

Medina County Schools'

Course of Study

For

Math

Data Collection & Analysis (Cloverleaf)

June 2008

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	Instructional Organization	Grade Level Indicators	Notes
By the end of the 8-10 program:			
A. Generalize and explain patterns and sequences in order to find the next term and the n th term.	M.4.A.DCA.2 <i>Use Patterns, Relations and Functions</i>	2. Generalize patterns using functions or relationships (linear, quadratic and exponential), and freely translate among tabular, graphical and symbolic representations.	
B. Identify and classify functions as linear or nonlinear, and contrast their properties using tables, graphs or equations.	M.4.B.DCA.1 <i>Use Patterns, Relations and Functions</i>	1. Define function with ordered pairs in which each domain element is assigned exactly one range element.	
	M.4.B.DCA.3	3. Describe problem situations (linear, quadratic and exponential) by using tabular, graphical and symbolic representations.	
C. Translate information from one representation (words, table, graph or equation) to another representation of a relation or function.	M.4.C.DCA.2	2. Generalize patterns using functions or relationships (linear, quadratic and exponential), and freely translate among tabular, graphical and symbolic representations.	

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	Instructional Organization	Grade Level Indicators	Notes
<p>By the end of the 8-10 program:</p> <p>D. Use algebraic representations, such as tables, graphs, expressions, functions and inequalities, to model and solve problem situations.</p> <p>E. Analyze and compare functions and their graphs using attributes, such as rates of change, intercepts and zeros.</p> <p>G. Solve quadratic equations with real roots by graphing, formula and factoring.</p>	<p>M.4.D.DCA.7 <i>Use Algebraic Expressions</i></p> <p>M.4.E.DCA.4 <i>Use Patterns, Relations and Functions</i></p> <p>M.4.E.DCA.5</p> <p>M.4.G.DCA.10 <i>Use Algebraic Representatives</i></p>	<p>7. Use formulas to solve problems involving exponential growth and decay.</p> <p>4. Demonstrate the relationship among zeros of a function, roots of equations, and solutions of equations graphically and in words.</p> <p>5. Describe and compare characteristics of the following families of functions: linear, quadratic and exponential functions; e.g., general shape, number of roots, domain, range, rate of change, maximum or minimum.</p> <p>10. Solve quadratic equations with real roots by factoring, graphing, using the quadratic formula and with technology.</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	Instructional Organization	Grade Level Indicators	Notes
<p>By the end of the 8-10 program:</p> <p>I. Model and solve problem situations involving direct and inverse variation.</p> <p>J. Describe and interpret rates of change from graphical and numerical data.</p>	<p>M.4.I.DCA.13 <i>Analyze Change</i></p> <p>M.4.I.DCA.14</p> <p>M.4.J.DCA.15</p>	<p>13. Model and solve problems involving direct and inverse variation using proportional reasoning.</p> <p>14. Describe the relationship between slope and the graph of a direct variation and inverse variation.</p> <p>15. Describe how a change in the value of a constant in a linear or quadratic equation affects the related graphs.</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	Instructional Organization	Grade Level Indicators	Notes
<p>By the end of the 8-10 program:</p> <p>B. Identify and classify functions as linear or nonlinear, and contrast their properties using tables, graphs or equations.</p> <p>G. Solve quadratic equations with real roots by graphing, formula and factoring.</p>	<p>M.4.B.DCA.1 <i>Use Algebraic Representatives</i></p> <p>M.4.G.DCA.10</p>	<p>1. Define function formally and with $f(x)$ notation.</p> <p>10. Solve real-world problems that can be modeled using linear, quadratic, exponential or square root functions.</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	Instructional Organization	Grade Level Indicators	Notes
<p>By the end of the 11-12 program:</p> <p>A. Analyze functions by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior.</p>	<p>M.4.A.DCA.3 <i>Use Patterns, Relations and Functions</i></p> <p>M.4.A.DCA.4</p> <p>M.4.A.DCA.5</p> <p>M.4.A.DCA.6 <i>Use Algebraic Representations</i></p>	<p>3. Describe and compare the characteristics of the following families of functions: quadratics with complex roots, polynomials of any degree, logarithms, and rational functions; e.g., general shape, number of roots, domain and range, asymptotic behavior.</p> <p>4. Identify the maximum and minimum points of polynomial, rational and trigonometric functions graphically and with technology.</p> <p>5. Identify families of functions with graphs that have rotation symmetry or reflection symmetry about the y-axis, x-axis or $y = x$.</p> <p>6. Represent the inverse of a function symbolically and graphically as a reflection about $y = x$.</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	Instructional Organization	Grade Level Indicators	Notes
