

Catholic Schools Office
Diocese of Tucson

Math Curriculum Grades K-8

Based on the National Council of Teachers of Math Students,
The Arizona State Standards of Mathematic Instruction, 2008

And

The Catholic Social Teachings

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Mathematics Vision Statement

The Catholic schools in the Diocese of Tucson are distinct because they educate the mind, body, and the soul. We believe every child is holy because they are made in the image and likeness of God and must be encouraged to grow spiritually and academically as they progress in their faith life journey.

Learning Mathematics improves the mind, is essential to succeed in life, and its mastery requires the development of important skills. It is important that the Mathematics curriculum help students accomplish the goals of the National Council of Teaches of Mathematics using the Arizona State Standards. Students will be able to:

- Learn to value Mathematics
- Learn to reason mathematically
- Become mathematical problem solvers
- Become confident of their mathematical abilities

Mathematics is a discipline that encourages skills of critical thinking and problem solving. Such skills require strategies that include multi-step problems that deal with real life situations, the analysis of solutions, and utilization of technology. The use of manipulatives greatly increases the understanding of mathematical concepts and the diverse needs of all students are addressed through innovative and developmentally appropriate methodologies to help them reach their greatest potential.

The ultimate goal is the formation of the whole child; individuals, who grow in their faith, and who, by developing a strong understanding of Mathematics, enrich their own lives and are able to contribute to their community.

How to use this Math Curriculum

1. Review the Math Vision Statement and Introduction
 - a. Includes the NCTM Standards and web addresses
 - b. Arizona Mathematics Strands

2. Catholic Social Teachings and a reflection on the role of Math and its connection to the Catholic Social Teachings:
 - a. Mathematics for Life
 - b. Mathematics as part of Cultural Heritage
 - c. Mathematics for the Workplace
 - d. Mathematics for the Scientific and Technical Community

3. Overview of the Catholic Social Teachings and Examples for their application to mathematics at each grade level in the curriculum.
 - a. The examples at each grade level make connections back to the Performance Objectives to be found in Math, Science and Social Studies.
 - b. The theory is to make all teaching a more cohesive whole of interrelated concepts that have pertinence in the “real world” as well as connecting the students to the relevance of all subjects to our Catholic Social Teaching.

4. CD of the Arizona 2008 Mathematics Standards: CD Contents
 - a. First folder contains all the Mathematics Strands by Grade Level – in this folder you find all of the math content to be taught through out the year in a particular grade level. Teachers should download this material and begin to correlate it with their text book for creating weekly lesson plan.

 - b. The second folder has all of the strands across the grade levels. This is very helpful for curriculum mapping. Teachers can work together to make long range plans and coordinate teaching content from grade to grade. Along with an overview of all the strands, this section includes Math Vocabulary and Definitions with examples to support the teaching process.

 - c. The following folder contains Changes that have been made in this current curriculum. You will notice that certain content material may have been moved from one grade to another,

placed either earlier or later in the teaching cycle. Please review carefully for content you have been teaching that does not “show up” in your particular grade level.

- d. The folder marked Crosswalks continues to help the math teacher connect with the changes in the curriculum for each strand. This section also gives suggestions and examples for teaching a particular concept.
 - e. The 4th year folder applies to high school possibilities
 - f. The Introduction power point is helpful to review at a faculty meeting or math meeting to introduce the curriculum as well as give background for the development of the curriculum.
5. Resources: This section is the “beginning” – continue to add resources as you discover them throughout the year.

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Overview of Math Standards

The Diocese of Tucson Mathematics curriculum for grades K-8 is based on the NCTM Standards, follows the Arizona Standards for Mathematics while making connections to Catholic Social Teachings:

(www.usccb.org/sdwp/projects/socialteaching/excerpts.shtml.)

