

# *Course of Study*

## *Geometry*

**Warren County Career Center**

**3525 North State Route 48  
Lebanon, Ohio 45036**

**Adopted 03/16/06**

*This document is for the use of the staff at Warren County Career Center.  
Credit is given the designer of the template, Upper Valley JVS, Piqua, Ohio.*

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# *Acknowledgements*

## **Geometry Warren County Career Center**

We would like to take this opportunity to express our gratitude to the following people for their guidance and support in the preparation of this course of study:

Warren County Career Center Administrative Team  
Warren County Educational Service Center  
Mr. Ali Mehdi  
Mr. Doug Bailey  
Mrs. Liz Rasch  
Mrs. Janet Wilmoth

***Warren County Career Center  
Resolution Of School Board Approval***

WHEREAS, representatives of the Math Department of the Warren County Career Center have reviewed the Course of Study; and

WHEREAS, this Course of Study is based upon Academic Content Standards adopted by the State of Ohio for the Geometry program; and

WHEREAS, the Math Department has reviewed and added competencies as needed to address local labor market needs and trends in the industry;

NOW, THEREFORE, BE IT RESOLVED, in accordance with the Superintendent's recommendation, that the Warren County Career Center adopt the Geometry Course of Study.

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District Superintendent

Date

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President, Board of Education

Date

## *Statement of Recommendation*

The Math Department at Warren County Career Center has reviewed this course of study and recommends it for use as the foundation for instruction in the Geometry class.

The developers of this course of study have considered local labor market needs and the school's ability to offer specialized programs. The competencies have been reviewed and accepted as being congruent with our school's vision, mission, and strategic goals. When appropriate, additional competencies related to the program area have been incorporated into this course of study.

Achievement of technical competencies, utilizing proper attitudes, and demonstrating appropriate values are critical for successful employment and for furthering educational opportunities within a student's chosen field. We believe that this course of study adequately and correctly focuses upon student development.

This course of study is recommended on: 03/16/2006

## ***Warren County Career Center Vision Statement***

WCCC is the valued partner of choice within the educational and economic systems of our communities, by providing quality academic and career technical education.

We pave the way for a future of opportunities unique to each of our learners.

## ***Warren County Career Center Mission Statement***

To prepare youths and adults to make informed career choices and to successfully enter, compete, and advance in a changing work world.

## ***Warren County Career Values***

- Treating each other with respect, dignity, trust and mutual value
- Communicating openly and honestly
- Taking ownership of personal actions and being held accountable for results
- Upholding and demonstrating high ethical, educational and fiscal standards
- Exhibiting high levels of professionalism
- Providing high quality instruction and highly qualified staff to ensure success for all learners
- Making quality customer service a high priority
- Promoting partnerships and a team environment
- Celebrating team and individual achievements
- Using data to drive planning, decision making and actions

## *Course Design*

Courses are designed to reflect career-focused education, which combines high-level academics with real-life technical skills. The intent is to maximize a student's present and future academic and career success.

Career-focused education enhances the integration of academic and technical skills, designs programs that prepare students with transferable skills and promotes each student's career opportunities.

## *Course Philosophy*

We believe that

- Mathematics literacy is needed to make everyday decisions such as choosing which product to purchase, interpreting information in news reports, and selecting insurance or health plans.
- Mathematical thinking and problem solving are needed in the workplace, and those who understand and can use mathematics have significantly enhanced opportunities and options.
- Mathematics plays a central role in modern culture, including aesthetic and recreational aspects, and an essential role in the scientific and technical community.
- Set high expectations and strong support for mathematics achievement by ALL students.
- Represent mathematics knowledge and skills needed to make successful transitions to post-secondary education, workplace and daily life.
- Reflect sound application of research on how students learn mathematics.
- Align with national standards documents and major studies in GGGeomathematics
- Address mathematics content knowledge and mathematical processes, including problem-solving, mathematical reasoning, communication, representation and connections.
- Focus on important mathematics topics that are well-articulated through benchmarks and grade-level indicators.
- Represent rigorous progression across grades and in-depth study within each grade.
- Provide an appropriate balance among conceptual understanding, procedural knowledge and skills, and application and problem solving.
- Incorporate use of technology by ALL students in learning mathematics
- Serve as the basis for classroom, district and state assessments.
- Guide the development of local mathematics curriculum and instructional programs.

