

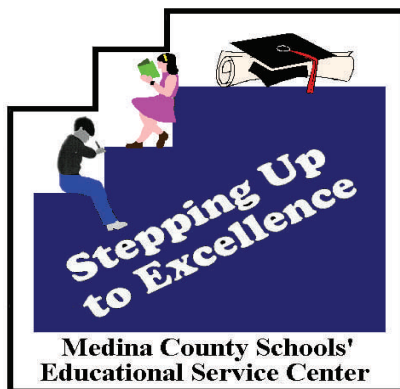
Medina County Schools

Math Course of Study

Grades:
Pre-Kindergarten
Through Twelve

William J. Koran
Superintendent

June 2008



Math
Graded Course of Study
PreK-12

William J. Koran, Superintendent

Approved by:
Governing Board of the Medina County Schools'
Educational Service Center
2008

Mission Statement

The Medina County Schools'
Educational Service Center
will be the leader in providing
services and products that promote
excellence in education.

Acknowledgements

The Medina County Schools' Educational Service Center wishes to acknowledge the contributions to the Math Course of Study made by the following:

Project Coordinator

Mary K. Kastanis, Special Projects Coordinator MCSESC
Dr. Dan Vincent, Curriculum Director MCSESC

Committee Members

Neal Call, Buckeye	Ty Damon, Highland
Barb Dawson, Cloverleaf	Barb Dailey, MCCC

Layout and Word Processing
Keturah Zacharias

The Ohio Department of Education
Office of Curriculum and Instruction

Table of Contents

Mission Statement	i
Acknowledgements	ii
Introduction	iv
K-12 Mathematics Philosophy	iv
Ohio’s K-12 Mathematics Academic Content Standards	v
Graded Course of Study	
Grade:	
Pre-Kindergarten	1
Kindergarten	17
First	33
Second	55
Third	73
Fourth	93
Fifth	115
Sixth	135
Seventh	155
Eighth	177
Ninth	197
Tenth	215
Eleventh	235
Twelfth	251
High School Discrete Courses	
Trigonometry	263
Data Collection & Analysis	277
Calculus	293
AP Calculus	307
Math Analysis	309
Algebra II — Cloverleaf	321
Geometry — Cloverleaf	341
Functions, Statistics and Trigonometry — Cloverleaf	361
Glossary	375
Appendix	387

Introduction

The Graded Course of Study is the approved document which defines the mathematics curriculum to be taught in all Medina County local school districts. This document satisfies the requirements of Ohio law, and is based on the Academic Content Standards developed by the Ohio Department of Education.

Teachers will base their daily plans on this document, thereby assuring each student a complete and comprehensive mathematics education. Through the use of continuous assessment, appropriate adjustments in instruction can be made to intervene with the students who are below grade level and to extend instruction to those students above grade level.

K-12 Mathematics Philosophy

The Mathematics Academic Content Standards provide a set of clear and rigorous expectations for what all students should know and be able to do by the time they graduate from high school. This K-12 curriculum is designed to insure that all students have the opportunity to become mathematically literate and capable of extending their learning. Students will be confident in their ability to use practical applications solving real life problems.

All students will be challenged by relevant mathematical instruction with the focus on understanding mathematical concepts. Mathematics instruction will include problem solving, reasoning, communicating, and applying mathematics to other curricular areas. All students have the right to learn and develop understandings of significant mathematical concepts. All students must be prepared to pursue a wide range of career options.

The curriculum and the instruction of students must be meaningful. Students must learn to formulate and solve problems using a variety of strategies, check and interpret results, and provide solutions to problems using real-world situations. Teachers must engage in continuous professional development in both the mathematical content area and the effective classroom instruction area. Assessment of learning must be aligned with the Mathematics Graded Course of Study.

Ohio's K-12 Mathematic Academic Content Standard

Number, Number Sense and Operations Standard

Students demonstrate number sense, including an understanding of number systems and operations and how they relate to one another. Students compute fluently and make reasonable estimates using paper and pencil, technology-supported and mental methods.

Measurement Standard

Students estimate and measure to a required degree of accuracy and precision by selecting and using appropriate units, tools and technologies.

Geometry and Spatial Sense Standard

Students identify, classify, compare and analyze characteristics, properties and relationships of one-, two- and three-dimensional geometric figures and objects. Students use spatial reasoning, properties of geometric objects, and transformations to analyze mathematical situations and solve problems.

Patterns, Functions and Algebra Standard

Students use patterns, relations and functions to model, represent and analyze problem situations that involve variable quantities. Students analyze, model and solve problems using various representations such as tables, graphs and equations.

Data Analysis and Probability Standard

Students pose questions and collect, organize, represent, interpret and analyze data to answer those questions. Students develop and evaluate inferences, predictions and arguments that are based on data.

Mathematical Processes Standard

Students use mathematical processes and knowledge to solve problems. Students apply problem-solving and decision-making techniques, and communicate mathematical ideas.

Note: Mathematical processes are used in all content areas and should be incorporated within instruction and assessment of the content-specific standards, benchmarks and grade-level indicators.

First Grade

Medina County Schools'

Course of Study

For

Math

June 2008

**STANDARD 1: Number, Number Sense and Operations
(Cont.)**

Students demonstrate number sense, including an understanding of number systems and operations and how they relate to one another. Students compute fluently and make reasonable estimates using paper and pencil, technology-supported and mental methods.

