

Medina County Schools'

# Course of Study

For

# Math

Geometry (Cloverleaf)  
Geometry Academic (Cloverleaf)  
Geometry Honors (Cloverleaf)

June 2008

## STANDARD 1: Number, Number Sense and Operations

Geometry—Clov.  
(GE-C)

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  
Grades 10

Instructional  
Organization

Grade Level Indicators

Notes

<p><b>By the end of the 8-10 program:</b></p> <p>A. Use scientific notation to express large numbers and numbers less than one.</p> <p>B. Identify subsets of the real number system.</p> <p>C. Apply properties of operations and the real number system and justify when they hold for a set of numbers.</p> <p>D. Connect physical, verbal and symbolic representations of integers, rational numbers and irrational numbers.</p> <p>E. Compare, order and determine equivalent forms of real numbers.</p> <p>F. Explain the effects of operations on the magnitude of quantities.</p>	<p>M.1.D.GE-C.1 <i>Use Measurement Techniques and Tools</i></p> <p>M.1.D.GE-C.2</p>	<p>1. Connect physical, verbal and symbolic representations of irrational numbers; e.g., construct <math>\sqrt{2}</math> as a hypotenuse or on a number line.</p> <p>2. Explain the meaning of the <math>n</math>th root.</p>	
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**STANDARD 1: Number, Number Sense and Operations  
(Cont.)**

Geometry—Clov.  
(GE-C)

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 Grades 10	Instructional Organization	Grade Level Indicators	Notes
<p><b>By the end of the 8-10 program:</b></p> <p>G. Estimate, compute and solve problems involving real numbers, including ratio, proportion and percent, and explain solutions.</p> <p>H. Find the square root of perfect squares, and approximate the square root of non-perfect squares.</p> <p>I. Estimate, compute and solve problems involving scientific notation, square roots and numbers with integer exponents.</p>	<p align="center">M.1.I.GE-C.4</p>	<p>4. Approximate the <math>n</math>th root of a given number greater than zero between consecutive integers when <math>n</math> is an integer; e.g., the 4th root of 50 is between 2 and 3.</p> <p><i>Note: There are instances where a grade-level indicator is linked to a benchmark for a grade band that does not include the grade level of the indicator. See Grade 11.</i></p>	

**STANDARD 2: Measurement**

Geometry—Clov.  
(GE-C)

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

Ohio Benchmarks  
Grade 10

Instructional  
Organization

Grade Level Indicators

Notes

<p><b>By the end of the 8-10 program:</b></p> <p>A. Solve increasingly complex non-routine measurement problems and check for reasonableness of results.</p> <p>B. Use formulas to find surface area and volume for specified three-dimensional objects accurate to a specified level of precision.</p> <p>C. Apply indirect measurement techniques, tools and formulas, as appropriate, to find perimeter, circumference and area of circles, triangles, quadrilaterals and composite shapes and to find volume of prisms, cylinders, and pyramids.</p>			
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**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 10	Instructional Organization	Grade Level Indicators	Notes
<p><b>By the end of the 8-10 program:</b></p> <p>D. Use proportional reasoning and apply indirect measurement techniques, including right triangle trigonometry and properties of similar triangles, to solve problems involving measurements and rates.</p>	<p>M.2.D.GE-C.5</p>	<p>5. Determine the measures of central and inscribed angles and their associated major and minor arcs.</p> <p><i>Note: There are instances where a grade-level indicator is linked to a benchmark for a grade band that does not include the grade level of the indicator. See Grade 11.</i></p>	

**STANDARD 2: Measurement (Cont.)**

Geometry—Clov.  
(GE-C)

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

Ohio Benchmarks  
Grade 10

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Notes

<p><b>By the end of the 8-10 program:</b></p> <p>E. Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision.</p> <p>F. Write and solve real-world, multi-step problems involving money, elapsed time and temperature, and verify reasonableness of solutions.</p>			
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**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 10**

**Instructional  
Organization**

**Grade Level Indicators**

**Notes**

<p><b>By the end of the 8-10 program:</b></p> <p>A. Formally define geometric figures.</p>	<p>M.3.A.GE-C.1a <i>Characteristics and Properties</i></p> <p>M.3.A.GE-C.1b</p> <p>M.3.A.GE-C.1c</p> <p>M.3.A.GE-C.1d</p> <p>M.3.A.GE-C.2</p> <p>M.3.A.GE-C.6 <i>Transformation and Symmetry</i></p> <p>M.3.A.GE-C.10 <i>Visualization and Geometric Models</i></p>	<p>1. Formally define and explain key aspects of geometric figures, including:</p> <ul style="list-style-type: none"> <li>a. interior and exterior angles of polygons;</li> <li>b. segments related to triangles (median, altitude, midsegment);</li> <li>c. points of concurrency related to triangles (centroid, incenter, orthocenter, and circumcenter);</li> <li>d. circles (radius, diameter, chord, circumference, major arc, minor arc, sector, segment, inscribed angle).</li> </ul> <p>2. Recognize and explain the necessity for certain terms to remain undefined, such as point, line and plane.</p> <p>6. Identify the reflection and rotation symmetries of two- and three-dimensional figures.</p> <p>10. Solve problems involving chords, radii, and arcs within the same circle.</p>	
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**STANDARD 3: Geometry and Spatial Sense (Cont.)**