## ***Course Goals***

The course goals for Geometry are to:

### **Number, Number Sense and Operations**

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**

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**

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.

## ***Course Description***

Geometry is a course that explores properties, measurements, and relationships of points, lines, surfaces, and solids in space. Students integrate their extensive knowledge of Algebra 1 with Euclidian geometry concepts to solve real world problems. It is a year-long course and meets for 45 minutes each day.

Students are required to have a full credit in Algebra I with a preference for college prep Algebra I prior to taking this course. Students must have passed Algebra I or have obtained permission of the building principal in order to take geometry.

Students who successfully complete this course earn one math credit.

## *Academic and Technical Integration*

Expectations of curriculum must be aligned with what is written, taught, assessed, and reported. Student expectations focus on active, project-centered learning—an approach to learning that emphasizes a connection between ideas in a discipline and the outside world. Educational programming and course content will clearly connect career and post-secondary opportunities. At the Warren County Career Center, the main goal is to design courses and projects that use strategies for authentic instruction. These characteristics of instruction focus on deep understanding, established opportunities for concept connections, provide anticipatory and abstract thinking, and emphasize genuine application.

The academic courses at the WCCC follow the state model curricula. They are designed to meet both associate school and state requirements. These standards respond to the need to improve student achievement, quality of curriculum and instruction, and strengthen school and community relationships.

## *Technology*

The Warren County Career Center board and staff believe that technology skills are essential for all students to achieve in the 21<sup>st</sup> century. It is the goal of this district to infuse technology into all facets of education:

- Instruction
- Assessment
- Administration
- Career planning
- Course design
- Professional development

Strategies to incorporate technology into all facets of education are a priority of the district and there is commitment to a continual process to provide updated hardware, software, and professional development for staff members for the purpose of providing a high quality education, with the integration of technology, for all students.

## *Students Served*

The population served by this program is juniors and seniors.

## *Scope and Sequence*

## **Number, Number Sense and Operations Standard**

Benchmark A. Connect physical, verbal and symbolic representations of integers, rational numbers and irrational numbers.

1. Connect physical, verbal and symbolic representations of irrational numbers; e.g., construct square root of 2 as a hypotenuse or on a number line.
2. Explain the meaning of the  $n$ th root.

Benchmark B. Estimate, compute and solve problems involving scientific notation, square roots and numbers with integer exponents.

1. Use factorial notation and computations to represent and solve problem situations involving arrangements.
2. Approximate the  $n$ th root of a given number greater than zero between consecutive integers when  $n$  is an integer; e.g., the 4th root of 50 is between 2 and 3.

## **Measurement Standard**

Benchmark A. Solve increasingly complex non-routine measurement problems and check for reasonableness of results.

Benchmark B. Use formulas to find surface area and volume for specified three-dimensional objects accurate to a specified level of precision.

Benchmark 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.

Benchmark 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.

1. Convert rates within the same measurement system; e.g., miles per hour to feet per second; kilometers per hour to meters per second. (9<sup>th</sup>)
2. Use unit analysis to check computations involving measurement. (9<sup>th</sup>)
3. Use the ratio of lengths in similar two-dimensional figures or three-dimensional objects to calculate the ratio of their areas or volumes respectively. (9<sup>th</sup>)
4. Use scale drawings and right triangle trigonometry to solve problems that include unknown distances and angle measures. (9<sup>th</sup>)
5. Solve problems involving unit conversion for situations involving distances, areas, volumes and rates within the same measurement system. (9<sup>th</sup>)
6. Determine the measures of central and inscribed angles and their associated major and minor arcs.

Benchmark E. Estimate and compute various attributes, including length, angle measure, area, surface area and volume, to a specified level of precision.

Benchmark F. Write and solve real-world, multi-step problems involving money, elapsed time and temperature, and verify reasonableness of solutions.

1. Explain how a small error in measurement may lead to a large error in calculated results.
2. Calculate relative error.
3. Explain the difference between absolute error and relative error in measurement.
4. Give examples of how the same absolute error can be problematic in one situation but not in another; e.g., compare “accurate to the nearest foot” when measuring the height of a person versus when measuring the height of a mountain.

### **Geometry and Spatial Sense Standard**

Benchmark A. Formally define geometric figures.

