about how many worms went in the box. For example: Jack put 5 worms in the box;. Jill added 6 worms. How many worms went in the flower box? Encourage partners to take turns telling an addition story, modeling it with pipe cleaners, and writing it as a number sentence. • Have students stand in a circle. Call out a sum (from 5 to 10) and throw the ball to one child. Ask student to name an addition fact for the sum. (For the sum of 5, a child might say 3 +2). Then throw the ball to another child who names a different fact. When most facts have been named, change the sum. • Display a tomato or a picture of one and have children describe it. Explain that scientists classify tomatoes as fruits because they contain seeds, but most people call them vegetables. Divide the class into two teams. Give each team cutouts of tomatoes. Have teams write on the cutouts as many addition sentences as they can for sums of 6, 7, 8, and 9 within a given time. • Describe three events, such as eating a bowl of vegetable soup, picking vegetables, and cooking soup. Ask children to identify which event came first, next, and last. Number the steps 1, 2, and 3. Then have children choose a sequence of three events and order them.	

Computation and Estimation 10. Demonstrate fluency in addition facts with addends through 9 and corresponding subtractions; e.g., 9 + 9 = 18, 18 – 9 = 9. 11. Add and subtract multiples of 10. 12. Demonstrate multiple strategies for adding and subtracting 2- or 3-digit whole numbers, such as: a. compatible numbers; b. compensatory numbers; c. informal use of commutative and associative properties of addition. 13. Estimate the results of whole number addition and subtraction problems using front-end estimation, and judge the reasonableness of the answers.	• Show children a penny, a nickel, and a dime. Review the value of each coin. Provide pairs of children with an assortment of coins. Have one child select several coins and determine the value of the coins. Have the partner use a different arrangement of coins to show the same amount. Encourage children to then switch roles. • Give students groups of pennies, nickels and dimes in amounts up to 15 cents. Set up a store where they can buy pencils for 4 cents, erasers for 3 cents, paper for 5 cents, or crayons for 15 cents. Children can buy the items from the store, and then continue to buy and sell among themselves. Monitor the activity to watch for correct addition and subtraction. • Discuss the job of cashier and have children name different places in the community where cashiers work. Explore why it is important for a cashier to know the value of different coins. Then have children take turns playing the role of cashier, using pennies and dimes. • Give children handfuls of mixed coins that equal less than $1.00. Have them estimate the value of the coins and then check their estimate by determining the exact value. Encourage children to trade pennies for nickels and dimes whenever possible. • Discuss with children some occupations that involve handling money. Provide practice by giving pairs of children 2 pennies, nickels, dimes, and quarters. Place 2 nickels and 1 penny in your hand. Have children ask questions to name the coins. For example: is the value less than 20cents? Is one of the coins a dime? Is the value more than 10 cents? Have pairs eliminate coins as you answer. Repeat with other sets of coins. • Look through books and magazines to try to find pictures of coins used in the past.	

II. Measurement Standard

Measurement Units 1. Identify and select appropriate units of measure for: a. length – centimeters, meters, inches, feet or yards; b. volume (capacity) – liters, cups, pints or quarts; c. weight – grams, ounces or pounds; d. time – hours, half-hours, quarter-hours or minutes and time designations, a.m. or p.m. 2. Establish personal or common referents for units of measure to make estimates and comparisons; e.g., the width of a finger is a centimeter, a large bottle of soda pop is 2 liters, a small paper clip weighs about one gram. 3. Describe and compare the relationships among units of measure, such as centimeters and meters; inches, feet and yards; cups, pints and quarts; ounces and pounds; and hours, half-hours, and quarter-hours; e.g., how many inches in a foot?	• Measure 3 items with a centimeter ruler and put base-ten units on a graph to indicate the length in centimeters of each. • Work in groups to measure each other's arm from wrist to elbow, head from chin to top, using connecting cubes. • Give students 2 classroom objects to measure with small paper clips. One child estimates the object's length in small paper clips and writes the estimate down. The other child measures the object with small papered clips. Children compare numbers. They repeat the process using large paper clips and reversing their roles. • Measure using craft sticks the length of a book or folder. Students estimate how many craft sticks they will need and use the craft sticks to measure the length and check their estimates. Pairs will estimate and measure the height of a bookcase or shelf from top to bottom. Pairs continue estimating and measuring other classroom objects. • Give each student a name tag and chalk. Teacher will tape a starting line onto the floor. Invite children to take turns standing at the starting line and then jump as far as possible. Children will use the chalk to mark where they landed and then measure the distance with a tape measure. Each child then places his or her name tag to the side of the spot where he or she landed. • Measure things in the classroom using either their thumbs or their feet. • Work in pairs to look at weights. Teacher will provide bean bags or actual half-pound or one pound weights. Each child chooses 2 items and decides which item is heavier and which is lighter. Then he or she lifts the heavier item 5 times in each hand. • Cut out ads from newspaper and	

Use Measurement Techniques and Tools 5. Estimate and measure the length and weight of common objects, using metric and U.S. customary units, accurate to the nearest unit. 6. Select and use appropriate measurement tools; e.g., a ruler to draw a segment 3 inches long, a measuring cup to place 2 cups of rice in a bowl, a scale to weigh 50 grams of candy. 7. Make and test predictions about measurements, using different units to measure the same length or volume.	• Sort classroom objects by the tool they will use to measure them. Students record the measurement of each item in a table. • Work in groups to estimate and measure length. Students gather pens, pencils, crayons, and other objects. They arrange the objects from shortest to longest and estimate the length of each object in centimeters. Then, they measure each object and compare the actual measurements with the estimates. • Make measurement posters. Students draw or attach pictures of measurement tools and underneath each picture they will write the name of the tool and the units that it measures. • Create riddles that involve measurements.	