NCTM CONTENT AND PROCESS STANDARDS AND EXPECTATION OF K-8

(<http://standards.nctm.org/document/chapter3/index.htm>)

(<http://standards.nctm.org/document/appendix/numb.htm>)

Content Standards

1. Numbers and Operations
2. Algebra
3. Geometry
4. Measurement
5. Data Analysis and Probability

Process Standards

6. Problem Solving
7. Reasoning and Proof
8. Communication
9. Connections
- 10. Representation**

ARIZONA MATHEMATICS STANDARD

- Strand 1 – Number and Operations
 - Concept 1- Number Sense
 - Concept 2- Numerical Operations
 - Concept 3- Estimation
- Strand 2 – Data Analysis and Probability and Discrete Mathematics
 - Concept 1-Data Analysis (statistics)
 - Concept 2- Probability
 - Concept 3- Systematic Listing and Counting
 - Concept 4- Vertex-Edge Graph
- Strand 3 – Patterns, Algebra and Functions
 - Concept 1- Patterns
 - Concept 2- Functions and Relationship
 - Concept 3- Algebraic Representation
 - Concept 4- Analysis of Change
- Strand 4 – Geometry and Measurement
 - Concept 1- Geometric Properties
 - Concept 2- Transformation of Shapes
 - Concept 3- Coordinate Geometry

- Concept 4- Measurement
- Strand 5 – Structure and Logic
 - Concept 1- Algorithms and Algorithmic Thinking
 - Concept 2- Logic, Reasoning, Problem Solving and Proof

CATHOLIC SOCIAL TEACHINGS (expanded version p. 12)

www.usccb.org/sdwp/projects/socialteaching/excerpts.shtml.)

1. Life and Dignity of the Human Person
2. Call to Family, Community and Participation
3. Rights and Responsibilities
4. Option for the Poor and Vulnerable
5. The Dignity of Work and the Rights of Workers
6. Solidarity
7. Care for God's Creation

The committee believes this revised Mathematics Curriculum, when used by teachers on a daily basis, will genuinely guide them to help students acquire necessary mathematics skills and to improve their students' thinking. It will increase their opportunities in life and help teachers fulfill the mission of the diocesan schools to educate the whole child.

We live in a time of extraordinary and accelerating change. New knowledge, tools, and ways of doing and communicating mathematics continue to emerge and evolve. Calculators, too expensive for common use in the early eighties, now are not only commonplace and inexpensive but vastly more powerful. Quantitative information available to limited numbers of people a few years ago is now widely disseminated through popular media outlets.

The need to understand and be able to use mathematics in everyday life and in the workplace has never been greater and will continue to increase. For Example:

- *Mathematics for life.* [**Life and Dignity of the Human Person, Option for the Poor and Vulnerable, Community and Participation, Care for God's Creation**] Knowing mathematics can be personally satisfying and empowering. The underpinnings of everyday life are increasingly mathematical and technological. For instance, making purchasing decisions, choosing insurance or health plans, and voting knowledgeably all call for quantitative sophistication.
- *Mathematics as part of cultural heritage.* [**Call to Family, Community and Participation, Solidarity**] Mathematics is one of the greatest cultural and intellectual achievements of human-kind, and citizens should

develop an appreciation and understanding of that achievement, including its aesthetic and even recreational aspects.

- *Mathematics for the workplace.* [**Dignity of Work and the Rights of Workers**] Just as the level of mathematics needed for intelligent citizenship has increased dramatically, so too has the level of mathematical thinking and problem solving needed in the workplace, in professional areas ranging from health care to graphic design.
- *Mathematics for the scientific and technical community.* [**Rights and Responsibilities**] Although all careers require a foundation of mathematical knowledge, some are mathematics intensive. More students must pursue an educational path that will prepare them for lifelong work as mathematicians, statisticians, engineers, and scientists.

In this changing world, those who understand and can do mathematics will have significantly enhanced opportunities and options for shaping their futures. Mathematical competence opens doors to productive futures. A lack of mathematical competence keeps those doors closed. NCTM challenges the assumptions that mathematics is only for the select few. On the contrary, everyone needs to understand mathematics. All students should have the opportunity and support necessary to learn significant mathematics with depth and understanding. There is no conflict between equity and excellence.

(NCTM)

Pre-School Math Curriculum

Standard 1: Number Sense

Preschool

Date		Objective: Student will	Activity/Assessment/Experiment
	P.1.1	Uses number words in the context of daily routine, activities, and play	Child participates in counting the numbers on the calendar. Child points to a number on a race car and says, "That is the number 7."
	P.1.2	Uses and create symbols to represent numbers	Child holds up four fingers when asked, "How old are you?"
	P.1.3	Counts groups of objects using one-to-one correspondence	Child counts out 4 straws for the 4 children at the table.
	P.1.4	Compares two sets of objects using terms such as more, fewer, or the same	Child says, "I have more blocks than you."
	P.1.5	Counts a collection of up to 10 items using the last counting word to tell, "How many?"	Child counts out six eggs. When teacher asks, How many? Child responds, "six."
	P.1.6	Identifies numerals 1-20	While playing game child says, "Five jumps!" when spinner lands on the numeral "5."
	P.1.7	Matches numerals to the quantities they represent	Child matches the numeral to the number of objects.