Ohio Benchmarks Grade 1	Instructional Organization	Grade Level Indicators	Notes
<p>By the end of the PreK-2 program:</p> <p>D. Determine the value of a collection of coins and dollar bills.</p> <p>E. Make change using coins for values up to one dollar.</p> <p>F. Count, using numerals and ordinal numbers.</p>	<p>M.1.D.1.6</p> <p>M.1.D.1.7</p> <p>M.1.E.1.8</p> <p>M.1.F.1.4</p>	<p>6. Identify and state the value of a penny, nickel, dime, quarter and dollar.</p> <p>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.</p> <p>8. Show different combinations of coins that have the same value.</p> <p>4. Count forward to 100, count backwards from 100, and count forward or backward starting at any number between 1 and 100.</p>	

**STANDARD 1: Number, Number Sense and Operations
(Cont.)**

Students demonstrate number sense, including an understanding of number systems and operations and how they relate to one another. Students compute fluently and make reasonable estimates using paper and pencil, technology-supported and mental methods.

Ohio Benchmarks Grade 1	Instructional Organization	Grade Level Indicators	Notes
<p>By the end of the PreK-2 program:</p> <p>G. Model, represent and explain addition as combining sets and counting on.</p>	<p>M.1.G.1.10a <i>Meaning of Operations</i></p> <p>M.1.G.1.10b</p> <p>M.1.G.1.10c</p> <p>M.1.G.1.10d</p> <p>M.1.G.1.12</p>	<p>10. Model, represent and explain addition as combining sets (part + part = whole) and counting on. For example:</p> <p>a. Model and explain addition using physical materials in contextual situations.</p> <p>b. Draw pictures to model addition.</p> <p>c. Write number sentences to represent addition.</p> <p>d. Explain that adding two whole numbers yields a larger whole number.</p> <p>12. Use conventional symbols to represent the operations of addition and subtraction.</p>	

STANDARD 1: Number, Number Sense and Operations (Cont.)

Students demonstrate number sense, including an understanding of number systems and operations and how they relate to one another. Students compute fluently and make reasonable estimates using paper and pencil, technology-supported and mental methods.

Ohio Benchmarks Grade 1	Instructional Organization	Grade Level Indicators	Notes
By the end of the PreK-2 program:			
H. Model, represent and explain subtraction as comparison, take-away and part-to-whole.	M.1.H.1.11a	11. Model, represent and explain subtraction as take-away and comparison. For example:	
	M.1.H.1.11b	a. Model and explain subtraction using physical materials in contextual situations.	
	M.1.H.1.11c	b. Draw pictures to model subtraction.	
	M.1.H.1.11d	c. Write number sentences to represent subtraction.	
	M.1.H.1.12	d. Explain that subtraction of whole numbers yields an answer smaller than the original number.	
I. Model, represent and explain multiplication as repeated addition, rectangular arrays and skip counting.	M.1.I.1.13	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?	

STANDARD 1: Number, Number Sense and Operations (Cont.)

Students demonstrate number sense, including an understanding of number systems and operations and how they relate to one another. Students compute fluently and make reasonable estimates using paper and pencil, technology-supported and mental methods.

Ohio Benchmarks Grade 1	Instructional Organization	Grade Level Indicators	Notes
<p>By the end of the PreK-2 program:</p> <p>J. Model, represent and explain division as sharing equally, repeated subtraction and rectangular arrays.</p> <p>K. Demonstrate fluency in addition facts with addends through 9 and corresponding subtractions.</p>	<p>M.1.J.1.14</p> <p>M.1.K.1.16a <i>Computation and Estimation</i></p> <p>M.1.K.1.16b</p> <p>M.1.K.1.16c</p> <p>M.1.K.1.16d</p> <p>M.1.K.1.16e</p> <p>M.1.K.1.16f</p> <p>M.1.K.1.16g</p> <p>M.1.K.1.16h</p>	<p>14. Model and represent division as sharing equally in contextual situations; e.g., sharing cookies.</p> <p>16. Develop strategies for basic addition facts, such as:</p> <p>a. counting all;</p> <p>b. counting on;</p> <p>c. one more, two more;</p> <p>d. doubles;</p> <p>e. doubles plus or minus one;</p> <p>f. make ten;</p> <p>g. using tens frames;</p> <p>h. identity property (adding zero).</p>	

**STANDARD 1: Number, Number Sense and Operations
(Cont.)**

Students demonstrate number sense, including an understanding of number systems and operations and how they relate to one another. Students compute fluently and make reasonable estimates using paper and pencil, technology-supported and mental methods.

Ohio Benchmarks Grade 1	Instructional Organization	Grade Level Indicators	Notes
<p>By the end of the PreK-2 program:</p> <p>K. Demonstrate fluency in addition facts with addends through 9 and corresponding subtractions.</p>	<p>M.1.K.1.17a</p> <p>M.1.K.1.17b</p> <p>M.1.K.1.17c</p> <p>M.1.K.1.17d</p> <p>M.1.K.1.17e</p>	<p>17. Develop strategies for basic subtraction facts, such as:</p> <p>a. relating to addition (for example, think of $7 - 3 = ?$ as “3 plus ? equals 7”);</p> <p>b. one less, two less;</p> <p>c. all but one (for example, $8 - 7$, $5 - 4$);</p> <p>d. using tens frames;</p> <p>e. missing addends.</p>	

**STANDARD 1: Number, Number Sense and Operations
(Cont.)**

Students demonstrate number sense, including an understanding of number systems and operations and how they relate to one another. Students compute fluently and make reasonable estimates using paper and pencil, technology-supported and mental methods.