III. Geometry and Spatial Sense Standard

Characteristics and Properties 1. Identify, describe, compare and sort three-dimensional objects (i.e., cubes, spheres, prisms, cones, cylinders and pyramids) according to the shape of the faces or the number of faces, edges or vertices. 2. Predict what new shapes will be formed by combining or cutting apart existing shapes. 3. Recognize two-dimensional shapes and three-dimensional objects from different positions.	• Describe and draw shapes and common objects. • Take space shapes to make a building. • Think of different places where certain shapes have been seen; list the shapes and places. • Write riddles about space shapes. • Draw space shapes on index cards. Concentration is the game. • Use pattern blocks in pairs and work together to make at least 2 animals. After completion, students show and tell. They make animals using different shapes. • Give a set of pattern blocks to students. The children begin sorting the blocks into groups with the same number of sides. The group that finishes first wins. • Use GeoBoards • Walk outdoors to look for congruent objects or two objects that have the same size and shape. Children will collect objects from nature such as leaves, rocks or twigs. They list the objects they found and draw a picture of it. • Use the computer to create a program to make a rectangle or triangle. Students move the images together to create shapes that have equal parts. • Use masking tape to create a grid on the classroom floor. Students brainstorm ways that a child could be directed to stand in a specific location on the grid. Another child might number the boxes. Each method will be tested after a child suggests it. Discussion will focus on ways that is most efficient.	

Spatial Relationships 4. Identify and determine whether two-dimensional shapes are congruent (same shape and size) or similar (same shape different size) by copying or using superposition (lay one thing on top of another).	• Draw small shapes, such as circles, squares or triangles on a piece of paper. They are to draw between 20 and 100 shapes. Pairs are to count their shapes and write the totals on the back of their papers. Have pairs exchange papers. Children can guess how many shapes the other pair drew, then check their guesses by looking at the number on the back of the drawing. Children may wish to circle one or more groups of ten to them make a better guess. As time permits, have children exchange pictures with other pair.	
Transformations and Symmetry 5. Create and identify two-dimensional figures with line symmetry; e.g., what letter shapes, logos, polygons are symmetrical?	• Look at cutout letters and say which letters are symmetrical. They can color the lines that show symmetry with the same color crayon.	

IV. Patterns, Functions and Algebra Standard

Use Patterns, Relations and Functions 1. Extend simple number patterns (both repeating and growing patterns), and create similar patterns using different objects, such as using physical materials or shapes to represent numerical patterns. 2. Use patterns to make generalizations and predictions; e.g., determine a missing element in a pattern. 3. Create new patterns with consistent rules or plans, and describe the rule or general plan of existing patterns.	• Create number patterns involving four 3-digit numbers. Children exchange patterns, write the next 3 numbers in the pattern and describe the pattern in words. • Take a nature walk to look for patterns in nature. Children should find patterns in leaves, tree barks, or plants. Have each child take one leaf back to the classroom. Children are to examine vein patterns in leaves with a hand lens and identify some common patterns. They are to draw two patterns to share with the class. • Select 5 students to form a row of five chairs and select five children to sit in them. Give four children each a number card to hold up so that the numbers form a pattern with a missing number. The first child who guesses the missing number gets the number cards and directs the five children in the formation of a new pattern. • Follow the pattern. Children will work with a partner and create patterns of three digit numbers, each with a missing number. Have pairs challenge their classmates to find the patterns and the solutions. • Collect drums and other percussion instruments. Model a rhythm pattern by playing a drum. Repeat several times and have children describe the pattern they hear, telling the number of drum beats. Then distribute percussion instruments to children and have them make up and play their own rhythm patterns while others describe the patterns.	

Use Algebraic Representations 4. Use objects, pictures, numbers and other symbols to represent a problem situation. 5. Understand equivalence and extend the concept to situations involving symbols; e.g., 4 + 5 = 9 and 9 = 4 + 5, and 4 + 5 = 3 + 6 = Δ + □… 6. Use symbols to represent unknown quantities and identify values for symbols in an expression or equation using addition and subtraction; e.g., □ + O = 10, Δ - 2 = 4.		
Analyze Change 7. Describe qualitative and quantitative changes, especially those involving addition and subtraction; e.g., a student growing taller versus a student growing two inches in one year.		

V. Data Analysis and Probability Standard

Data Collection 1. Pose questions, use observations, interviews and surveys to collect data, and organize data in charts, picture graphs and bar graphs.	• Pair children of different ages. Have them take a survey of classmates on favorite sports and make a bar graph showing survey results. • Use student journal.	
2. Read, interpret and make comparisons and predictions from data represented in charts, line plots, picture graphs and bar graphs.	• Tape to the wall a piece of brown craft paper showing measurements in inches. Explain to children that they are going to measure their heights. Show children how to mark their heights on the Kraft paper. As they measure, tally the results on .the chalkboard. Then help children to use the measurements to make a bar graph. • Prepare a table on chart paper, on which you list the children's favorite fruits. As you name each fruit, have children raise their hands if it is their favorite. Help volunteers tally the results and make a graph. Then invite children to tell subtraction problems based on the table or graph and to solve the problem.	
3. Read and construct simple timelines to sequence events.	• Write three classroom activities that took place earlier in the day in random order. Then have the children draw pictures of the activities and put them in order to make a time line. • Make a birthday time line. • Make a decorative time line of the special days in the year.	

Statistical Methods 4. Write a few sentences to describe and compare categories of data represented in a chart or graph, and make statements about the data as a whole. 5. Identify untrue or inappropriate statements about a given set of data. 6. Recognize that data may vary from one population to another; e.g., favorite TV shows of students and of parents.		
Probability 7. List some of the possible outcomes of a simple experiment, and predict whether given outcomes are more, less or equally likely to occur. 8. Use physical models and pictures to represent possible arrangements of 2 or 3 objects.		