Standard 2: Numerical Operations

Preschool

Date		Objective: Student will	Activity/Assessment/Experiment
	P.2.1	Describes change in two or more sets of object when they are combined	Child adds her blocks to her friend's blocks and says, "Now we have more."
	P.2.2	Describes changes in a set of objects when they are separated into parts	Child says, "I have four grapes." Child eats one grape and says, "Now I have three grapes."

Standard 3: Data Collection and Organization

Preschool

Date		Objectives: Student will	Activity/Assessment/Experiment
	P.3.1	Gathers data about self or the environment	Child uses name card to indicate their answer to a question on a class graph.
	P.3.2	Organizes and displays information by shared attribute or relationship	Child places objects on the appropriate trays in a "sink or float" activity. Child places purple color samples in order from lightest to darkest.

Standard 4: Data Analysis

Preschool

***This standard is usually observed with teacher facilitation.**

Date		Objective: Student will	Activity/Assessment/Experiment
	P.4.1	Uses descriptive language to compare data in picture graphs or other concrete representations	After discussing the “Question of the Day” child says, “A lot of kids like bananas.” Child identifies which category has more, fewer, or the same number of objects.

Standard 5: Patterns

Preschool

Date		Objective: Student will	Activity/Assessment/Experiment
	P.5.1	Copies simple patterns	Teacher creates a pattern (e.g. red, blue, red, blue,...) child copies the pattern
	P.5.2	Extends simple patterns	Teacher reads and points to a pattern: red, blue, red, blue and child continues the pattern without assists.
	P.5.3	Creates own simple patterns	Teacher asks child to create a pattern. Child creates a pattern of purple, orange, purple, orange,...
	P.5.4	Label patterns with everyday language	Teacher asks child to show her a pattern in the classroom (calendar pattern).

Standard 6: Spatial Relationships and Geometry

Preschool

Date		Objective: Student will	Activity/Assessment/Experiment
	P.6.1	Demonstrates understanding of positional terms (e.g. between, inside, under, behind)	Child asks to stand next to Jenny and moves next to her.
	P.6.2	Identifies or name basic shapes (e.g. circle, square, triangle, rectangle, oval, heart, and diamond) found in the environment	Teacher asks, “What shape is this?” child says, “A circle.”
	P.6.3	Represents shapes found in the environment	Child point to a picture of a sun and says, “The sun is a circle.”
	P.6.4	Compares and describes attributes of two and three dimensional objects using own vocabulary	Child points to a square and counts the sides and then points to a triangle and counts the sides.
	P.6.5	Describes the position or location of objects in relation to self or to other objects	Child notices a puppy between two children in a magazine picture and says, “The puppy is in the middle.”

Standard 7: Measurement
Preschool

Date		Objective: Student will	Activity/ Assessment/Experiment
	P.7.1	Compares objects using nonstandard units of measurement (e.g. hands, bodies, containers)	Child stacks blocks as tall as his friend. Child uses outstretched arms to measure a doorway.
	P.7.2	Compares objects and uses terms such as longer-shorter, hotter-colder, and faster-slower	Child says, "My car is faster than yours." Child says, "I can't pull the wagon. You're too heavy."
	P.7.3	Uses various standard measuring tools for simple measuring tasks	Child helps to measure a doorway with a yardstick. Child helps to measure cups of flour for bread.
	P.7.4	Uses appropriate vocabulary to describe time and sequence related to daily routines	Child says, "After choice time we going outside." When asks, "What did you do this morning?" child says, "Watched <i>Dragon Tales</i> ."

Standard 8: Logic and Reasoning
Preschool

Date		Objective: Student will	Activity/Assessment/Experiment
	P.8.1	Matches and sorts objects by one attribute (e.g. size, color, shape)	Child organizes objects smallest to biggest. Child matches a star shape to a star shape.
	P.8.2	Matches and sorts objects by two or more attributes (e.g. by size and by color)	Child sorts all the large, red cars from a group of cars of various sizes and colors.
	P.8.3	Describes relationships between groups of objects	Child sorts buttons with two holes and places in pile. Child sorts buttons with four holes and places in pile.