1. Formally define and explain key aspects of geometric figures, including:
  - a. interior and exterior angles of polygons;
  - b. segments related to triangles (median, altitude, midsegment);
  - c. points of concurrency related to triangles (centroid, incenter, orthocenter, circumcenter);

- d. circles (radius, diameter, chord, circumference, major arc, minor arc, sector, segment, inscribed angle).
2. Recognize and explain the necessity for certain terms to remain undefined, such as point, line and plane.
3. Identify the reflection and rotation symmetries of two- and three-dimensional figures.
4. Solve problems involving chords, radii and arcs within the same circle.

Benchmark B. Describe and apply the properties of similar and congruent figures; and justify conjectures involving similarity and congruence.

Benchmark C. Recognize and apply angle relationships in situations involving intersecting lines, perpendicular lines and parallel lines.

1. Solve problems involving chords, radii and arcs within the same circle.

Benchmark D. Use coordinate geometry to represent and examine the properties of geometric figures.

Benchmark E. Draw and construct representations of two- and three-dimensional geometric objects using a variety of tools, such as straightedge, compass and technology.

1. Construct right triangles, equilateral triangles, parallelograms, trapezoids, rectangles, rhombuses, squares and kites, using compass and straightedge or dynamic geometry software.
2. Construct congruent figures and similar figures using tools, such as compass, straightedge, and protractor or dynamic geometry software.
3. Perform reflections and rotations using compass and straightedge constructions and dynamic geometry software.

Benchmark F. Represent and model transformations in a coordinate plane and describe the results.

1. Derive coordinate rules for translations, reflections and rotations of geometric figures in the coordinate plane.

2. 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.

Benchmark G. Prove or disprove conjectures and solve problems involving two- and three-dimensional objects represented within a coordinate system.

1. Analyze two-dimensional figures in a coordinate plane; e.g., use slope and distance formulas to show that a quadrilateral is a parallelogram. (9<sup>th</sup>)

Benchmark H. Establish the validity of conjectures about geometric objects, their properties and relationships by counter-example, inductive and deductive reasoning, and critiquing arguments made by others.

1. 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:
  - a. Prove the Pythagorean Theorem;
  - b. Prove theorems involving triangle similarity and congruence;
  - c. Prove theorems involving properties of lines, angles, triangles and quadrilaterals;
  - d. Test a conjecture using basic constructions made with a compass and straightedge or technology.
2. Solve problems involving chords, radii and arcs within the same circle.

Benchmark I. Use right triangle trigonometric relationships to determine lengths and angle measures.

1. Define the basic trigonometric ratios in right triangles: sine, cosine and tangent. (9<sup>th</sup>)
2. Apply proportions and right triangle trigonometric ratios to solve problems involving missing lengths and angle measures in similar figures. (9<sup>th</sup>)

### **Patterns, Functions and Algebra Standard**

1. Define function formally and with  $f(x)$  notation.

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.
3. Solve equations and formulas for a specified variable; e.g., express the base of a triangle in terms of the area and height.
4. Use algebraic representations and functions to describe and generalize geometric properties and relationships.
5. Solve simple linear and nonlinear equations and inequalities having square roots as coefficients and solutions.
6. Solve equations and inequalities having rational expressions as coefficients and solutions.
7. Solve systems of linear inequalities.
8. Graph the quadratic relationship that defines circles.
9. Recognize and explain that the slopes of parallel lines are equal and the slopes of perpendicular lines are negative reciprocals.
10. Solve real-world problems that can be modeled using linear, quadratic, and exponential or square root functions.
11. Solve real-world problems that can be modeled, using systems of linear equations and inequalities.
12. Describe the relationship between slope of a line through the origin and the tangent function of the angle created by the line and the positive x-axis.

### **Data Analysis and Probability Standard**

1. Describe measures of center and the range verbally, graphically and algebraically.
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.
3. Display bivariate data where at least one variable is categorical.
4. Identify outliers on a data display; e.g., use interquartile range to identify outliers on a box-and-whisker plot.
5. Provide examples and explain how a statistic may or may not be an attribute of the entire population; e.g., intentional or unintentional bias may be present.

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.
7. Model problems dealing with uncertainty with area models (geometric probability).
8. Differentiate and explain the relationship between the probability of an event and the odds of an event, and compute one given the other.

