

Math Achievement Indicators Grade 9-12

Content Standard 1.0

Students will accurately calculate and use estimation techniques, number relationships, operation rules and algorithm; they will determine the reasonableness of answers and the accuracy of solutions to solve problems, communicate, reason, and make connections within and beyond the field of mathematics.

Content Standard Indicator	Work at the Emergent/Developing level may indicate...	Work at the Approaches level may indicate...	Work at the Meets level demonstrates...	Work at the Exceeds level demonstrates...
1.12.6 Determine an approximate value of radical and exponential expressions using a variety of methods.	ability to find the value of a radical and an exponential expression relying on a calculator.	difficulty approximating radical or exponential values. ability to simplify perfect squares or single-digit numbers using cubes.	ability to determine approximate values of radical and exponential expressions using a variety of methods.	application of radical and exponential values in practical situations.
1.12.7 Solve mathematical problems involving exponents and roots. Perform addition, subtraction, and scalar multiplication on matrices.	ability to solve mathematical problems involving exponents and roots using procedural prompts. ability to perform matrix addition, subtraction and scalar multiplication using a calculator with a matrix program.	difficulty solving mathematical problems including exponents or roots. ability to add and use scalar multiplication. difficulty subtracting matrices.	ability to solve mathematical problems that include exponents and roots. ability to add, subtracts, and applies scalar multiplication to matrices.	application of knowledge of exponents and roots to practical situations. extension of knowledge of matrices to include multi-step matrix problems.
1.12.8 Identify and apply real number properties to solve problems.	application of the real number properties. inability to identify the properties.	application of properties of real numbers to solve problems. difficulty identifying the correct property.	identification and application of real number properties to solve problems.	ability to justify and prove properties of real numbers to solve mathematical and practical problems.

Math Achievement Indicators Grade 9-12

Content Standard 2.0

Students will use various algebraic methods to analyze, illustrate, extend, and create numerous representations (words, numbers, tables, and graphs) of patterns, functions, and algebraic relations as modeled in practical situations to solve problems, communicate, reason, and make connections within and beyond the field of mathematics.

Content Standard Indicator	Work at the Emergent/Developing level may indicate...	Work at the Approaches level may indicate...	Work at the Meets level demonstrates...	Work at the Exceeds level demonstrates...
2.12.1 Use algebraic expressions to identify and describe the n^{th} term of a sequence.	ability to determine the difference and predict the next term in the sequence. inability to describe the n^{th} term of the sequence.	ability to recognize algebraic patterns and identify specific terms difficulty representing this information in an n^{th} term formula.	use of algebraic expressions to identify and describe the n^{th} term of a sequence.	extension of algebraic expressions through the development of formulas to identify the n^{th} term of a sequence.
2.12.2 Isolate any variable in given equations, inequalities, proportions, and formulas to use in mathematical and practical situations.	ability to isolate a variable in one-step equations and proportions.	ability to isolate variables in given equations and proportions. difficulty isolating variables in inequalities and formulas.	ability to isolate variables in given equations, inequalities, proportions, and formulas to use in mathematical and practical situations.	ability to isolate variables to solve practical problems in other disciplines.
2.12.3 Add, subtract, multiply, and factor 1^{st} and 2^{nd} degree polynomials connecting the arithmetic and algebraic processes.	ability to simplify polynomials by collecting like terms of polynomials written without parenthesis.	ability to add polynomials and multiply a polynomial with a monomial. difficulty subtracting polynomials.	ability to add, subtract, multiply, and factor 1^{st} and 2^{nd} degree polynomials connecting the arithmetic and algebraic processes.	ability to add, subtract, multiply, and factor higher-degree polynomials using a variety of methods.