Catholic Social Teachings

Life and Dignity of the Human Person	Human life is sacred and the dignity of the human person is the foundation of a moral vision for society.
Call to Family, Community and Participation	The person is not only sacred but also social. How we organize our society in economics and politics, in law and policy directly affects human dignity and the capacity of individuals grow in community.
Rights and Responsibilities	The Catholic tradition teaches that human dignity can be protected and a healthy community can be achieved only if human rights are protected and responsibilities are met.
Option for the Poor and Vulnerable	A basic moral test in how our most vulnerable members are faring.
The Dignity of Work and the Rights of Workers	The economy must serve people, not the other way around. Work is more than a way to make a living; it is a form of continuing participation in God's creation.
Solidarity	We are one human family whatever our national, racial, ethnic, economic and ideological differences. We are our brothers' and sisters' keepers, wherever they must be.
Care for God's Creation	We show our respect for the Creator by our stewardship of creation.

CATHOLIC SOCIAL TEACHINGS
Math Examples K-2

Catholic Social Teaching	Description	Examples
Life and Dignity of the Human Person	Human life is sacred and the dignity of the human person is the foundation of a moral vision for society.	Count and record on a chart the total servings of fruits or vegetables during breakfast, snack, lunch and dinner. Calculate and compare the daily total of fruits or vegetables with a classmate. MOK-2 S1C1PO1
Call to Family, Community and Participation	The person is not only sacred but also social. How we organize our society in economics and politics, in law and policy directly affects human dignity and the capacity of individuals grow in community.	Students participate in a class fundraiser. Use concepts of counting coins and dollars to raise revenue for a healthy community. MOK N/A MO1 S1C1PO2 MO2 S1C1PO5
Rights and Responsibilities	The Catholic tradition teaches that human dignity can be protected and a healthy community can be achieved only if human rights are protected and responsibilities are met.	Use manipulative to distribute evenly among small groups. Determine which groups received fair distribution (odd and even). Use pretzels or pennies. MOK,1,2 S1C1PO2
Option for the Poor and Vulnerable	A basic moral test in how our most vulnerable members are faring.	Count and Classify how many and what kind of canned foods are collected for a food drive. MOK S1C1PO1 MO1 S2C1PO1 MO2 S2C1PO1

CATHOLIC SOCIAL TEACHINGS
Math Examples K-2

<p>The Dignity of Work and the Rights of Workers</p>	<p>The economy must serve people, not the other way around. Work is more than a way to make a living; it is a form of continuing participation in God’s creation.</p>	<p>Use a flow chart to articulate ordinal numbers in the production of certain products. Discuss the consequences of not having God’s creation of natural resources and workers. MOK,1,2 SIC1PO5</p>
<p>Solidarity</p>	<p>We are one human family whatever our national, racial, ethnic, economic and ideological differences. We are our brothers’ and sisters’ keepers, wherever they must be.</p>	<p>Create a bar or pie graph about eye or hair color of classroom students. Discuss the differences and commonalities of its functions. MOK,1,2, S2CIPO1,2</p>
<p>Care for God’s Creation</p>	<p>We show our respect for the Creator by our stewardship of creation.</p>	<p>Measure how many ounces it takes to raise a healthy plant or germinate seeds. Record the amount of water is used on a weekly calendar. <i>Focus Questions:</i> What happens when too much water? What happens when too little water is used? Create a daily graph. MOK S4C4PO1 MO1 S4C4PO1,3 MO2 S4C4PO2,4</p>

CATHOLIC SOCIAL TEACHINGS
Math Examples 3-5

Catholic Social Teaching	Description	Example and Curriculum References
Life and Dignity of the Human Person	Human life is sacred and the dignity of the human person is the foundation of a moral vision for society.	Solve a word problem that incorporates social issues such as sharing. Reference: M03-S1C2-PO2, M04-S5C2-PO5, M05-S1C2-PO2
Call to Family, Community and Participation	The person is not only sacred but also social. How we organize our society in economics and politics, in law and policy directly affects human dignity and the capacity of individuals grow in community.	Use fractions to calculate participation with drive items. (Food, diaper, clothing, etc.) Reference: M03-S1C1-PO5, M04-S1C1-PO3, M05-S1C1-PO4
Rights and Responsibilities	The Catholic tradition teaches that human dignity can be protected and a healthy community can be achieved only if human rights are protected and responsibilities are met.	Use elapsed time (clock or calendar) to identify when a responsible individual begins or ends a task. Reference: M03-S4C4-PO1, M04-S4C4-PO1, M05-S4C4-PO1
Option for the Poor and Vulnerable	A basic moral test in how our most vulnerable members are faring.	Estimate the cost it will take to provide a less fortunate individual with food for a day. Reference: M03-S1C3-PO1, M04-S1C3-PO1, M05-S1C3-PO1