# *Technology Standards*

## **Standard 1: Nature of Technology**

**Students develop an understanding of technology, its characteristics, scope, core concepts\* and relationships between technologies and other fields.**

Benchmark A: Synthesize information, evaluate and make decisions about technologies.

Benchmark B: Apply technological knowledge in decision-making.

Benchmark C: Examine the synergy between and among technologies and other fields of study when solving technological problems.

## **Standard 2: Technology and Society Interaction**

**Students recognize interactions among society, the environment and technology, and understand technology's relationship with history. Consideration of these concepts forms a foundation for engaging in responsible and ethical use of technology.**

Benchmark A: Interpret and practice responsible citizenship relative to technology.

Benchmark B: Demonstrate the relationship among people, technology and the environment.

Benchmark C: Interpret and evaluate the influence of technology throughout history, and predict its impact on the future.

Benchmark D: Analyze ethical and legal technology issues and formulate solutions and strategies that foster responsible technology usage.

Benchmark E: Forecast the impact of technological products and systems.

## **Standard 3: Technology for Productivity Applications**

**Students learn the operations of technology through the usage of technology and productivity tools.**

Benchmark A: Integrate conceptual knowledge of technology systems in determining practical applications for learning and technical problem-solving.

Benchmark B: Identify, select and apply appropriate technology tools and resources to produce creative works and to construct technology-enhanced models.

#### **Standard 4: Technology and Communication Applications**

**Students use an array of technologies and apply design concepts to communicate with multiple audiences, acquire and disseminate information and enhance learning.**

Benchmark A: Apply appropriate communication design principles in published and presented projects.

Benchmark B: Create, publish and present information, utilizing formats appropriate to the content and audience.

Benchmark C: Identify communication needs, select appropriate communication tools and design collaborative interactive projects and activities to communicate with others, incorporating emerging technologies.

#### **Standard 5: Technology and Information Literacy**

**Students engage in information literacy strategies, use the Internet, technology tools and resources, and apply information-management skills to answer questions and expand knowledge.**

Benchmark A: Determine and apply an evaluative process to all information sources chosen for a project.

Benchmark B: Apply a research process model to conduct research and meet information needs.

Benchmark C: Formulate advanced search strategies, demonstrating an understanding of the strengths and limitations of the Internet, and evaluate the quality and appropriate use of Internet resources.

Benchmark D: Evaluate choices of electronic resources and determine their strengths and limitations.

#### **Standard 6: Design**

**Students apply a number of problem-solving strategies demonstrating the nature of design, the role of engineering and the role of assessment.**

Benchmark A: Identify and produce a product or system using a design process, evaluate the final solution and communicate the findings.

Benchmark B: Recognize the role of teamwork in engineering design and of prototyping in the design process.

Benchmark C: Understand and apply research, development and experimentation to problem-solving.

## **Standard 7: Designed World**

**Students understand how the physical, informational and bio-related technological systems of the designed world are brought about by the design process. Critical to this will be students' understanding of their role in the designed world: its processes, products, standards, services, history, future, issues and career connections.**

Benchmark A: Classify, demonstrate, examine, and appraise energy and power technologies.

Benchmark B: Classify, demonstrate, examine and appraise transportation technologies.

Benchmark C: Classify, demonstrate, examine and appraise manufacturing technologies.

Benchmark D: Classify, demonstrate, examine and appraise construction technologies.

Benchmark E: Classify, demonstrate, examine and appraise information and communication technologies

Benchmark F: Classify, demonstrate, examine and appraise medical technologies.

Benchmark G: Classify, demonstrate, examine and appraise agricultural and related biotechnologies.

# *Performance Measures/Student Assessment/Instructional Strategies*

## **Assessments/Evaluations**

- Observations
- Demonstrations
- Portfolios
- Standardized Tests
- Class Assignment
- Quizzes/Tests/Exams

## **Instructional Strategies**

- Teacher-Directed & Student-Centered Activities
- Case Study Problem Solving
- Cooperative Learning
- Project-Based Learning
- Career-Based Learning (Internships/Shadowing/Placement)
- Community-Based Learning (CTSOs and Other)
- Exploratory Learning
- Independent Research
- Team Teaching

## **Content Specific Strategies**