MATH EMATICS STANDARDS for GRADE 3

I. Number, Number Sense and Operations Standard

Students will	Educator can support organizer & indicator	Teacher notes
Number and Number Systems 1. Identify and generate equivalent forms of whole numbers; e.g., 36, 30 + 6, 9 x 4, 46 - 10, number of inches in a yard. 2. Use place value concepts to represent whole numbers and decimals using numerals, words, expanded notation and physical models. For example: a. Recognize 100 means "10 tens" as well as a single entity (1 hundred) through physical models and trading games. b. Describe the multiplicative nature of the number system; e.g., the structure of 3205 as 3 x 1000 plus 2 x 100 plus 5 x 1. c. Model the size of 1000 in multiple ways; e.g., packaging 1000 objects into 10 boxes of 100, modeling a meter with centimeter and decimeter strips, or gathering 1000 pop-can tabs. d. Explain the concept of tenths and hundredths using physical models, such as metric pieces, base ten blocks, decimal squares or money. 3. Use mathematical language and symbols to compare and order; e.g., less than, greater than, at most, at least, <, >, =, $\leq$, $\geq$. 4. Count money and make change using coins and paper bills to ten dollars. 5. Represent fractions and mixed numbers using words, numerals and physical models. 6. Compare and order commonly used fractions and mixed numbers using number lines, models (such as fraction circles or bars), points of reference (such as more or less than 1/2), and equivalent forms using physical or visual models. 7. Recognize and use decimal and fraction concepts and notations as related ways of representing parts of a whole or a set; e.g., 3 of 10 marbles are red can also be described as 3/10 and 3 tenths are red.	• Hundred Charts. • Physical Models for Number sense such as coffee stirrers, counters, pop-can tabs, M&Ms, lifesavers for modeling tens, hundreds, thousands. • Place Value Charts. • Trading games with counters, chips etc. to show 10 tens as 100 etc. • Physical models to package in bundles of ten (-coffee stirrers, unit blocks, ten strips, hundred mats). • Base ten blocks. • Metric Pieces, centimeter and decimeter strips, Geometric Shape Blocks, decimal squares and money for metric system. • Use association of familiar objects to teach < or >. (Alligator's Mouth, Packman eating smaller number etc.). • Play money and coins, pretend stores, cash registers, pictures or objects to be purchased to learn value of money. • Physical models, such as pizza puzzle pieces, models such as fraction circles or bars to teach fractions. • Geometric shape blocks that can be divided into parts. • Put students in groups; they fold a piece of paper into parts. Shade parts and write fraction for parts. Pairs compare drawings to find identical and equivalent fractions.	

Meaning of Operations 8. Model, represent and explain multiplication; e.g., repeated addition, skip counting, rectangular arrays and area model. For example: a. Use conventional mathematical symbols to write equations for word problems involving multiplication. b. Understand that, unlike addition and subtraction, the factors in multiplication and division may have different units; e.g., 3 boxes of 5 cookies each. 9. Model, represent and explain division; e.g., sharing equally, repeated subtraction, rectangular arrays and area model. For example: a. Translate contextual situations involving division into conventional mathematical symbols. b. Explain how a remainder may impact an answer in a real-world situation; e.g., 14 cookies being shared by 4 children. 10. Explain and use relationships between operations, such as: a. relate addition and subtraction as inverse operations; b. relate multiplication and division as inverse operations; c. relate addition to multiplication (repeated addition); d. relate subtraction to division (repeated subtraction). 11. Model and use the commutative and associative properties for addition and multiplication.	• Use counter, beans, coins etc. to show X as repeated addition. • Hundred Charts, Colored Tiles for Skip Counting. • Counters, Chips, Beans to form arrays. • Find everyday objects in arrays—ceiling tiles, windows, bookshelves, etc. • Use number line to explain multiplication as repeated addition and division as repeated subtraction. • Use number families to show relationship between inverse operations. • Frames with number spaces to relate addition-subtraction and multiplication-division. • Use counters to explore remainders in division. • Use cooperative learning to write problems to trade. (Some in which remainder is ignored, some in which it is rounded up, and one in which it is the answer).	

Computation and Estimation 12. Add and subtract whole numbers with and without regrouping. 13. Demonstrate fluency in multiplication facts through 10 and corresponding division facts. 14. Multiply and divide 2- and 3-digit numbers by a single-digit number, without remainders for division. 15. Evaluate the reasonableness of computations based upon operations and the numbers involved; e.g., considering relative size, place value and estimates.	• Use counters or other manipulatives to show commutative property of addition and multiplication. • Draw pictures of objects in groups and use arrays to demonstrate commutative properties. • Use index cards with numbers .Students separate cards into groups of three numbers equaling a certain sum. Share groupings to demonstrate associative properties. • Use spinners to spin 4 numbers and add them in different order to demonstrate associative property. • Base 10 blocks, counters or other manipulatives to add and subtract. • Colored tiles, colored counters with place value charts to show regrouping. • Use coffee stirrers, M&Ms, etc., to demonstrate columns with regrouping. • Develop fluency in multiplication facts by using records, tapes, CD's, flashcards, hidden pictures, codes, bingo games, wrap up strings and other teacher generated drill tools. Math Programs such as Accelerated Math or Rocket Math, SRA, timed tests to monitor rate of fluency. • Have a daily, weekly, monthly or end of the year reward chart or program to reward progress in rate of fluency, such as ice cream sundae party where mastery of each multiplication table earns a different topping for ice cream sundae. • Use spinners to spin 3 numbers and write as many 2 digits by one digit multiplication exercises as possible in 2 minutes. Partners trade exercises. • Use objects in a jar for estimations and reasonable guesses of amounts. • Daily basic math drills.	