Ohio Benchmarks Grade 1	Instructional Organization	Grade Level Indicators	Notes
<p>By the end of the PreK-2 program:</p> <p>L. Demonstrate fluency in adding and subtracting multiples of 10, and recognize combinations that make 10.</p>	<p>M.1.L.1.16a</p> <p>M.1.L.1.16b</p> <p>M.1.L.1.16c</p> <p>M.1.L.1.16d</p> <p>M.1.L.1.16e</p> <p>M.1.L.1.16f</p> <p>M.1.L.1.16g</p> <p>M.1.L.1.16h</p>	<p>16. Develop strategies for basic addition facts, such as:</p> <p>a. counting all;</p> <p>b. counting on;</p> <p>c. one more, two more;</p> <p>d. doubles;</p> <p>e. doubles plus or minus one;</p> <p>f. make ten;</p> <p>g. using tens frames;</p> <p>h. identity property (adding zero).</p>	

**STANDARD 1: Number, Number Sense and Operations
(Cont.)**

Students demonstrate number sense, including an understanding of number systems and operations and how they relate to one another. Students compute fluently and make reasonable estimates using paper and pencil, technology-supported and mental methods.

Ohio Benchmarks Grade 1	Instructional Organization	Grade Level Indicators	Notes
<p>By the end of the PreK-2 program:</p> <p>L. Demonstrate fluency in adding and subtracting multiples of 10, and recognize combinations that make 10.</p> <p>M. Add and subtract two-digit numbers with and without regrouping.</p>	<p>M.1.L.1.17a</p> <p>M.1.L.1.17b</p> <p>M.1.L.1.17c</p> <p>M.1.L.1.17d</p>	<p>17. Develop strategies for basic subtraction facts, such as:</p> <p>a. relating to addition (for example, think of $7 - 3 = ?$ as “3 plus ? equals 7”);</p> <p>b. one less, two less;</p> <p>c. all but one (for example, $8 - 7$, $5 - 4$);</p> <p>d. using tens frames; e. missing addends.</p>	

STANDARD 2: Measurement

Students estimate and measure to a required degree of accuracy and precision by selecting and using appropriate units, tools and technologies.

Ohio Benchmarks Grade 1	Instructional Organization	Grade Level Indicators	Notes
<p>By the end of the PreK-2 program:</p> <p>A. Explain the need for standard units of measure.</p> <p>B. Select appropriate units for length, weight, volume (capacity) and time, using:</p> <ul style="list-style-type: none"> • objects; i.e., non-standard units; • U.S. customary units: inch, foot, yard, ounce, pound, cup, quart, gallon, minute, hour, day, week and year; • metric units: centimeter, meter, gram and liter. 	<p>M.2.A.1.1 <i>Measurement Units</i></p>	<p>1. Recognize and explain the need for fixed units and tools for measuring length and weight; i.e., rulers and balance scales.</p>	

STANDARD 2: Measurement (Cont.)

Students estimate and measure to a required degree of accuracy and precision by selecting and using appropriate units, tools and technologies.

Ohio Benchmarks Grade 1	Instructional Organization	Grade Level Indicators	Notes
<p>By the end of the PreK-2 program:</p> <p>C. Develop common referents for units of measure for length, weight, volume (capacity) and time to make comparisons and estimates.</p> <p>D. Apply measurement techniques to measure length, weight and volume (capacity).</p> <p>E. Recognize that using different units of measurement will yield different numbers for the same measurement.</p>	<p>M.2.C.1.2</p> <p>M.2.C.1.3</p> <p>M.2.D.1.4 <i>Use Measurement Techniques and Tools</i></p> <p>M.2.D.1.5</p>	<p>2. Tell time to the hour and half hour on digital and analog (dial) timepieces.</p> <p>3. Order a sequence of events with respect to time; e.g., summer, fall, winter and spring; morning, afternoon and night.</p> <p>4. Estimate and measure weight using non-standard units; e.g., blocks of uniform size.</p> <p>5. Estimate and measure lengths using non-standard and standard units; i.e., centimeters, inches and feet.</p>	

STANDARD 3: Geometry and Spatial Sense

Students identify, classify, compare and analyze characteristics, properties and relationships of one-, two- and three-dimensional geometric figures and objects. Students use spatial reasoning, properties of geometric objects, and transformations to analyze mathematical situations and solve problems.

Ohio Benchmarks Grade 1	Instructional Organization	Grade Level Indicators	Notes
<p>By the end of the PreK-2 program:</p> <p>A. Describe and create plane figures: circle, rectangle, square, triangle, hexagon, trapezoid, parallelogram and rhombus, and identify them in the environment.</p> <p>B. Describe solid objects: cube, rectangular prism, sphere, cylinder, cone and pyramid, and identify them in the environment.</p>	<p>M.3.A.1.2</p> <p>M.3.A.1.3</p> <p>M.3.B.1.3</p>	<p>2. Create new shapes by combining or cutting apart existing shapes.</p> <p>3. Identify the shapes of the faces of three-dimensional objects.</p> <p>3. Identify the shapes of the faces of three-dimensional objects.</p>	

STANDARD 3: Geometry and Spatial Sense (Cont.)

Students identify, classify, compare and analyze characteristics, properties and relationships of one-, two- and three-dimensional geometric figures and objects. Students use spatial reasoning, properties of geometric objects, and transformations to analyze mathematical situations and solve problems.