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<p>By the end of the 11-12 program:</p> <p>C. Use recursive functions to model and solve problems; e.g., home mortgages, annuities.</p>	<p>M.4.C.DCA.1 <i>Use Patterns, Relations and Functions</i></p> <p>M.4.C.DCA.2</p>	<p>1. Identify and describe problem situations involving an iterative process that can be represented as a recursive function; e.g., compound interest.</p> <p>2. Translate a recursive function into a closed form expression or formula for the nth term to solve a problem situation involving an iterative process; e.g., find the value of an annuity after 7 years.</p>	
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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	Instructional Organization	Grade Level Indicators	Notes
<p>By the end of the 11-12 program:</p> <p>A. Analyze functions by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior.</p>	<p>M.4.A.DCA.1 <i>Use Patterns, Relations and Functions</i></p> <p>M.4.A.DCA.2</p> <p>M.4.A.DCA.6</p>	<p>1. Analyze the behavior of arithmetic and geometric sequences and series as the number of terms increases.</p> <p>2. Translate between the numeric and symbolic form of a sequence or series.</p> <p>6. Make arguments about mathematical properties using mathematical induction.</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	Instructional Organization	Grade Level Indicators	Notes
<p>By the end of the 8-10 program:</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>G. Describe sampling methods and analyze the effects of method chosen on how well the resulting sample represents the population.</p>	<p>M.5.A.DCA.2 <i>Data Collection</i></p> <p>M.5.A.DCA.4</p> <p>M.5.A.DCA.6 <i>Statistical Methods</i></p> <p>M.5.G.DCA.5 <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>4. Identify outliers on a data display; e.g., use the interquartile range to identify outliers on a box-and-whisker plot.</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> <p>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.</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	Instructional Organization	Grade Level Indicators	Notes
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<p>By the end of the 11-12 program:</p> <p>A. Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators.</p>	<p>M.5.A.DCA.4 <i>Statistical Methods</i></p> <p>M.5.A.DCA.5</p> <p>M.5.A.DCA.7</p> <p>M.5.A.DCA.8</p> <p>M.5.A.DCA.10 <i>Probability</i></p>	<p>4. Create a scatterplot of bivariate data, identify trends, and find a function to model the data.</p> <p>5. Use technology to find the Least Squares Regression Line, the regression coefficient, and the correlation coefficient for bivariate data with a linear trend, and interpret each of these statistics in the context of the problem situation.</p> <p>7. Describe the standard normal curve and its general properties, and answer questions dealing with data assumed to be normal.</p> <p>8. Analyze and interpret univariate and bivariate data to identify patterns, note trends, draw conclusions, and make predictions.</p> <p>10. Understand and use the concept of random variable, and compute and interpret the expected value for a random variable in simple cases.</p>	
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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	Instructional Organization	Grade Level Indicators	Notes
<p>By the end of the 11-12 program:</p> <p>B. Use descriptive statistics to analyze and summarize data, including measures of center, dispersion, correlation and variability.</p>	<p>M.5.B.DCA.3 <i>Statistical Methods</i></p> <p>M.5.B.DCA.5</p> <p>M.5.B.DCA.6</p> <p>M.5.B.DCA.8</p>	<p>3. Describe how a linear transformation of univariate data affects range, mean, mode, and median.</p> <p>5. Use technology to find the Least Squares Regression Line, the regression coefficient, and the correlation coefficient for bivariate data with a linear trend, and interpret each of these statistics in the context of the problem situation.</p> <p>6. Use technology to compute the standard deviation for a set of data, and interpret standard deviation in relation to the context or problem situation.</p> <p>8. Analyze and interpret univariate and bivariate data to identify patterns, note trends, 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	Instructional Organization	Grade Level Indicators	Notes