II. Measurement Standard

Measurement Units 1. Identify and select appropriate units for measuring: a. length – miles, kilometers and other units of measure as appropriate; b. volume (capacity) – gallons; c. weight – ounces, pounds, grams, or kilograms; d. temperature – degrees (Fahrenheit or Celsius). 2. Establish personal or common referents to include additional units; e.g., a gallon container of milk; a postage stamp is about a square inch. 3. Tell time to the nearest minute and find elapsed time using a calendar or a clock. 4. Read thermometers in both Fahrenheit and Celsius scales.	• Have groups pose capacity questions, such as "How much water in a swimming pool?" and select unit of measurement. • Use familiar objects to illustrate common units of measurement such as a postage stamp for square inch, gallon container of milk, etc. • Measure areas around school to illustrate inches, feet, yards, miles. • Pour liquids into a variety of containers (cups, quarts, gallons) to illustrate liquid measurement). • Use containers filled with objects such as pompoms etc. to teach capacity. • Bring in a variety of scales to measure weight (ounces, pounds, grams and kilograms). • Make paper or cardboard thermometers and use a sliding elastic strip colored red for temperature. • Use information from the Internet to compare temperatures of different cities. • Use newspapers to locate their town's temperature in degrees Fahrenheit and Celsius. • Run a certain distance and time each other with stop watches to teach elapsed time. • Make paper clocks fastening hands with a brad to use to teach time. • Keep a time journal of before and after school schedule and write the times using words and numbers. • Create a class schedule of times for their school day. • Generate questions about elapsed time from their schedules (e.g., How much time is there from lunch until we go home?). • Construct a calendar for the current month with their activities for that month written in and then trade with another student. Students ask each other questions about calendar time (e.g.,	

Use Measurement Techniques and Tools 5. Estimate and measure length, weight and volume (capacity), using metric and U.S. customary units, accurate to the nearest $\frac{1}{2}$ or $\frac{1}{4}$ unit as appropriate. 6. Use appropriate measurement tools and techniques to construct a figure or approximate an amount of specified length, weight or volume (capacity); e.g., construct a rectangle with length $2\frac{1}{2}$ inches and width 3 inches, fill a measuring cup to the $\frac{3}{4}$ cup mark. 7. Make estimates for perimeter, area and volume using links, tiles, cubes and other models.	• Display a variety of objects and ask students to estimate length to nearest one half to one fourth inch. • *Provide a variety of scales to measure weight of various objects. • Invite guest speakers from Bureau of Weights and Measures to speak to the students about weights, measures and careers in this field. • Use yarn, links, Lincoln logs, toothpicks, craft sticks to measure and teach about perimeter. • Use stacking cubes, Legos, vanilla wafers or other stackable objects to teach about area. • Use different types of containers with objects such as pompoms for teaching volume.	

III. Geometry and Spatial Sense Standard

Characteristics and Properties 1. Analyze and describe properties of two-dimensional shapes and three-dimensional objects using terms such as vertex, edge, angle, side and face. 2. Identify and describe the relative size of angles with respect to right angles as follows: a. Use physical models, like straws, to make different sized angles by opening and closing the sides, not by changing the side lengths. b. Identify, classify and draw right, acute, obtuse and straight angles.	• Construct a class mural using all geometric shapes and different size angles. • Bring in a local artist to tell students how geometry, shapes and angles are important in art. • Take a trip to the local Art Museum with a study guide to find certain shapes, angles in the art work. • Contact a local quilting group to come to the classroom to tell about the processes involving making a quilt and the importance of shapes, angles, etc. in the finished product. • Use Geo Boards to construct angles. • Use straws to construct right, acute and obtuse angles. • Give students pictures of buildings to find shapes, angles. • Ask an architect to come and speak to the class about how shapes and angles fit into building design.	

Spatial Relationships 3. Find and name locations on a labeled grid or coordinate system; e.g., a map or graph.	• Make a floor grid with masking tape. Label axis 0-6. Place objects on points on the grid. Name an ordered pair and ask students to find the object. • Create shapes on geoboards and write ordered pairs to plot the shapes. Give papers to a friend to plot on grid paper. • Make a floor grid with masking tape. Label each axis 0-6. Name an ordered pair and have students walk along the grid to location named. • Draw a town/city map on grid paper and devise a tour by having ordered pairs to stop and see. Have a friend take the tour and find the places. • Use graph paper to plot ordered pairs. • Use different areas of the school or playground to plot certain objects in ordered pairs.	
Transformations and Symmetry *4.* Draw lines of symmetry to verify symmetrical two-dimensional shapes.	• Use butterflies to teach symmetry. • Fold construction paper in half and draw familiar objects such as hearts or snowflakes on the fold. Open fold and look at figure to teach symmetry. • Have students brainstorm a list of living things in the natural world that share a symmetrical pattern (e.g. leaves, flower petals).	
Visualization and Geometric Models 5. Build a three-dimensional model of an object composed of cubes; e.g., construct a model based on an illustration or actual object.	• Use connecting cubes, craft sticks, legos or straws to construct a three dimensional model based on an illustration or actual object.	

IV. Patterns, Functions and Algebra Standard

Use Patterns, Relations and Functions 1. Extend multiplicative and growing patterns, and describe the pattern or rule in words. 2. Analyze and replicate arithmetic sequences with and without a calculator. 3. Use patterns to make predictions, identify relationships, and solve problems.	• Use hundreds charts with highlighters to identify number patterns. • Use two colored counters and paper cups to create patterns by placing different numbers of counters in each cup. Record the patterns they make by writing the number of counters in each cup. Share their patterns. Predict the next step of the other student's patterns. • Use different colored objects such as marbles, counting bears, M&Ms to create patterns, trade with other student and predict next step in pattern.	
Use Algebraic Representations 4. Model problem situations using objects, pictures, tables, numbers, letters and other symbols. 5. Write, solve and explain simple mathematical statements, such as $7 + \square > 8$ or $\Delta + 8 = 10$. 6. Express mathematical relationships as equations and inequalities.	• Create, exchange and solve each other's problems using simple mathematical statements and using symbols such as triangle, square for missing numbers. • Use place value charts to compare numbers. • Use an almanac or road atlas to research populations of four cities in TN and list the populations from least to greatest. • Compare and order distances from their city to other cities in their state. • Use toy store advertisements to choose five favorite toys, listing them from least expensive to most expensive.	
Analyze Change 7. Create tables to record, organize and analyze data to discover patterns and rules. 8. Identify and describe quantitative changes, especially those involving addition and subtraction; e.g., the height of water in a glass becoming 1 centimeter lower each week due to evaporation.	• Create tables of information from class polls, such as favorite vacation spot, favorite recess activity, etc. • Have students make their own tables and exchange them to analyze data to discover patterns. • Use science experiments to study quantitative changes, such as growth of a plant or evaporation.	