Achievement Indicators for Math
Grade 9-12

Content Standard 2.0 (continued)				
Students will use various algebraic methods to analyze, illustrate, extend, and create numerous representations (words, numbers, tables, and graphs) of patterns, functions, and algebraic relations as modeled in practical situations to solve problems, communicate, reason, and make connections within and beyond the field of mathematics.				
Content Standard Indicator	Work at the Emergent/Developing level may indicate...	Work at the Approaches level may indicate...	Work at the Meets level demonstrates...	Work at the Exceeds level demonstrates...
Simplify algebraic expressions, including exponents and radicals.	ability to simplify algebraic expressions including exponents with procedural prompts.	difficulty connecting concepts from arithmetic to algebraic processes. ability to simplify algebraic expressions, including exponents through cubes. list must be generated of all factors of the algebraic expression under the radical to simplify the radical.	ability to simplify algebraic expressions, including exponents and radicals.	application of algebraic expressions, including exponents and radicals in practical situations.
2.12.4 Determine the domain and range of functions, including linear, quadratic, and absolute value, algebraically and graphically.	ability to list all the “x” and “y” values from a list of ordered pairs given procedural prompts. inability to make connections between the domain and range of the graph.	limited knowledge of domain and range regarding linear equations. difficulty applying knowledge of domain and range regarding linear quadratic and absolute value equations.	ability to determine the domain and range of functions, including linear, quadratic, and absolute value, algebraically and graphically.	ability to determine the domain and range of a variety of equations and communicate these results in practical situations.
Solve absolute value equations and inequalities both algebraically and graphically.	ability to find only the positive solution to an absolute value equations and inequalities. ability to can graph the solution on a number line.	difficulty graphically solving absolute value equations and inequalities.	ability to solve absolute value equations and inequalities both algebraically and graphically.	ability to solve equations and inequalities both algebraically and graphically, and effectively communicate these results in practical situations.

Content Standard 2.0 (continued)

Students will use various algebraic methods to analyze, illustrate, extend, and create numerous representations (words, numbers, tables, and graphs) of patterns, functions, and algebraic relations as modeled in practical situations to solve problems, communicate, reason, and make connections within and beyond the field of mathematics.

Content Standard Indicator	Work at the Emergent/Developing level may indicate...	Work at the Approaches level may indicate...	Work at the Meets level demonstrates...	Work at the Exceeds level demonstrates...
2.12.5 Solve systems of two linear equations algebraically and graphically and verify solutions (with and without technology).	<p>ability to solve systems of two linear equations graphically with technology.</p> <p>inability to determine the solution algebraically.</p>	<p>ability to solve systems of two linear equations algebraically.</p> <p>difficulty applying knowledge of solving systems of two linear equations algebraically using graphic representation.</p>	<p>ability to solve systems of two linear equations algebraically and graphically and verify solutions (with and without technology).</p>	<p>ability to solve mathematical and practical problems involving systems of linear equations with a variety of methods.</p>
2.12.6 Solve mathematical and practical problems involving linear and quadratic equations with a variety of methods, including discrete methods (with and without technology).	<p>difficulty with properties of equality.</p> <p>difficulty solving mathematical problems involving quadratic equations.</p>	<p>difficulty solving practical problems involving linear or quadratic equations is using a variety of methods.</p>	<p>ability to solve mathematical and practical problems involving linear and quadratic equations with a variety of methods, including discrete methods (with and without technology).</p>	<p>ability to solve and justify mathematical and practical problems involving linear and quadratic equations using a variety of methods.</p>

Math Achievement Indicators Grade 9-12

Content Standard 3.0

Students will use appropriate tools and techniques of measurement to determine estimate, record, and verify direct and indirect measurements to solve problems, communicate, reason and make connections within and beyond the field of mathematics.

Content Standard Indicator	Work at the Emergent/Developing level may indicate...	Work at the Approaches level may indicate...	Work at the Meets level demonstrates...	Work at the Exceeds level demonstrates...
3.12.1 Estimate and convert between customary and metric systems.	ability to use formulas to convert between customary and metric given procedural prompts, including the use of proportions.	difficulty estimating and using mathematics to convert between the systems.	ability to estimate and convert between customary and metric systems.	ability to perform multi-step estimations and conversions between customary and metric systems selecting the most appropriate units to represent the results in practical situations.
3.12.2 Justify, communicate, and differentiate between precision, error, and tolerance in practical problems.	ability to demonstrate a basic mathematical explanation of precision, error and tolerance.	difficulty in the justification, communication, and differentiation between precision, error, and tolerance in practical problems.	ability to justify, communicate, and differentiate between precision, error, and tolerance in practical problems.	ability to justify, communicate, and differentiate between precision, error, and tolerance in practical problems and defend their results.
3.12.3 Select and use appropriate measurement tools, techniques, and formulas to solve problems in mathematical and practical situations.	difficulty selecting and using the appropriate measurement tool.	ability to select and use the appropriate measurement tool. difficulty selecting and applying the correct formulas in mathematical and practical situations.	ability to select and use appropriate measurement tools, techniques, and formulas to solve problems in mathematical and practical situations.	ability to justify their use of the appropriate measurement tools, techniques, and formulas used to solve mathematical and practical problems.