CATHOLIC SOCIAL TEACHINGS
Math Examples 3-5

<p>The Dignity of Work and the Rights of Workers</p>	<p>The economy must serve people, not the other way around. Work is more than a way to make a living; it is a form of continuing participation in God’s creation.</p>	<p>Calculate or count, and compare a day’s wage for various workers. Reference: M03-S1C1-PO3, M04-S1C2-PO1, M05-S1C1-PO4 & M05-S1C2-PO1</p>
<p>Solidarity</p>	<p>We are one human family whatever our national, racial, ethnic, economic and ideological differences. We are our brothers’ and sisters’ keepers, wherever they must be.</p>	<p>Determine the ethnic or socioeconomic population in various locations. Reference: M03-S1C1-PO6, M04-S1C1-PO1, M04-S1C1-PO4, M05-S1C1-PO4</p>
<p>Care for God’s Creation</p>	<p>We show our respect for the Creator by our stewardship of creation.</p>	<p>Collect, record, organize, and display data for recycling. Reference: M03-S2C1-PO1, M04-S2C1-PO1, M05-S2C1-PO1</p>

CATHOLIC SOCIAL TEACHINGS
Math Examples Grades 6-8

Catholic Social Teaching	Description	Example and Curriculum References
Life and Dignity of the Human Person	Human life is sacred and the dignity of the human person is the foundation of a moral vision for society.	<p>STRAND: Structure and Logic CONCEPT: Logic, Reasoning, Problem Solving, and Proof PO: Analyze a problem situation to determine the questions to be answered EXAMPLE: Research and compile information into a graph comparing the graduation rates of diverse ethnic groups.</p> <p>Reference: M06-S5C2-PO1 M07-S5C2-PO2 M08-S5C2-PO1</p>
Call to Family, Community and Participation	The person is not only sacred but also social. How we organize our society in economics and politics, in law and policy directly affects human dignity and the capacity of individuals grow in community.	<p>STRAND: Number and Operation CONCEPT: Number Sense PO: Recognize and convert between expressions for positive and negative rational numbers including fractions, decimals, percents and ratios EXAMPLE: Given the number of prisoners of diverse ethnic groups, write fractions for each ethnic group and convert to decimals and percents.</p>

CATHOLIC SOCIAL TEACHINGS
Math Examples Grades 6-8

		<p>Reference: M06-S1C1-PO7 M07-S1C1-PO1 M08-S1C1-PO1</p> <p>STRAND: Data Analysis, Probability, and Discrete Mathematics</p> <p>CONCEPT: Data Analysis (Statistics)</p> <p>PO: Solve problems by selecting, constructing, and interpreting multi-line graphs and scatterplots:</p> <p>EXAMPLE: Based on the documentary <i>An Inconvenient Truth</i> compile causes or ways to prevent pollution and construct a display and interpret it.</p>
<p>Rights and Responsibilities</p>	<p>The Catholic tradition teaches that human dignity can be protected and a healthy community can be achieved only if human rights are protected and responsibilities are met.</p>	<p>Reference: M06-S1C1-PO1 M07-S2C1-PO1 M08-S2C1-PO1</p> <p>STRAND: Data Analysis, Probability, and Discrete Mathematics</p> <p>CONCEPT: Data Analysis and (Statistics)</p> <p>PO: Solve problems by selecting, constructing, and interpreting</p>
<p>Option for the Poor and Vulnerable</p>	<p>A basic moral test in how our most vulnerable members are faring.</p>	<p>Reference: M06-S1C1-PO1 M07-S2C1-PO1 M08-S2C1-PO1</p> <p>STRAND: Data Analysis, Probability, and Discrete Mathematics</p> <p>CONCEPT: Data Analysis and (Statistics)</p> <p>PO: Solve problems by selecting, constructing, and interpreting</p>