V. Data Analysis and Probability Standard

Data Collection 1. Collect and organize data from an experiment, such as recording and classifying observations or measurements, in response to a question posed. 2. Draw and interpret picture graphs in which a symbol or picture represents more than one object. 3. Read, interpret and construct bar graphs with intervals greater than one. 4. Support a conclusion or prediction orally and in writing, using information in a table or graph. 5. Match a set of data with a graphical representation of the data. 6. Translate information freely among charts, tables, line plots, picture graphs and bar graphs; e.g., create a bar graph from the information in a chart. 7. Analyze and interpret information represented on a timeline.	• Invite students to collect data about their classmates. (e.g., color of their eyes).Ask students to decide how to collect, organize and analyze the data. They might use pictograph or bar graph. Have students analyze data in various ways. • Have students construct their own pictograph with a symbol standing for more than one of the object. • Connect science with graphing by using information in science text to graph using bar graphs, tables, and pictographs. • Have students find some information that can be put into a chart, table, line plots, picture graphs, bar graphs and compare the different interpretations of the data.	

Statistical Methods 8. Identify the mode of a data set and describe the information it gives about a data set.	• Draw a timeline of the previous school day. • Have students use the reference section of the school library to find books that use timelines. • List some books in chronological order according to publication year. Plot the years on a reference book time line. • Have the students make a timeline showing the date each of the 13 colonies was formed. • Give the students paper with empty horizontal cartoon strips and ask them to write a date over each box. • Invite students to make a timeline of their lives including special events in their life.	
Probability 9. Conduct a simple experiment or simulation of a simple event, record the results in a chart, table or graph, and use the results to draw conclusions about the likelihood of possible outcomes. 10. Use physical models, pictures, diagrams and lists to solve problems involving possible arrangements or combinations of two to four objects.	• Use dice, spinners, colored tiles, M&M's to record results of color chosen or number rolled in a table or graph and draw conclusions about the likelihood of possible outcomes. • Graph the results of samples chosen using a bag of different colored noodles. Draw conclusions of the likelihood of possible outcomes • Get some menus from local restaurants and have students come up with different combinations of appetizers, main dish and desserts. • Graph information from the cafeteria on ice cream products or snacks sold (or items in packed lunches) and find the most frequent (mean)	

MATHEMATICS STANDARDS for GRADE 4

Students will	Educator can support organizer & indicators	Teacher notes
I. Number, Number Sense and Operations Standard *Number and Number Systems* 1. Identify and generate equivalent forms of fractions and decimals. For example: a. Connect physical, verbal and symbolic representations of fractions, decimals and whole numbers; e.g., $\frac{1}{2}$, $\frac{5}{10}$, "five tenths," 0.5, shaded rectangles with half, and five tenths. b. Understand and explain that ten tenths is the same as one whole in both fraction and decimal form.	• Create bulletin board with visual models of the current taught indicators. • http://math.rice.edu/~lanius/fractions/index.html This site has six lesson activities, including the definition of a fraction, equivalent fractions, addition of fractions, and multiplication of fractions. • Model equivalent fractions using overhead • Use one layer of pattern blocks to find equivalent fractions by exactly covering a hexagon block with the other red, green and blue pattern blocks. • Use graph paper, draw rectangles that model equivlancy of fractions and decimals.	
2. Use place value structure of the base-ten number system to read, write, represent and compare whole numbers through millions and decimals through thousandths.	• Use place value chart as necessary • Given numbers written on construction paper have students order the card being held or use comparison signs such as <,> or = .	
3. Round whole numbers to a given place value.	• Find your number (find the place you're rounding to -- tens, hundreds, etc. & underline it). Look RIGHT next door (look one place to the RIGHT) -- 4 or lower, just ignore (if that digit is 4 or lower, it stays the same); 5 or higher, add one more (if that digit is 5 or higher, the digit underlined increases by 1). Sounds complicated, but once you work through it 1 time or 2 times, they've got it.	

II. Measurement Standard *Measurement Units* 1. Relate the number of units to the size of the units used to measure an object, e.g., compare the number of cups to fill a pitcher to the number of quarts to fill the same pitcher.	• http://illuminations.nctm.org/index_d.aspx?id=194 Students do some mathematics in preparation for making brownies. They consider the inverse relationship between the base area of two different sizes of cake pans and the thickness of the same volume of batter poured into each pan. They also consider ways of cutting the brownies into various numbers of equal pieces by folding paper that matches the base of each pan.	
2. Demonstrate and describe perimeter as surrounding and area as covering a two-dimensional shape, and volume as filling a three-dimensional object	• http://illuminations.nctm.org/index_d.aspx?id=240 Students explore how variations in the shape, color, and other characteristics of solar collectors affect the energy absorbed. Students make rectangular prisms that have the same volume but different linear dimensions. After measuring the volume of several boxes with unit cubes, they develop the formula for the volume of a rectangular prism. They consider several other factors besides shape in experimenting to see what kind of solar collector is most efficient. This lesson is a nice integration of mathematics and science.	
Use Measurement Techniques and Tools 3. Identify and select appropriate units to measure: a. perimeter – string or links (inches or centimeters). b. area – tiles (square inches or square centimeters). c. volume – cubes (cubic inches or cubic centimeters).	• http://illuminations.nctm.org/index_d.aspx?id=509Students brainstorm all the terms they can think of that relate to measurement. Working in pairs, they sort the terms into categories of their own choosing. The whole class discusses and reaches consensus on a single list of categories. Students then write brief sentences about what they know about each term. This activity provides a warm-up and pre-assessment of students'	