Geometry—Clov.  
(GE-C)

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 10	Instructional Organization	Grade Level Indicators	Notes
<p><b>By the end of the 8-10 program:</b></p> <p>B. Describe and apply the properties of similar and congruent figures; and justify conjectures involving similarity and congruence.</p> <p>C. Recognize and apply angle relationships in situations involving intersecting lines, perpendicular lines, and parallel lines.</p> <p>D Use coordinate geometry to represent and examine the properties of geometric figures.</p>	<p>M.3.C.GE-C.10 <i>Visualization and Geometric Models</i></p>	<p>10. Solve problems involving chords, radii, and arcs within the same circle.</p>	

### STANDARD 3: Geometry and Spatial Sense (Cont.)

Geometry—Clov.  
(GE-C)

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 10	Instructional Organization	Grade Level Indicators	Notes
<p><b>By the end of the 8-10 program:</b></p> <p>E. Draw and construct representations of two- and three-dimensional geometric objects using a variety of tools, such as straightedge, compass and technology.</p> <p>F. Represent and model transformations in a coordinate plane and describe the results.</p>	M.3.E.GE-C.4 <i>Spatial Relationships</i>	4. Construct right triangles, equilateral triangles, parallelograms, trapezoids, rectangles, rhombuses, squares and kites, using compass and straightedge or dynamic geometry software.	
	M.3.E.GE-C.5	5. Construct congruent or similar figures using tools, such as compass, straightedge, and protractor or dynamic geometry software.	
	M.3.E.GE-C.7	7. Perform reflections and rotations using compass and straightedge constructions and dynamic geometry software.	
	M.3.F.GE-C.8	8. Derive coordinate rules for translations, reflections and rotations of geometric figures in the coordinate plane.	
	M.3.F.GE-C.9	9. Show and describe the results of combinations of translations, reflections and rotations (compositions); e.g., perform compositions and specify the result of a composition as the outcome of a single motion, when applicable.	

### STANDARD 3: Geometry and Spatial Sense (Cont.)

Geometry—Clov.  
(GE-C)

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 10	Instructional Organization	Grade Level Indicators	Notes
<p><b>By the end of the 8-10 program:</b></p> <p>G. Prove or disprove conjectures and solve problems involving two- and three-dimensional objects represented within a coordinate system.</p> <p>H. Establish the validity of conjectures about geometric objects, their properties and relationships by counterexample, inductive and deductive reasoning, and critiquing arguments made by others.</p>	<p>M.3.H.GE-C.3a</p> <p>M.3.H.GE-C.3b</p> <p>M.3.H.GE-C.3c</p> <p>M.3.H.GE-C.3d</p> <p>M.3.H.GE-C.10 <i>Visualization and Geometric Models</i></p>	<p><i>Note: This benchmark is also supported with indicators from benchmark F and benchmark H.</i></p> <p>3. Make, test and establish the validity of conjectures about geometric properties and relationships using counterexample, inductive and deductive reasoning, and paragraph or two-column proof, including:</p> <ul style="list-style-type: none"> <li>a. prove the Pythagorean Theorem;</li> <li>b. prove theorems involving triangle similarity and congruence;</li> <li>c. prove theorems involving properties of lines, angles, triangles and quadrilaterals;</li> <li>d. test a conjecture using basic constructions made with a compass and straightedge or technology.</li> </ul> <p>10. Solve problems involving chords, radii, and arcs within the same circle.</p>	

### STANDARD 3: Geometry and Spatial Sense (Cont.)

Geometry—Clov.  
(GE-C)

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 10

Instructional  
Organization

Grade Level Indicators

Notes

<p><b>By the end of the 8-10 program:</b></p> <p>I. Use right triangle trigonometric relationships to determine lengths and angle measures.</p>			
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## STANDARD 4: Patterns, Functions and Algebra

Geometry—Clov.  
(GE-C)