CATHOLIC SOCIAL TEACHINGS
Math Examples Grades 6-8

		<p>displays of data including multi-line graphs and scatter plots.</p> <p>EXAMPLE: Given information construct and interpret information about Caretaking of Elderly.</p> <p>Reference: M06-S1C1-PO1 M07-S2C1-PO1 M08-S2C1-PO1</p>
<p>The Dignity of Work and the Rights of Workers</p>	<p>The economy must serve people, not the other way around. Work is more than a way to make a living; it is a form of continuing participation in God’s creation.</p>	<p>STRAND: Data Analysis, Probability and Discrete mathematics</p> <p>CONCEPT: Data Analysis (statistics)</p> <p>PO: Use extreme values, mean, median, mode, and range to analyze and describe the distribution of a given data set.</p> <p>EXAMPLE: Use sets of data that represent the diversity of age groups in the work place. Analyze and describe the distribution using extreme values, mean, median mode and range.</p> <p>Reference: M06-S1C1-PO3 M07-S2C1-PO3 M08-S2C1-PO3</p>

CATHOLIC SOCIAL TEACHINGS
Math Examples Grades 6-8

<p>Solidarity</p>	<p>We are one human family whatever our national, racial, ethnic, economic and ideological differences. We are our brothers' and sisters' keepers, wherever they must be.</p>	<p>STRAND: Structure and Logic CONCEPT: Logic, Reasoning, Problem Solving, and Proof PO: Analyze a problem situation to determine the questions to be answered EXAMPLE: Research and compile information into a graph comparing the graduation rates of diverse ethnic groups.</p> <p>Reference: M06-S5C2-PO1 M07-S5C2-PO2 M08-S5C2-PO1</p>
<p>Care for God's Creation</p>	<p>We show our respect for the Creator by our stewardship of creation.</p>	<p>STRAND: Data Analysis, Probability, and Discrete Mathematics CONCEPT: Data Analysis (Statistics) PO: Solve problems by selecting, constructing, and interpreting displays of data including multi-line graphs and scatterplots: EXAMPLE: Based on the documentary <i>An Inconvenient Truth</i> compile causes or ways to prevent pollution and construct a display and interpret it. Reference: M06-S1C1-PO1 M07-S2C1-PO1, M08-S2C1-PO1</p>

Resources

Books and Articles:

(NCTM website)

The Essentials of Mathematics, K–6: Effective Curriculum, Instruction, and Assessment.
by Kathy Checkley

Momentum Magazine, September/October 2008:

“Creating a School That is Catholic in All That it Does: How to Integrate Catholic social teaching throughout the curriculum.” Rick Pendergast, pp. 10-14 (Good resource and overview for infusing CST into the Curriculum.

Math and Girls

Danica McKellar has a series of books on math especially for Middle School Girls:

Math Doesn't Suck: How to Survive Middle School Math Without Losing Your Mind or Breaking a Nail.

Kiss My Math: Showing Pre-Algebra Who's Boss.

The Math Book for Girls and Other People Who Count by Valerie Wyatt and Pat Cupples

These and similar books can be found on Amazon.com or booksellers around the city, your public library or could be requested for inclusion in a School Book Fair.

Websites:

Material on the National Council of Teachers of Mathematics Website has many, many resources for teachers including games, other websites and books. Please make sure you check out their e-examples at the end of each of the Grade Level Strands.

<http://www.nctm.org>

<http://www.love2learn.net/math/mathindx.htm>

Resources for Catholic homeschoolers and educators

<http://www.rethinkingschools.org>

Rethinking Mathematics: Teaching Social Justice by the Numbers is a good resource to make connections between Mathematics Curriculum and Catholic Social Teaching Issues—suggestions mostly for the middle or upper grades.

Demystifying the 2008 Mathematics Standard: Process and Product

The Process

A statewide committee of over 70 mathematics educators was involved in revising the 2008 Mathematics Standard. This diverse committee was composed of representatives from urban and rural areas, large and small districts, and charter schools. The committee included participants from Higher Education, curriculum directors, mathematics teacher leaders, Career and Technical Education teachers, second-career teachers, and classroom teachers (elementary, middle school and high school).

The committee analyzed the 2003 Mathematics Standard and determined which items needed updating, which could remain as is, and those that would be eliminated due to overlap. Utilizing current research and guidance from national organizations/resources such as National Council of Teachers of Mathematics *Principles and Standards*, the American Diploma Project, the National Assessment of Educational Progress (NAEP), the Curriculum Focal Points K-8 (NCTM), other states' standards. *Adding it UP* (National Research Council) and the Framework for 21st Century Learning, the committee began the process of revision. The process entailed revising and defining by grade level, the concepts and performance objectives for kindergarten through grade 12. Articulation through twelfth grade (College and Work Readiness) is an extension from the current standard (2003).