III. Geometry and Spatial Sense Standard *Characteristics and Properties*		
1. Identify, describe and model intersecting, parallel and perpendicular lines and line segments; e.g., use straws or other material to model lines.	• Create a bingo card with basic geometry picture models. • Have students draw an orignial pictue (eg, a flag or simple boat) using only line segmnets. Have them label each end point. Display the drawings. • http://illuminations.nctm.org/index_d.aspx?id=270 This game requires students to classify polygons according to more than one property at a time. Students identify shapes whose sides and angles satisfy specified criteria, and in so doing, move from a simple description of shapes to an analysis of how properties are related. Game cards and templates for shapes are provided. A list of references and several Internet extensions are also included.	
2. Describe, classify, compare and model two- and three-dimensional objects using their attributes.	• Have students use dot paper to draw and label figures with intersecting, parallel, and perpindicular lines. Ask them to write questions about their drawings and to exchange their questions and drawings with other students.	
3. Identify similarities and differences of quadrilaterals; e.g., squares, rectangles, parallelograms and trapezoids.	• http://illuminations.nctm.org/index_d.aspx?id=270 Polygon Capture: A Geometry Game.	
4. Identify and define triangles based on angle measures (equiangular, right, acute and obtuse triangles) and side lengths (isosceles, equilateral and scalene triangles).	• Have small groups of students play "Polygon Concentration". Provide each group with 20 index cards. On ten of the cards, students draw two of each polygon and write the name on each polygon drawn. Set the cards up in an array of 5 X 4 and play the game, "Concentration." The winner is determined by the player with the most cards.	
Spatial Relationships 5. Describe points, lines and planes, and identify models in the environment.	• Look at buildings for shapes, for example,	

IV. Patterns, Functions and Algebra Standard *Use Patterns, Relations and Functions* 1. Use models and words to describe, extend and make generalizations of patterns and relationships occurring in computation, numerical patterns, geometry, graphs and other applications. 2. Represent and analyze patterns and functions using words, tables and graphs. *Use Algebraic Representations* 3. Construct a table of values to solve problems associated with a mathematical relationship. 4. Use rules and variables to describe patterns and other relationships. 5. Represent mathematical relationships with equations or inequalities. *Analyze Change* 6. Describe how a change in one variable affects the value of a related variable e.g., as one increases, the	• Use mnemonic devices to aid students to remember the order of operation, such as "Protect My Dear Aunt Sally Parentheses, Multiply, Divide, Add, Subtract". • Students measure, record, and graph plant growth and interpret data. Students plant seeds and, once the seeds sprout, record the height of the plants for several days. In groups or individually, they make graphs to display the data and then predict how the future growth may appear on the graph. Students continue to gather data, complete, and interpret the graphs. Then students work in small groups to write an appropriate story about the life cycle of a plant that corresponds to a graph they are given. • Complete function tables. • http://filer.weblogger.com/earlyalgebraManilaWebsite/classes/	

V. Data Analysis and Probability Standard *Data Collection* 1. Create a plan for collecting data for a specific purpose. 2. Represent and interpret data using tables, bar graphs, line plots and line graphs. 3. Interpret and construct Venn diagrams to sort and describe data. 4. Compare different representations of the same data to evaluate how well each representation shows important aspects of the data, and identify appropriate ways to display the data. 5. Propose and explain interpretations and predictions based on data displayed in tables, charts and graphs. *Statistical Methods* 6. Describe the characteristics of a set of data based on a graphical representation, such as range of the data, clumps of data, and holes in the data. 7. Identify the median of a set of data and describe what it indicates about the data. 8. Use range, median and mode to make comparisons among related sets of data.	• After demonstrating paper/pencil method students can create graph on computer using Excel.. • http://illuminations.nctm.org/index_o.aspx?id=100In . In The Factor Game, students start with a number and find its factors. In the The Product Game has 4 parts. Students play the game in Part I. In Part II, they make their own game boards and learn by experimenting with what factors and products to include in a game. In Part III, students construct Venn diagrams to represent the relationships between the factors or products of two numbers. Part IV contains extensions and connections. • Use line plot graph to discuss range, clumps of data and holes in data. • Find the mode, median, and range of vowels in classes first names, etc.	

MATHEMATICS SATNDARDS for GRADE 5

Students will	Educator can support organizer & indicators	Teacher notes
I. Number, Number Sense and Operations Standard *Number and Number Systems* 1. Use models and visual representation to develop the concept of ratio as part-to-part and part-to-whole, and the concept of percent as part-to-whole.	• http://www.pbs.org/teachersource/mathline/lessonplans/msmp/alphabits/alphabits_procedure.shtm Students list questions of a mathematical nature that could be asked about the contents of a box of Alphabits cereal. They decide to investigate the percent of each letter of the alphabet found in a box of Alphabits. They discover that this question leads naturally to some of the other questions they posed. • http://illuminations.nctm.org/index_d.aspx?id=257 This lesson capitalizes on students' interest in sports to integrate instruction on fractions, decimals, percents, rounding, Cartesian coordinates, probability, and statistics. • http://illuminations.nctm.org/index_d.aspx?id=249 Students use a 10 x 10 grid to solve various types of percent problems. The grid model offers a means of visualizing the given information as well as suggesting different approaches to solving problems. • http://math.rice.edu/~lanius/Patterns/index.htmlThis website includes four different pattern block activities that focus on identifying fractional values in the context of arbitrarily defined unit wholes. • http://math.rice.edu/~lanius/fractions/index.htmlThis site comprises six lesson activities including the definition of a fraction, equivalent fractions, addition of fractions, and multiplication of fractions. • http://illuminations.nctm.org/index_d.aspx?id=336 Students find fractional parts of a set of a dozen plastic eggs. Finding fractional parts of a set of discrete objects is harder than finding fractional parts of	