Ohio Benchmarks Grade 1	Instructional Organization	Grade Level Indicators	Notes
<p>By the end of the PreK-2 program:</p> <p>C. Sort and compare two-dimensional figures and three-dimensional objects according to their characteristics and properties.</p> <p>D. Identify, explain and model (superposition, copying) the concept of shapes being congruent and similar.</p> <p>E. Recognize two- and three-dimensional objects from different positions.</p>	<p>M.3.C.1.1a <i>Characteristics and Properties</i></p> <p>M.3.C.1.1b</p> <p>M.3.D.1.5</p> <p>M.3.E.1.5</p>	<p>1. Identify, compare, and sort two-dimensional shapes; i.e., square, circle, ellipse, triangle, rectangle, rhombus, trapezoid, parallelogram, pentagon, and hexagon. For example:</p> <p>a. Recognize and identify triangles and rhombuses independent of position, shape or size;</p> <p>b. Describe two-dimensional shapes using attributes such as number of sides and number of vertices (corners, or angles).</p> <p>5. Copy figures and draw simple two-dimensional shapes from memory.</p> <p>5. Copy figures and draw simple two-dimensional shapes from memory.</p>	

STANDARD 3: Geometry and Spatial Sense (Cont.)

Students identify, classify, compare and analyze characteristics, properties and relationships of one-, two- and three-dimensional geometric figures and objects. Students use spatial reasoning, properties of geometric objects, and transformations to analyze mathematical situations and solve problems.

Ohio Benchmarks
Grade 1Instructional
Organization

Grade Level Indicators

Notes

Ohio Benchmarks Grade 1	Instructional Organization	Grade Level Indicators	Notes
<p>By the end of the PreK-2 program:</p> <p>F. Describe location, using comparative (before, after), directional (above, below), and positional (first, last) words.</p> <p>G. Identify and draw figures with line symmetry.</p>	<p>M.3.F.1.4 <i>Spatial Relationships</i></p> <p>M.3.G.1.5</p>	<p>4. Extend the use of location words to include distance (near, far, close to) and directional words (left, right).</p> <p>5. Copy figures and draw simple two-dimensional shapes from memory.</p>	

STANDARD 4: Patterns, Functions and Algebra

Students use patterns, relations and functions to model, represent and analyze problem situations that involve variable quantities. Students analyze, model and solve problems using various representations such as tables, graphs and equations.

Ohio Benchmarks Grade 1	Instructional Organization	Grade Level Indicators	Notes
<p>By the end of the PreK-2 program:</p> <p>A. Sort, classify, and order objects by size, number, and other properties, and describe the attributes used.</p> <p>B. Extend sequences of sounds and shapes or simple number patterns, and create and record similar patterns.</p> <p>C. Create and extend patterns and describe the rule in words.</p> <p>D. Model problem situations using objects, pictures, tables, numbers, letters, and other symbols.</p>	<p>M.4.A.1.1 <i>Use Patterns, Relations and Functions</i></p> <p>M.4.B.1.2a</p> <p>M.4.B.1.2b</p> <p>M.4.C.1.3</p> <p>M.4.D.1.5</p>	<p>1. Sort, classify and order objects by two or more attributes, such as color and shape, and explain how objects were sorted.</p> <p>2. Extend sequences of sounds, shapes or simple number patterns, and create and record similar patterns. For example:</p> <p>a. Analyze and describe patterns with multiple attributes using numbers and shapes; e.g., AA, B, aa, b, AA, B, aa, b,...</p> <p>b. Continue repeating and growing patterns with materials, pictures and geometric items; e.g., XO, XOO, XOOO, XOOOO.</p> <p>3. Describe orally the basic unit or general plan of a repeating or growing pattern.</p> <p>5. Describe orally and model a problem situation using words, objects or number phrase or sentence.</p>	

STANDARD 4: Patterns, Functions and Algebra (Cont.)

Students use patterns, relations and functions to model, represent and analyze problem situations that involve variable quantities. Students analyze, model and solve problems using various representations such as tables, graphs and equations.

Ohio Benchmarks Grade 1	Instructional Organization	Grade Level Indicators	Notes
<p>By the end of the PreK-2 program:</p> <p>E. Solve open sentences and explain strategies.</p> <p>F. Represent an unknown quantity as a variable using a symbol, such as \square, Δ, O.</p> <p>G. Describe and compare qualitative and quantitative change.</p>	<p>M.4.E.1.4 <i>Use Algebraic Representations</i></p>	<p>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 ($R+B=B+R$).</p>	

STANDARD 5: Data Analysis and Probability

Students use patterns, relations and functions to model, represent and analyze problem situations that involve variable quantities. Students analyze, model and solve problems using various representations such as tables, graphs and equations.

Ohio Benchmarks Grade 1	Instructional Organization	Grade Level Indicators	Notes
<p>By the end of the PreK-2 program:</p> <p>A. Pose questions and gather data about everyday situations and familiar objects.</p> <p>B. Sort and classify objects by attributes, and organize data into categories in a simple table or chart.</p> <p>C. Represent data using objects, picture graphs and bar graphs.</p>	<p>M.5.A.1.5</p> <p>M.5.B.1.1 <i>Data Collection</i></p> <p>M.5.B.1.2</p> <p>M.5.B.1.6 <i>Statistical Methods</i></p> <p>M.5.B.1.7</p> <p>M.5.C.1.3</p> <p>M.5.C.1.4</p>	<p>5. Construct a question that can be answered by using information from a graph.</p> <p>1. Identify multiple categories for sorting data.</p> <p>2. Collect and organize data into charts using tally marks.</p> <p>6. Arrange five objects by an attribute, such as size or weight, and identify the ordinal position of each object.</p> <p>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.</p> <p>3. Display data in picture graphs with units of 1 and bar graphs with intervals of 1.</p> <p>4. Read and interpret charts, picture graphs and bar graphs as sources of information to identify main ideas, draw conclusions, and make predictions.</p>	

STANDARD 5: Data Analysis and Probability (Cont.)