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 10	Instructional Organization	Grade Level Indicators	Notes
<p><b>By the end of the 8-10 program:</b></p> <p>A. Generalize and explain patterns and sequences in order to find the next term and the <math>n</math>th term.</p> <p>B. Identify and classify functions as linear or nonlinear, and contrast their properties using tables, graphs or equations.</p> <p>C. Translate information from one representation (words, table, graph or equation) to another representation of a relation or function.</p>	<p>M.4.A.GE-C.1 <i>Use Patterns, Relations and Functions</i></p> <p>M.4.A.GE-C.2</p>	<p>1. Define function formally and with <math>f(x)</math> notation.</p> <p>2. Describe and compare characteristics of the following families of functions: square root, cubic, absolute value and basic trigonometric functions; e.g., general shape, possible number of roots, domain and range.</p>	

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

Geometry—Clov.  
(GE-C)

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 10	Instructional Organization	Grade Level Indicators	Notes
<b>By the end of the 8-10 program:</b>			
D. Use algebraic representations, such as tables, graphs, expressions, functions and inequalities, to model and solve problem situations.	M.4.D.GE-C.3 <i>Use Algebraic Representations</i>	3. Solve equations and formulas for a specified variable; e.g., express the base of a triangle in terms of the area and height.	
	M.4.D.GE-C.4	4. Use algebraic representations and functions to describe and generalize geometric properties and relationships.	
	M.4.D.GE-C.5	5. Solve simple linear and nonlinear equations and inequalities having square roots as coefficients and solutions.	
	M.4.D.GE-C.6	6. Solve equations and inequalities having rational expressions as coefficients and solutions.	
F. Solve and graph linear equations and inequalities.	M.4.F.GE-C.8	8. Graph the quadratic relationship that defines circles.	

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

Geometry—Clov.  
(GE-C)

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 10	Instructional Organization	Grade Level Indicators	Notes
<p><b>By the end of the 8-10 program:</b></p> <p>H. Solve systems of linear equations involving two variables graphically and symbolically.</p> <p>J. Describe and interpret rates of change from graphical and numerical data.</p>	<p>M.4.H.GE-C.7</p> <p>M.4.H.GE-C.11</p> <p>M.4.J.GE-C.9</p>	<p>7. Solve systems of linear inequalities.</p> <p>11. Solve real-world problems that can be modeled, using systems of linear equations and inequalities.</p> <p>9. Recognize and explain that the slopes of parallel lines are equal and the slopes of perpendicular lines are negative reciprocals.</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 10	Instructional Organization	Grade Level Indicators	Notes
<p><b>By the end of the 8-10 program:</b></p> <p>A. Create, interpret and use graphical displays and statistical measures to describe data; e.g., box-and-whisker plots, histograms, scatter plots, measures of center and variability.</p>	<p>M.5.A.GE-C.2 <i>Data Collection</i></p> <p>M.5.A.GE-C.3</p> <p>M.5.A.GE-C.6 <i>Statistical Methods</i></p>	<p>2. Represent and analyze bivariate data using appropriate graphical displays (scatterplots, parallel box-and-whisker plots, histograms with more than one set of data, tables, charts, spreadsheets) with and without technology.</p> <p>3. Display bivariate data where at least one variable is categorical.</p> <p>6. Interpret the relationship between two variables using multiple graphical displays and statistical measures; e.g., scatterplots, parallel box-and-whisker plots, and measures of center and spread.</p>	



**STANDARD 5: Data Analysis and Probability (Cont.)**

Geometry—Clov.  
(GE-C)

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 10

Instructional  
Organization

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Notes

<p><b>By the end of the 8-10 program:</b></p> <p>H. Use counting techniques, such as permutations and combinations, to determine the total number of options and possible outcomes.</p> <p>I. Design an experiment to test a theoretical probability, and record and explain results.</p>			
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**STANDARD 6: Mathematical Processes (Cont.)**

Geometry—Clov.  
(GE-C)

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

Ohio Benchmarks Grade 10	Instructional Organization	Grade Level Indicators	Notes
<p><b>By the end of the 8-10 program:</b></p> <p>D. Apply reasoning processes and skills to construct logical verifications or counter-examples to test conjectures and to justify and defend algorithms and solutions.</p> <p>E. Use a variety of mathematical representations flexibly and appropriately to organize, record and communicate mathematical ideas.</p> <p>F. Use precise mathematical language and notations to represent problem situations and mathematical ideas.</p> <p>G. Write clearly and coherently about mathematical thinking and ideas.</p> <p>H. Locate and interpret mathematical information accurately, and communicate ideas, processes and solutions in a complete and easily understood manner.</p>	<p>M.6.D.GE-C</p> <p>M.6.E.GE-C</p> <p>M.6.F.GE-C</p> <p>M.6.G.GE-C</p> <p>M.6.H.GE-C</p>		