II. Measurement Standard *Measurement Units* 1. Identify and select appropriate units to measure angles; i.e., degrees. 2. Identify paths between points on a grid or coordinate plane and compare the lengths of the paths; e.g., shortest path, paths of equal length. 3. Demonstrate and describe the differences between covering the faces (surface area) and filling the interior (volume) of three-dimensional objects.	• http://www.pbs.org/teachersource/mathline/lessonplans/atmp/blazing/blazing_procedure.shtm Using compasses to gauge direction and counting paces to estimate distance, teams of students run an orienteering course that includes half a dozen landmarks. Students estimate distances between landmarks and use proportional reasoning to find the actual distances as walked and as depicted on scaled maps. • http://www.explorelearning.com/index.cfm?method=cResource.dspDetail&ResourceID=221 Build right triangles in an interactive geoboard and build squares on the sides of the triangles to discover the Pythagorean Theorem. • http://www.pbs.org/teachersource/mathline/lessonplans/esmp/ittakesten/ittakesten_procedure.sht Students estimate and measure in the metric system through a variety of lab experiences. Students review the importance and use of standard units of measure. • http://www.pbs.org/teachersource/mathline/lessonplans/msmp/noses/noses_procedure.shtm In this lesson, students view a picture or video of the Statue of Liberty and are asked how long the arm would be if the nose measures 4 feet 6 inches. Given chart paper, string, and rulers, students work in groups to develop their own strategies for finding the solution. They measure the length of their own nose and the length of their arm and form a ratio. Using proportions, students compute the length of the statue's arm. • http://illuminations.nctm.org/tools/	

III. Geometry and Spatial Sense Standard *Characteristics and Properties* 1. Draw circles, and identify and determine relationships among the radius, diameter, center and circumference; e.g., radius is half the diameter, the ratio of the circumference of a circle to its diameter is an approximation of π.	• http://mathforum.org/alejandre/circles.html Students can construct a number of compass-and-straightedge designs using ideas from this site. • Celebrate Pi Day March 14! • http://illuminations.nctm.org/index_d.aspx?id=350 While exploring properties of rectangles and parallelograms using dynamic software, students identify, compare, and analyze attributes of both shapes through physical and mental manipulation. • http://illuminations.nctm.org/index_d.aspx?id=277This site presents an idea for linking geometry to probability and statistics, but the teacher and students have to fill in most of the specifics.	
2. Use standard language to describe line, segment, ray, angle, skew, parallel and perpendicular.	• http://www.explorelearning.com/index.cfm?method=cResource.dspDetail&ResourceID=224 Explore the properties of intersecting, parallel, and skew lines as well as lines in the plane. Rotate the plane and lines in threedimensional space to ensure a full understanding of these objects. • http://www.pbs.org/teachersource/mathline/lessonplans/msmp/tiling/tiling_procedure.shtm Students first explore making patterns with a variety of pattern blocks. They next engage in experiments of making tile designs using only one shape by rotating that shape around a point. Finally, they are faced with the situation of entering a contest for creating the best tile design (tessellation) for the new plaza using these geometric shapes. • http://illuminations.nctm.org/tools/tool_detail.aspx?id=9 Students use an applet to show that the sum of the measures of the interior angles of a triangle is 180°; of a quadrilateral, 360°. The applet allows exploration with pentagons and hexagons,	

IV. Patterns, Function, and Algebra Standard *Use Patterns, Relations and Functions* 1. Justify a general rule for a pattern or a function by using physical materials, visual representations, words, tables or graphs.	• http://www.pbs.org/teachersource/mathline/lessonplans/msmp/greatrace/greatrace_procedure.shtm Students construct charts to examine number patterns and use these patterns to generate a graph. • http://www.pbs.org/teachersource/mathline/lessonplans/hsmp/yoyo/yoyo_procedure.shtm Students explore linear patterns, write a pattern in symbolic form, and solve linear equations using algebra tiles, symbolic manipulation, and the graphing calculator. equation using algebra tiles. • http://illuminations.nctm.org/index_d.aspx?id=246 Students develop their skills in collecting and recording data using the real-world situation of bouncing a tennis ball. • http://illuminations.nctm.org/index_d.aspx?id=247 This site shows how single-solution arithmetic problems can be generalized to algebraic problems. • http://www.pbs.org/teachersource/mathline/lessonplans/atmp/hoptoit/hoptoit_procedure.shtm This lesson emphasizes discerning patterns and developing general rules for the nth term of a sequence. • http://math.rice.edu/~lanius/Lessons/calen.html Ask a friend to choose 4 days that form a square on any monthly calendar and tell you only the sum of the four days. • http://illuminations.nctm.org/index_o.aspx?id=122 Students explore geometric solids and their properties. There are five parts to the investigation that include the rotation of shapes. • http://www.sciencenetlinks.com/lessons.cfm?DocID=249 Students use red beans, black beans, and lima beans to find solutions to word problems that can be modeled with simple equations and inequalities.	