<p>By the end of the 11-12 program:</p> <p>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.</p>	<p>M.5.C.DCA.1 <i>Data Collection</i></p> <p>M.5.C.DCA.2</p> <p>M.5.C.DCA.9 <i>Statistical Methods</i></p>	<p>1. Design a statistical experiment, survey or study for a problem; collect data for the problem; and interpret the data with appropriate graphical displays, descriptive statistics, concepts of variability, causation, correlation and standard deviation.</p> <p>2. Describe the role of randomization in a well -designed study, especially as compared to a convenience sample, and the generalization of results from each.</p> <p>9. Evaluate validity of results of a study based on characteristics of the study design, including sampling method, summary statistics and data analysis techniques.</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	Instructional Organization	Grade Level Indicators	Notes
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<p>By the end of the 11-12 program:</p> <p>D. Connect statistical techniques to applications in workplace and consumer situations.</p>	<p>M.5.D.DCA.1 <i>Data Collection</i></p> <p>M.5.D.DCA.2</p> <p>M.5.D.DCA.9</p> <p>M.5.D.DCA.11 <i>Probability</i></p>	<p>1. Design a statistical experiment, survey or study for a problem; collect data for the problem; and interpret the data with appropriate graphical displays, descriptive statistics, concepts of variability, causation, correlation and standard deviation.</p> <p>2. Describe the role of randomization in a well -designed study, especially as compared to a convenience sample, and the generalization of results from each.</p> <p>9. Evaluate validity of results of a study based on characteristics of the study design, including sampling method, summary statistics and data analysis techniques.</p> <p>11. Examine statements and decisions involving risk; e.g., insurance rates and medical decisions.</p>	
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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	Instructional Organization	Grade Level Indicators	Notes
<p>By the end of the 11-12 program:</p> <p>A. Create and analyze tabular and graphical displays of data using appropriate tools, including spreadsheets and graphing calculators.</p> <p>B. Use descriptive statistics to analyze and summarize data, including measures of center, dispersion, correlation and variability.</p> <p>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.</p>	<p>M.5.A.DCA.4 <i>Statistical Methods</i></p> <p>M.5.B.DCA.3</p> <p>M.5.C.DCA.1 <i>Data Collection</i></p>	<p>4. Apply the concept of a random variable to generate and interpret probability distributions, including binomial, normal and uniform.</p> <p>3. 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.</p> <p>1. Identify and use various sampling methods (voluntary response, convenience sample, random sample, stratified random sample, census) in a study.</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	Instructional Organization	Grade Level Indicators	Notes
By the end of the 11-12 program:			
A. Construct algorithms for multi-step and non-routine problems.	M.6.A.DCA	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. Construct logical verifications or counter-examples to test conjectures and to justify or refute algorithms and solutions to problems.	M.6.B.DCA		
C. Assess the adequacy and reliability of information available to solve a problem.	M.6.C.DCA		
D. Select and use various types of reasoning and methods of proof.	M.6.D.DCA		
E. Evaluate a mathematical argument and use reasoning and logic to judge its validity.	M.6.E.DCA		
F. Present complete and convincing arguments and justifications, using inductive and deductive reasoning, adapted to be effective for various audiences.	M.6.F.DCA		

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	Instructional Organization	Grade Level Indicators	Notes
<p>By the end of the 11-12 program:</p> <p>G. Understand the difference between a statement that is verified by mathematical proof, such as a theorem, and one that is verified empirically using examples or data.</p> <p>H. Use formal mathematical language and notation to represent ideas, to demonstrate relationships within and among representation systems, and to formulate generalizations.</p> <p>I. Communicate mathematical ideas orally and in writing with a clear purpose and appropriate for a specific audience.</p> <p>J. Apply mathematical modeling to workplace and consumer situations, including problem formulation, identification of a mathematical model, interpretation of solution within the model, and validation to original problem situation.</p>	<p>M.6.G.DCA</p> <p>M.6.H.DCA</p> <p>M.6.I.DCA</p> <p>M.6.J.DCA</p>		