

Course of Study

Advanced Math / Pre-calculus

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

Advanced Math / Pre-calculus 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 Advanced Math / Pre-calculus 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 Advanced Math / Pre-calculus Course of Study.

District Superintendent

Date

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 Advanced Math / Pre-calculus 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 Advanced Math / Pre-calculus are to:

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.

Course Description

This Course is designed for students who plan to go to college or enter a technical career which requires Advanced Math / Pre-calculus skills.

Topics include:

- Functions and graphs of various types (polynomials, rational, exponential, logarithmic) to analyze relationships between variables and solve applied problems from many disciplines.
- Geometric properties of conic sections to derive equations and graphs for these curves' reflective properties t solve applied problems.
- Systems of linear and nonlinear equations by methods of substitution, elimination, Gaussian elimination and inverse matrix.
- Matrix operations of addition, subtraction, scaler multiplication, matrix multiplication, and finding the determinant and inverse of a square matrix.
- General terms of sequence and write series in summation notation. Use functions and graphs of various types (polynomials, rational, exponential, logarithmic) to analyze relationships between variables and solve applied problems.

This course is alignment with the Ohio Academic Content Standards for 12th grade.

The class meets 45 minutes each day for one school year. One credit is earned in Advanced Math / Pre-calculus. Students must have earned a C or higher in Algebra II or permission of the instructor before taking Advanced Math / Pre-calculus.

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 21st 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. Apply factorials and exponents, including fractional exponents, to solve practical problems.

1. Apply combinations as a method to create coefficients for the Binomial Theorem, and make connections to everyday and workplace problem situations.

Benchmark B. Represent and compute with complex numbers.

1. Determine what properties (closure, identity, inverse, commutative and associative) hold for operations with complex numbers.

Measurement Standard

Benchmark A. Explain differences among accuracy, precision and error, and describe how each of those can affect solutions in measurement situations.

1. Determine the number of significant digits in a measurement. (11th)

Benchmark B. Apply various measurement scales to describe phenomena and solve problems.

1. Use radian and degree angle measures to solve problems and perform conversions as needed. (11th)

Benchmark C. Estimate and compute areas and volume in increasingly complex problem situations.

1. Apply informal concepts of successive approximation, upper and lower bounds, and limits in measurement situations; e.g., measurement of some quantities, such as volume of a cone, can be determined by sequences of increasingly accurate approximations.
2. Derive a formula for the surface area of a cone as a function of its slant height and the circumference of its base. (11th)
3. Calculate distances, areas, surface areas and volumes of composite three-dimensional objects to a specified number of significant digits. (11th)

Benchmark D. Solve problem situations involving derived measurements; e.g., density, acceleration.

1. Solve problems involving derived measurements; e.g., acceleration and pressure.
2. Use radian measures in the solution of problems involving angular velocity and acceleration.
3. Solve real-world problems involving area, surface area, volume and density to a specified degree of precision. (11th)

Geometry and Spatial Sense Standard

Benchmark A. Use trigonometric relationships to verify and determine solutions in problem situations.

1. Derive and apply the basic trigonometric identities; i.e., angle addition, angle subtraction and double angle.
2. Use trigonometric relationships to determine lengths and angle measures; i.e., Law of Sines and Law of Cosines. (11th)
3. Identify, sketch and classify the cross sections of three-dimensional objects. (11th)

Benchmark B. Represent transformations within a coordinate system using vectors and matrices.

1. Use matrices to represent translations, reflections, rotations, dilations and their compositions.
2. Relate graphical and algebraic representations of lines, simple curves and conic sections.
3. Recognize and compare specific shapes and properties in multiple geometries; e.g., plane, spherical and hyperbolic.
4. Use polar coordinates to specify locations on a plane. (11th)
5. Represent translations using vectors. (11th)
6. Describe multiplication of a vector and a scalar graphically and algebraically, and apply to problem situations. (11th)

Patterns, Functions and Algebra Standard

Benchmark A. Analyze functions by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior.

1. Analyze the behavior of arithmetic and geometric sequences and series as the number of terms increases.
2. Translate between the numeric and symbolic form of a sequence or series.
3. Describe and compare the characteristics of transcendental and periodic functions; e.g., general shape, number of roots, domain and range, asymptotic behavior, extrema, local and global behavior.
4. Represent the inverse of a transcendental function symbolically.
5. Make arguments about mathematical properties using mathematical induction.
6. Make mathematical arguments using the concepts of limit.
7. Translate freely between polar and Cartesian coordinate systems.
8. Use the concept of limit to find instantaneous rate of change for a point on a graph as the slope of a tangent at a point.

Benchmark B. Use recursive functions to model and solve problems; e.g., home mortgages, annuities.

1. Compare estimates of the area under a curve over a bounded interval by partitioning the region with rectangles; e.g., make successive estimates using progressively smaller rectangles.

Benchmark C. Apply algebraic methods to represent and generalize problem situations involving vectors and matrices.

1. Set up and solve systems of equations using matrices and graphs, with and without technology.

Data Analysis and Probability Standard

Benchmark A. Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators.

1. Transform bivariate data so it can be modeled by a function; e.g., use logarithms to allow nonlinear relationship to be modeled by linear function.
2. Apply the concept of a random variable to generate and interpret probability distributions, including binomial, normal and uniform.

Benchmark B. Use descriptive statistics to analyze and summarize data, including measures of center, dispersion, correlation and variability.

1. Describe the shape and find all summary statistics for a set of univariate data, and describe how a linear transformation affects shape, center and spread.

Benchmark C. Design and perform a statistical experiment, simulation or study; collect and interpret data; and use descriptive statistics to communicate and support predictions and conclusions.

1. Identify and use various sampling methods (voluntary response, convenience sample, random sample, stratified random sample, census) in a study.
2. Use sampling distributions as the basis for informal inference.

Benchmark D. Connect statistical techniques to applications in workplace and consumer situations.

1. Use theoretical or experimental probability, including simulations, to determine probabilities in real-world problem situations involving uncertainty, such as mutually exclusive events, complementary events, and conditional probability.

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