V. Data Analysis and Probability Standard *Data Collection* 1. Read, construct and interpret frequency tables, circle graphs and line graphs. 2. Select and use a graph that is appropriate for the type of data to be displayed; e.g., numerical vs. categorical data, discrete vs. continuous data	• http://www.sciencenetlinks.com/lessons.cfm?D_ocID=108 Students use baseball data available on the Internet to look at different ways data can be analyzed. • http://standards.nctm.org/document/eexamples/chap5/5.5/part2.htm Students use the graphing functions of a spreadsheet to help them interpret the weather data they have collected and entered in a spreadsheet in an earlier activity (accessible from this site). • http://illuminations.nctm.org/index_d.aspx?id=254 Students develop their understanding of time and distance. The mathematics in the lesson relates to measuring time and distance, as well as graphing the data collected. • http://www.horizonshelpr.org/math/mrktgraphs/overview.html Students use computer software to represent data in a spreadsheet as bar, line, and circle graphs. • http://www.bced.gov.bc.ca/careers/aa/lessons/aom12.htm Students learn the difference between sensorineural and conductive hearing loss, graph the data from a patient's hearing test, and interpret the data to determine the kind of hearing loss the patient is experiencing. This kind of problem provides a good example of a real application of graph interpretation, a skill that research shows is difficult for students. The solution to the problem is provided and extensions of the activity are suggested. • http://illuminations.nctm.org/index_d.aspx?id=232 Students enter numerical and categorical data on activity sheets, compute means of the numerical data, and decide how to display	

I.. Numbers, Number Sense and Operations Standard	**Educator can support organizer & indicators**	**Teacher notes**
Number and Number Systems 1. Decompose and recompose whole numbers using factors and exponents (e.g., 32 = 2 x 2 x 2 x 2 x 2 = 2^5), and explain why "squared" means "second power" and "cubed" means "third power." 2. Find and use the prime factorization of composite numbers. For example: a. Use the prime factorization to recognize the greatest common factor (GCF). b. Use the prime factorization to recognize the least common multiple (LCM). c. Apply the prime factorization to solve problems and explain solutions. 3. Explain why a number is referred to as being "rational," and recognize that the expression $\frac{a}{b}$ can mean *a* parts of size $\frac{1}{b}$ each, *a* divided by *b*, or the ratio of *a* to *b*. 4. Describe what it means to find a specific percent of a number, using real life examples. 5. Use models and pictures to relate concepts of ratio, proportion and percent, including percents less than 1 and greater than 100.	• Use tiles and cubes to create models of perfect square and cube numbers. • Complete a multiplication table and locate the diagonal line of squares. • Form factor trees from composite numbers. • Use a Venn-diagram to identify common factors of two or more numbers. • Use a multiplication chart to locate common multiples for a set of factors. • Use graph paper of 100 square units to teach percent. • Have cooperative groups create their own graph models for specific percents. Exchange with other groups to crosscheck. • Play bingo to reinforce the connections between equivalent fractions, decimals and percents. • Have groups make matching sets for equivalent fractions, decimals and percents.	
Meaning of Operations 6. Use the order of operations, including the use of exponents, decimals and rational numbers, to simplify numerical expressions.	• Have cooperative groups work to place numbers and operation signs correctly in order to arrive at a specific solution. • Use pattern blocks to demonstrate the various	

I. Number, Number Sense and Operations Standard *Number and Number Systems* 1. Demonstrate and understanding of place value using power of 10 and write large numbers in scientific notation. 2. Explain the meaning of exponents that are negative or 0. 3.Describe differences between rational and irrational numbers; e.g., use technology to show that some numbers (rational) can be expressed as terminating or repeating decimals and others (irrational) as non-terminating and non-repeating decimals. *Meaning of Operations* 4. Use order of operations and properties to simplify numerical expressions involving integers, fractions and decimals. 5. Explain the meaning and effect of adding, subtracting, multiplying and dividing integers; e.g., how adding two integers can result in a lesser value. *Computation and Estimation* 6. Simplify numerical expressions involving integers and use integers to solve real-life problems. 7. Solve problems using the appropriate form of a rational number (fraction, decimal or percent). 8. Develop and analyze algorithms for computing with percents and integers, and demonstrate fluency in their use. 9. Represent and solve problem situations that can be modeled by and solved using concepts of absolute value, exponents and square roots (for perfect squares)	• Use Base 10 flats, rods and cubes to model how larger numbers in scientific form. • Play memory games to match models with the correct property it represents. • Use number and sign cubes to play a cooperative game of combining integers. An example would be “Deep Sea Dive”; the winner had the greatest negative value. • Use fraction bars and paper IOUs (indicating negative rational numbers) in order to find the sum or difference of rational numbers.	

I. Number, Number Sense and Operations Standard	Educator cam support organizer & indicators	Teacher notes
Number and Number Systems 1. Use scientific notation to express large numbers and small numbers between 0 and 1. 2.Recognize that natural numbers, whole numbers, integers, rational numbers and irrational numbers are subsets of the real number system. *Meaning of Operations* 3. Apply order of operations to simplify expressions and perform computations involving integer exponents and radicals. 4. Explain and use the inverse and identity properties and use inverse relationships (addition/subtraction, multiplication/division, squaring/square roots) in problem solving situations. *Computation and Estimation* 5. Determine when an estimate is sufficient, and when an exact answer is needed in problem situations, and evaluate estimates in relation to actual answers; e.g., very close, less than, greater than. 6. Estimate, compute and solve problems involving rational numbers, including ratio, proportion and percent, and judge the reasonableness of solutions. 7. Find the square root of perfect squares, and approximate the square root of non-perfect squares as consecutive integers between which the root lies; e.g., $\sqrt{130}$ is between 11 and 12. 8.Add, subtract, multiply, divide and compare numbers written in scientific notation.	• Compute conventional numbers for real life numbers, e.g., world population, then number of fingers in world, etc; then convert to scientific notation. This helps students see the reason for scientific notation. • Change large conventional numbers to scientific notation using calculators • Create matching sets of conventional numbers and scientific notation. Use the same digits, but change the exponents. • Use tiles to illustrate squares and square root. • Find or create crossword puzzles for the four operations for both computation and word problems. • Identify online game sites which reinforce skills defined in the indicators. • Practice rounding off decimals by using calculators to determine approximate square roots between perfect squares.	