Students use patterns, relations and functions to model, represent and analyze problem situations that involve variable quantities. Students analyze, model and solve problems using various representations such as tables, graphs and equations.

Ohio Benchmarks Grade 1	Instructional Organization	Grade Level Indicators	Notes
<p>By the end of the PreK-2 program:</p> <p>D. Describe the probability of chance events as more, less or equally likely to occur.</p>	<p>M.5.D.1.8 <i>Probability</i></p>	<p>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.</p>	

STANDARD 6: Mathematical Processes

Students use mathematical processes and knowledge to solve problems. Students apply problem-solving and decision-making techniques, and communicate mathematical ideas.

Ohio Benchmarks Grade 1	Instructional Organization	Grade Level Indicators	Notes
By the end of the PreK-2 program:			
A. Use a variety of strategies to understand problem situations; e.g., discussing with peers, stating problems in own words, modeling problems with diagrams or physical materials, identifying a pattern.	M.6.A.1	Note: Mathematical processes are used within all of the content standards and should be incorporated within the instruction and assessment of the benchmarks and grade-level indicators.	
B. Identify and restate in own words the question or problem and the information needed to solve the problem.	M.6.B.1		
C. Generate alternative strategies to solve problems.	M.6.C.1		
D. Generate alternative strategies to solve problems.	M.6.D.1		
E. Explain to others how a problem was solved.	M.6.E.1		
F. Draw pictures and use physical models to represent problem situations and solutions.	M.6.F.1		

STANDARD 6: Mathematical Processes (Cont.)

Students use mathematical processes and knowledge to solve problems. Students apply problem-solving and decision-making techniques, and communicate mathematical ideas.

Ohio Benchmarks Grade 1	Instructional Organization	Grade Level Indicators	Notes
<p>By the end of the PreK-2 program:</p> <p>G. Use invented and conventional symbols and common language to describe a problem situation and solution.</p> <p>H. Recognize the mathematical meaning of common words and phrases, and relate everyday language to mathematical language and symbols.</p> <p>I. Communicate mathematical thinking by using everyday language and appropriate mathematical language.</p>	<p>M.6.G.1</p> <p>M.6.H.1</p> <p>M.6.I.1</p>		

Medina County Schools'

Course of Study

For

Math

Glossary

June 2008

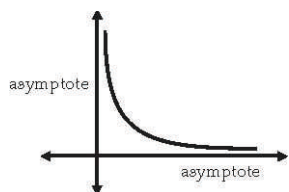
absolute error The absolute value of the difference between the measured value of a quantity and its true value.

acute An angle whose measure is greater than 0° and less than 90° .

algorithm A procedure or series of steps used to solve a problem.

associative property The result of an operation on real numbers will be unchanged due to grouping; e.g., for addition, $(a + b) + c = a + (b + c)$ or for multiplication, $a(bc) = (ab)c$.

asymptote A straight line that a curve approaches but never touches. For example,



biased sampling A sample that overrepresents or underrepresents part of the population.

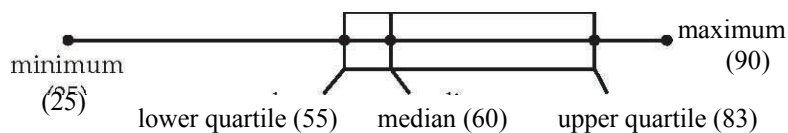
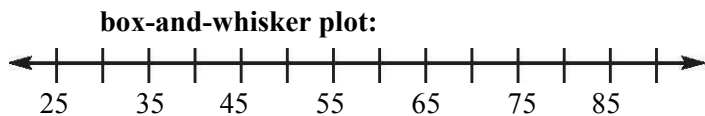
bivariate data Data or events described using two variables.

box-and-whisker plot A diagram that shows pictorially the *median* and *measures of spread* (upper and lower *interquartile ranges* and the *range*) for one set of data. For example,

Box-and-whisker plot data:

35	25	90	60	45
40	58	90	90	55
60	55	80	90	60
55	60	85	75	60
56	55	75	80	90

The number of days students in Mr. Jones' homeroom spent studying for the ACT exam.



- causation** The relationship between two *variables* where a change in one *variable* affects the outcome of the other *variable*.
- categorical data** Data that can be classified by type; e.g., color, types of dogs. These types of data are typically represented using bar chart, pie charts or pictographs.
- central angle** An angle whose vertex is the center of a circle and is in the same plane as the circle.
-
- Central angle
- coefficient** The numeric factor in a term; e.g., the number 3 in the term $3x^2y$ is the coefficient or in the term a^3b , 1 is the coefficient.
- Combination** A selection of a group of items or events from a set without regard to order; e.g., the number of 3-piece outfits from the set of clothes in the closet.
- common factor** A number, *polynomial* or quantity that evenly divides into two or more mathematical expressions.
- common referents** Something that is familiar that can be used to relate to another **referents** thing that is not familiar; e.g., the width of a finger is a centimeter.
- Commutative property** The order of the objects in an operation can be changed with out **property** affecting the results; e.g., for addition, $a + b = b + a$ or for multiplication, $ab = ba$.
- compatible numbers** Numbers that go together easily, usually related by pairing in the basic **numbers** facts; use of compatible numbers generally gives an approximate result; e.g., $473 \div 6 \approx 80$.
- Compensatory numbers** Compensatory numbers are used to adjust numbers in a computation after use of *compatible numbers*; e.g., $23 + 18 = 23 + 20 = 43$. Since two was added to increase 18 to 20 as compatible numbers, two will be subtracted from 43 to compensate for the change. Therefore, two is the compensatory number.
- complementary events** Two or more *mutually exclusive events* that together cover all possible **events** outcomes. The sum of the probabilities of complementary events is 1.
- compound events** Combining two or more separate events or outcomes and considering events it as one single event or outcome.
- conditional probability** The probability of an event occurring given that another event has already occurred. For example, What is the probability that the total of two dice will be greater than 8 given that the first die is a 6?