The accordion model of representation was employed with a rotation of members, maintaining a consistence from meeting to meeting so that the work could move forward. Comments from the public and from three external content reviews were collected during March 2008. The revision members met to review each comment and determine what modifications to the standard were appropriate. The final draft of the standard was presented to the State Board of Education on June 24, 2008, and approved.

The Product

The comprehensive document (K-12) is designed so that teachers can view the continuum of learning across grade levels. Due to the addition of grades 11-12 (College Work Readiness), there are now two sections to the comprehensive document, grade K-6 and grades 7-12. There is an intentional clustering of performance objectives in order to emphasize certain key understandings at specific grade levels. In many cases, performance objectives were shifted from grade levels to allow a more concentrated focus. For instance, performance was shifted from second and third grades to fourth and fifth grades. Fractions were shifted from first grade to grades three and four to support a deeper understanding of this complex topic.

The standard builds on the learning in previous grade levels, connects important ideas, and highlights new content each year. The coherency supports students in developing new understandings and skills. Looking down each individual column enables a teacher to see the content that students are expected to know and be able to do at any grade level.

The content in College Work Readiness (grades 11-12) is a new addition to the mathematics Standard. This content is separated into the five main strands. Performance objectives highlighted in italics in the document have been identified as core to an Algebra II course. As districts/schools create additional high school mathematics courses, they may select from the comprehensive set of performance objectives within the five strands.

New to the 2008 mathematics Standard is the development of more comprehensive grade level documents. The former of these documents will support implementation efforts. After each concept statement, there are summary expectations appropriate for that specific grade level. These summary

statements provide a road map for instruction. There are now three columns of information. The first column lists the performance objectives with connections to other mathematics performance objectives and other content areas. The middle column is labeled “Process Integration” and highlights explicit connections to Strand 5, Concept 2 performance objectives. The majority of these Strand 5, Concept 2 performance objectives are new to the standard across grade levels. The third column provides instructional support to teachers in the form of “explanations and examples.”

Close examination of the standard reveals a purposeful closure of topics rather than repeating the same performance objective from year to year. Carefully sequenced learning progressions exist throughout the 2008 Mathematics Standard. An example of Strand 3-Concept 1, begins in kindergarten with performance object 1. An understanding of patterns and sequences is linked very thoughtfully to the previous year’s learning and culminates in grades 11-12. The learning progressions often extend over a few grade levels or there might be an intentional skip of grade level. There is also an increased emphasis of multiple representations throughout the strands and grade levels in order to support deeper mathematical understanding.

The concepts of systematic listing and counting and vertex-edge graphs have been more fully defined in the standard with the addition of new mathematical terminology. Even though the ideas of Hamilton and Euler paths and circuits are not new to the standard, the terminology is more explicit. These types of problems are real-world and application-based. The coloring of pictures and maps now begin with second grade where there is an intentional clustering of performance objectives at this grade level in order to build a firm foundation. The fundamental ideas of vertex-edge graphs are expanded through grades 11-12.

Below are major areas of focus/change that have been identified at different grade level bands:

- Grades K-2: Greater depth of exploration of quantity, place value, and equivalence with an increased focus on developing number facts with reasoning
- Grades 3-4: Increased emphasis on using models and representations across all strands, but specifically in the development of multiplication and division; introduction to decimals to the hundredths and using connecting multiple representations with whole numbers, fractions, decimals and percents; composing and decomposing numbers using factors and multiples; introduction to simple ratios in 4th grade
- Grades 5-6: Focus on number with addition of ratio in 5th grade; focus on number, specifically operations with fractions and decimals (addition and subtraction in 5th grade and multiplication and division in 6th grade, and the modeling of addition and subtraction of integers in 6th grade)
- Grades 7-8: Focus on proportional reasoning in 7th grade leading to an understanding of functions in 8th grade.
- High School (grades 9-10): Strand 3 Concept 3; focus on multiple representations with a more explicit emphasis on logic; increased emphasis on quadratic functions and factoring as a new skill.
- College Work Readiness (grades 11-12): Strand 3 Concept 2; focus on function and difference between Algebra II and 4th year courses