Content Standard 3.0 (continued)				
Students will use appropriate tools and techniques of measurement to determine estimate, record, and verify direct and indirect measurements to solve problems, communicate, reason and make connections within and beyond the field of mathematics.				
Content Standard Indicator	Work at the Emergent/Developing level may indicate...	Work at the Approaches level may indicate...	Work at the Meets level demonstrates...	Work at the Exceeds level demonstrates...
3.12.4 Interpret and apply consumer data presented in charts, tables, and graphs to make informed financial decisions related to practical applications.	ability to gather information from graphs, charts and tables when given leading questions to ascertain needed information.	ability to identify consumer data presented in charts, tables, and graphs to make informed financial decisions related to practical applications.	ability to interpret and apply consumer data presented in charts, tables, and graphs to make informed financial decisions related to practical applications.	ability to collect consumer data and present results in charts, tables, and graphs to make informed financial decisions.
3.12.5 Determine the measure of unknown dimensions, angles, areas, and volumes using relationships and formulas to solve problems.	ability to find area and volume given the correct formulas and dimensions. difficulty finding a missing dimension given the area/volume.	difficulty using formulas necessary to determine the unknown dimensions, angles, areas, or volumes to solve problems.	ability to determine the measure of unknown dimensions, angles, areas, and volumes using relationships and formulas to solve problems.	ability to calculate and apply the measure of unknown dimensions, angles, areas, and volumes using relationships and formulas to solve practical problems.

Math Achievement Indicators Grade 9-12

Content Standard **4.0**

Students will identify, represent, verify, and apply spatial relationships and geometric properties to solve problems, communicate, reason, and make connections within and beyond the field of mathematics.

Content Standard Indicator	Work at the Emergent/Developing level may indicate...	Work at the Approaches level may indicate...	Work at the Meets level demonstrates...	Work at the Exceeds level demonstrates...
<p>4.12.1 Identify and use the parts of a circle to solve mathematical and practical problems.</p> <p>Identify and apply properties of interior and exterior angles of polygons to solve mathematical and practical problems.</p>	<p>difficulty identifying parts of a circle.</p> <p>ability to identify the sum of the interior and exterior angles of quadrilaterals and pentagons.</p> <p>difficulty applying the sum to find an individual angle.</p>	<p>difficulty using the parts of a circle to solve mathematical problems.</p> <p>difficulty applying properties of interior or exterior angles of polygons without a formula given.</p>	<p>ability to identify and use the parts of a circle to solve mathematical and practical problems.</p> <p>ability to identify and apply properties of interior and exterior angles of polygons to solve mathematical and practical problems.</p>	<p>ability to justify their use of the parts of a circle to solve problems in mathematical and practical problems.</p> <p>ability to derive the formulas for finding the interior and exterior angles of polygons.</p>
<p>4.12.2 Apply properties of similarity through right triangle trigonometry to find missing angles and sides.</p>	<p>ability to identify the trigonometry ratios.</p> <p>inability to apply the needed ratio to find a missing side.</p> <p>difficulty using similarity to find missing sides or angles.</p>	<p>difficulty using trigonometric ratios when finding missing angles or sides.</p>	<p>application of properties of similarity and right triangle trigonometry to find missing angles and sides.</p>	<p>application of similarity and right triangle trigonometry to find all missing angles and sides in practical situations.</p>

Achievement Indicators for Math
Grade 9-12

Content Standard 4.0 (continued)				
Students will identify, represent, verify, and apply spatial relationships and geometric properties to solve problems, communicate, reason, and make connections within and beyond the field of mathematics.				
Content Standard Indicator	Work at the Emergent/Developing level may indicate...	Work at the Approaches level may indicate...	Work at the Meets level demonstrates...	Work at the Exceeds level demonstrates...
4.12.5 Determine the slope of lines using coordinate geometry and algebraic techniques.	ability to identify the slope of a line when given the graph of a line.	ability to plot points to determine slope and intercepts of a linear equation.	ability to determine the slope of lines using coordinate geometry and algebraic techniques.	ability to apply knowledge of slope to practical situations.
Identify parallel, perpendicular, and intersecting lines by slope.	difficulty identifying the slope in a linear equation.	difficulty determining slope using algebraic techniques.	difficulty determining parallel or perpendicular lines by slope.	ability to identify parallel, perpendicular, and intersecting lines by slope.
Graph linear equations and find possible solutions to those equations using coordinate geometry.	ability to find ordered pair solutions if given the slope intercept form of the linear equation, the value of one variable and the table in order.	difficulty substituting ordered pairs into an equation to check for solutions.	ability to graph a linear equation.	ability to graph linear equations and find possible solutions to those equations using coordinate geometry.
Find possible solution sets of systems of equations whose slopes indicate parallel, perpendicular, or intersecting lines.	difficulty identifying the slope in a linear equation.	difficulty identifying the possible solutions sets given the slopes of the two linear equations.	ability to find possible solution sets of systems of equations whose slopes indicate parallel, perpendicular, or intersecting lines.	ability to justify the relationships of lines algebraically, graphically, and in practical situations.
			ability to justify possible solutions to linear equations using a variety of methods.	ability to justify possible solutions to linear equations using a variety of methods.
				ability to use several methods for solving linear systems of equations including graphing, substitution, and elimination.