- congruent** Having exactly the same size and shape.
- continuous data** Data that can be assigned an infinite number of values between whole numbers, the assigned values are approximated; e.g., the size of the apples on an apple tree is continuous data. See *discrete data* for a counterexample.
- Coordinate plane** A plane determined by the intersection of two perpendicular number lines in which any point can be located.
- correlation** The relation between two sets of data, a positive or direct correlation exists when both sets vary in the same direction (both sets decrease); a negative or inverse correlation exists when one set of data increases as the other decreases.
- correlation** A measure of the *correlation* between two *variables* or sets of data.
- coefficient** The value of the correlation coefficient, r , is always $-1 < r < 1$, where 1 is a perfect positive correlation, 0 is no correlation, and -1 is a perfect negative correlation.
- covariants** Varying with another variable quantity in a manner that leaves a specified relationship unchanged.
- decomposing** The process of breaking a number into smaller units to simplify problem solving; e.g., 15 can be $10 + 5$ or 10 can be $6 + 4$.
- deductive reasoning** Use logic to arrive at a conclusion from a given premise.
- dependent events** A statement or *probability* for one event affects a statement or *probability for another event*.
- descriptive statistics** To gather and describe data using *probability*, statistical methods and concepts like graphs and *measures of center*.
- dispersion** How data is spread out around some central point.
- distribution** The distribution of a set of data is a graph or table showing how many pieces of data there are in each class, or of each type.
- distributive property** The product of a number and the sum (or difference) of two numbers is equal to the sum (or difference) of the two products; e.g., $7(30 + 5) = (7 \cdot 30) + (7 \cdot 5)$ or $a(b-c) = ab - ac$.
- equation** A statement that shows two mathematical expressions that are equal to each other.
- equiangular** In a given shape, all angles have the same measure.
- equilateral** In a given shape, all sides have the same length.
- equivalent** Two items that have the same value.

experimental probability The probability based on a series of trials. The experimental probability, P , can be found using the following equation: $P(\text{event}) = \frac{\text{number of favorable outcomes}}{\text{number of trials}}$

experimental results The outcome as a result of a probability experiment or test. These outcomes are sometimes called actual results.

expressions Any combination of variables, numbers, and symbols (excluding the equality and inequality symbols).

extrema A term that refers to maximum and minimum values.

factoring Rewriting a mathematical expression as a product of factors.

frequency distribution A collection of data that represents the number of times a set of numbers, items or events have occurred.

frequency table A table that shows how often each item, number, or range of numbers occurs in a set of data.

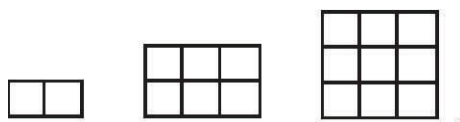
front-end estimation Using the leading, or left-most, digits to make an estimate quickly and easily. After making an initial estimate using front-end digits, an adjustment can be made to refine the estimate; e.g., Using front-end estimation to estimate the sum of 594, 32, and 221, an initial estimate would be $5 + 0 + 2$ hundreds or 700. An adjustment can be made by grouping the tens and ones (about $100 + 50$ or 150 more) and adding to get an adjusted estimate of 850.

function A mathematical relationship between two variables, an independent *variable* and a *dependent variable*, where every value of the independent variable corresponds to exactly one value of the dependent value.

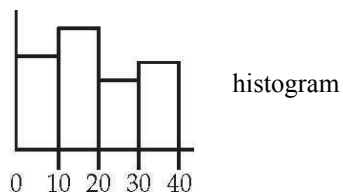
Fundamental Counting Principle The principle which states that all possible outcomes in a sample space can be found by multiplying the number of ways each event can occur.

geometric patterns A sequence or series, where each term can be found by multiplying the previous term by a constant factor, sometimes referred to as a common ratio.

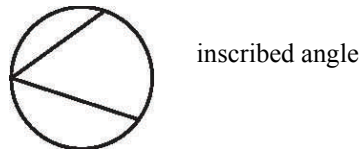
growing patterns Patterns that involve a progression. For example,



histogram A graph that uses bars to show the frequency of data within equal intervals.



inscribed angle An angle whose vertex is on a circle and whose sides are chords of the circle.



measures of center Numbers that provide information about cluster and average of a collection of data.

mean The sum of a set of numbers divided by the number of elements in the set.

mode The number or object that appears most frequently in a set of numbers or objects.

median The middle number or item in a set of numbers or objects arranged from least to greatest, or the mean of the two middle numbers when the set has two middle numbers.

measures of spread or variability A term used to refer to how much numbers are spread, varied or dispersed in a set of data.

range The difference between the greatest and the least numbers in a set of data.

quartile In conjunction with the median, the quartiles divide the set of data into four groups of equal size.

interquartile range The difference between the upper quartile range and the lower quartile.

median See measures of center.

minor arc An arc that is less than a semicircle or 180° .

mode See measures of center.

monomials An algebraic expression which is a product of constants and variables.

multiplicative patterns Number patterns with relationships between consecutive numbers involving multiplication.

Mutually exclusive events Two events that cannot occur at the same time.

nonlinear A sequence of values that increase in a manner other than linear.

outlier A data point in a sample widely separated from the main cluster of points in the sample.

parallel lines Lines in the same plane that do not cross, the distance between the lines is constant.

permutations Possible orders or arrangements of a set of events or items.

perpendicular lines Lines that intersect at one point forming 90° .

polygon A closed figure formed from line segments that meet only at their endpoints.

polynomials The sum of monomials; e.g., $2a^2 + 4a - 5$.

precision To determine the size of the unit to be used.

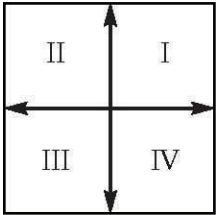
prime factorization The expression of a number as the product of prime factors; e.g., the prime factorization of 18 is $2 \cdot 3 \cdot 3$.

probability The chance of an event occurring. The probability of an event is equal to the number of favorable outcomes divided by the number of possible outcomes.

probability distribution The set of random data and the probabilities associated with that data.

proportion An equation showing that two ratios are equal.

quadrants The two axes of a coordinate system divide the plane into four separate sections known as quadrants. These are identified as the first, second, third, and fourth quadrants.



qualitative data Data that can be assigned qualities or categories. They are non-numerical data.

quantitative data Data that are numerical. The data can be *discrete* or *continuous*.

random sample A *sample* in which every event has an equal chance of selection and each event is chosen by a random process.

random sampling A random *sample* is a sample that has been chosen by a process of random selection so that it models the characteristics of the population it is supposed to represent as closely as possible.

random variable A variable that takes any of a range of values that cannot be predicted with certainty.

rate of change A relationship such as distance over time, often described by using a slope.

rational expressions Fractions whose numerators and denominators are polynomials; e.g., $\frac{n^2 - 3n}{2}$.

rational numbers Any number that can be written in the form $\frac{a}{b}$, where a and b are integers and $b \neq 0$.

rectangular arrays An arrangement of things or data in rows and columns.

Recursive function A function defined in terms of the repeated application of a number of simpler functions to their own values.

reflection See transformation.

relative error The error or uncertainty in a measurement expressed as a fraction of the true value.

right Relating to 90° ; e.g., a right angle measures 90° , a right triangle has only one right angle.

roots of equations A value that will satisfy the equation which has been formed by putting an expression, containing one *variable*, equal to zero.

rotation See transformation.

sample A set of data taken from a larger set used to create or test theories about the data as a whole.

sample space A list of all possible outcomes of an activity.

sampling method The process used to collect data; e.g., see random sampling.

scientific notation A form of writing numbers as the product of a power of 10 and a decimal number greater than or equal to 1 and less than 10; e.g., 8,924,000 is written as 8.924×10^6 .

sequence An ordered set of objects or numbers.

series Sum of a finite or infinite sequence of terms.

simple event A subset of the *sample space* that contains only one outcome that cannot be broken down into a simpler, more basic outcome.

standard deviation The measure of the *dispersion* of a distribution is equal to the square root of the *variance*.

stem-and-leaf plot A frequency diagram which displays the actual data together with its frequency, by using a part of the value of each piece of data to fix the class or group (the stem), while the remainder of the value is actually listed (the leaves). For example,

Stem-and-leaf plot data: Coach Smith's last 30 basketball game scores for the 7th grade Wildcats.

50	65	70	35	40	57	66	65	70	35
29	33	44	56	66	60	44	50	58	46
67	78	79	47	35	35	44	57	60	57

Stem-and-leaf plot

Stem	Leaves
2	9
3	3 5 5 5 6
4	0 4 4 4 6 7
5	0 0 6 7 7 7 8
6	0 0 5 5 6 6 7
7	0 0 8 9

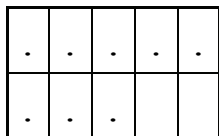
Key: 4 | 6 represents a score of 46.

successive approximation To find the approximate value of a quantity by starting from a first estimate and then deriving from each approximation another that is more accurate.

symbolic form To represent something using numbers and symbols.

target population The set from which a sample will be selected.

tens frame A physical model that represents the structure of the number system's place value; e.g., the following diagram represents the number eight using a tens frame.



tens frame

terms The quantities in an algebraic equation that are linked to each other by means of + or - signs.

theoretical probability Identifying, using mathematical expectations, the number of ways an event could happen compared to all the events that could happen.

transcendental function *Functions* that are not algebraic; e.g., trigonometric functions.

transformation An operation that creates an image from an original figure, or preimage.

reflection A *transformation* that results in a mirror image of the original shape.

rotation A rotation is a *transformation* about a fixed point such that every point in the object turns through the same angle relative to that fixed point.

translation A *transformation* in which an image is formed by moving every point on a figure the same distance in the same direction.

dilation A *transformation* that preserves the shape of a figure, but allows the size to change.

translation See transformation.

two-dimensional figures A shape that has two dimensions, usually described in terms of length and breadth, or length and height.

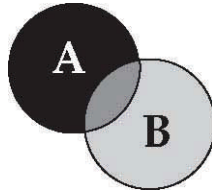
univariate data Having one *variable*.

variable A changing quantity, usually a letter in an algebraic equation or expression, that might have one of a range of possible values.

variance A measure of the *dispersion* of the *distribution* of a *random variable*.

variants *Variables.*

Venn Diagrams A diagram that is used to show relationships between sets.



zeros of a function The solutions of a *function* or the x-intercepts.

<i>Grade 1 Standard 1</i>		First Quarter	Second Quarter	Third Quarter	Fourth Quarter
<i>Number, Number Sense and Operations</i>					
M.1.A.1.5	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.				
M.1.A.1.3	3. Read and write the numerals for numbers to 100.				
M.1.B.1.1	1. Use ordinal numbers to order objects e.g., first, second, third.				
M.1.B.1.2	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.				
M.1.B.1.4	4. Count forward to 100, count backwards from 100, and count forward or backward starting at any number between 1 and 100.				
M.1.B.1.15	15. Demonstrate that equal means "the same as" using visual representations.				
M.1.C.1.9	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.				
M.1.D.1.6	6. Identify and state the value of a penny nickel, dime, quarter, and dollar.				
M.1.D.1.7	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.				
M.1.E.1.8	8. Show different combinations of coins that have the same value.				
M.1.F.1.4	4. Count forward to 100, count backwards from 100, and count forward or backward starting at any number between 1 and 100.				
M.1.G.1.10	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.				
M.1.G.1.12	12. Use conventional symbols to represent the operations of addition and subtraction.				

<i>Grade 1 Standard 1 Cont.</i>		First Quarter	Second Quarter	Third Quarter	Fourth Quarter
<i>Number, Number Sense and Operations</i>					
M.1.H.1.11	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.				
M.1.H.1.12	12. Use conventional symbols to represent the operations of addition and subtraction.				
M.1.I.1.13	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?				
M.1.J.1.14	14. Model and represent division as sharing equally in contextual situations; e.g., sharing cookies.				
M.1.K.1.16	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. identify property (adding zero).				
M.1.K.1.17	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.				

<i>Grade 1 Standard 1 Cont.</i>		First Quarter	Second Quarter	Third Quarter	Fourth Quarter
<i>Number, Number Sense and Operations</i>					
M.1.L.1.16	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. identify property (adding zero).				
M.1.L.1.17	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.				
<i>Grade 1 Standard 2</i>		First Quarter	Second Quarter	Third Quarter	Fourth Quarter
<i>Measurement</i>					
M.2.A.1.1	1. Recognize and explain the need for fixed units and tools for measuring length and weight; e.g., rules and balance scales.				
M.2.C.1.2	2. Tell time to the hour and half hour on digital and analog (dial) timepieces.				
M.2.C.1.3	3. Order a sequence of events with respect to time; e.g., summer, fall, winter and spring; morning, afternoon and night				
M.2.D.1.4	4. Estimate and measure weight using non-standard units; e.g., blocks of uniform size.				
M.2.D.1.5	5. Estimate and measure lengths using non-standard and standard units; i.e., centimeters, inches and feet.				

<i>Grade 1 Standard 3</i>		First Quarter	Second Quarter	Third Quarter	Fourth Quarter
<i>Geometry and Spatial Sense</i>					
M.3.A.1.2	2. Create new shapes by combining or cutting apart existing shapes.				
M.3.A.1.3	3. Identify the shapes of the faces of three-dimensional objects.				
M.3.B.1.3	3. Identify the shapes of the faces of three-dimensional objects.				
M.3.C.1.1	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 and size;				
	b. Describe two-dimensional shapes using attributes such as number of sides and number of vertices (corners, or angles).				
M.3.D.1.5	5. Copy figures and draw simple two-dimensional shapes from memory.				
M.3.E.1.5	5. Copy figures and draw simple two-dimensional shapes from memory.				
M.3.F.1.4	4. Extend the use of location words to include distance (near, far, close to) and directional words (left, right).				
M.3.G.1.5	5. Copy figures and draw simple two-dimensional shapes from memory.				

<i>Grade 1 Standard 4</i>		First Quarter	Second Quarter	Third Quarter	Fourth Quarter
<i>Patterns, Functions and Algebra</i>					
M.4.A.1.1	1. Sort, classify and order objects by two or more attributes, such as color and shape, and explain how objects were sorted.				
M.4.B.1.2	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., X0, X00, X000, X0000.				
M.4.C.1.3	3. Describe orally the basic unit or general plan of a repeating or growing pattern.				
M.4.D.1.5	5. Describe orally and model a problem situation using words, objects or number phrase or sentence.				
M.4.E.1.4	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 ($R + B = B + R$).				
<i>Grade 1 Standard 5</i>		First Quarter	Second Quarter	Third Quarter	Fourth Quarter
<i>Data Analysis & Probability</i>					
M.5.A.1.5	5. Construct a question that can be answered by using information from a graph.				
M.5.B.1.1	1. Identify multiple categories for sorting data.				
M.5.B.1.2	2. Collect and organize data into charts using tally marks.				
M.5.B.1.6	6. Arrange five objects by an attribute, such as size or weight, and identify the ordinal position of each object.				
M.5.B.1.7	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.				
M.5.C.1.3	3. Display data in picture graphs with units of 1 and bar graphs with intervals of 1.				
M.5.C.1.4	4. Read and interpret charts, picture graphs and bar graphs as sources of information to identify main ideas, draw conclusions, and make predictions.				
M.5.D.1.8	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.				