Achievement Indicators for Math
Grade 9-12

Content Standard 4.0 (continued)				
Students will identify, represent, verify, and apply spatial relationships and geometric properties to solve problems, communicate, reason, and make connections within and beyond the field of mathematics.				
Content Standard Indicator	Work at the Emergent/Developing level may indicate...	Work at the Approaches level may indicate...	Work at the Meets level demonstrates...	Work at the Exceeds level demonstrates...
4.12.6 Solve problems using complementary and supplementary angles, congruent angles, vertical angles, angles formed when parallel lines are cut by a transversal and angles in polygons.	ability to identify complementary and supplementary angles. difficulty identifying vertical angles and congruent angles formed by two lines cut by a transversal.	difficulty solving problems using complementary and supplementary angles. ability to identify the vertical angles and angle relationships formed by two parallel lines cut by a transversal.	ability to solve problems using complementary and supplementary angles, congruent angles, vertical angles, angles formed when parallel lines are cut by a transversal and angles in polygons.	ability to apply knowledge of complementary and supplementary angles, congruent angles, vertical angles, angles formed when parallel lines are cut by a transversal and angles in polygons to practical situations.
4.12.7. Apply the Pythagorean Theorem and its converse in mathematical and practical situations.	ability to apply the Pythagorean Theorem when solving for the hypotenuse. difficulty solving for the missing leg.	difficulty applying the Pythagorean theorem and its converse with non-Pythagorean triples.	ability to apply the Pythagorean Theorem and its converse in mathematical and practical situations.	ability to extend the Pythagorean Theorem and its converse to coordinate geometry and trigonometry.
4.12.8 Solve problems by drawing and/or constructing geometric figures to demonstrate geometric relationships.	ability to draw/or construct the geometric figures. inability to use geometric figures to solve problems.	difficulty solving problems using constructions or drawings.	ability to solve problems by drawing and/or constructing geometric figures to demonstrate geometric relationships.	ability to extend construction of geometric figures to a combination of constructions to prove various geometric relationships in practical situations.

Content Standard 4.0 (continued)

Students will identify, represent, verify, and apply spatial relationships and geometric properties to solve problems, communicate, reason, and make connections within and beyond the field of mathematics.

Content Standard Indicator	Work at the Emergent/Developing level may indicate...	Work at the Approaches level may indicate...	Work at the Meets level demonstrates...	Work at the Exceeds level demonstrates...
4.12.9 Formulate, evaluate, and justify arguments using inductive and deductive reasoning in mathematical and practical situations.	inabilities to formulate, evaluate, or justify an argument using any method of inductive and deductive reasoning.	difficulty formulating, evaluating, and justifying arguments using inductive and deductive reasoning. ability to complete arguments with prompts or fill in the blank templates using inductive and deductive reasoning.	ability to formulate, evaluate, and justify arguments using inductive and deductive reasoning in mathematical and practical situations.	ability to prove arguments using inductive and deductive reasoning in practical situations.

Math Achievement Indicators Grade 9-12

Content Standard 5.0

Students will collect, organize, display, interpret, and analyze data to determine statistical relationships and probability projections to solve problems, communicate, reason and make connections within and beyond the field of mathematics.

Content Standard Indicator	Work at the Emergent/Developing level may indicate...	Work at the Approaches level may indicate...	Work at the Meets level demonstrates...	Work at the Exceeds level demonstrates...
5.12.1 Organize statistical data through the use of tables, graphs, and matrices (with and without technology).	difficulty filling the data into a specified data representation such as tables, graphs or matrices.	difficulty selecting the appropriate graph to organizing statistical data.	ability to organize statistical data through the use of tables, graphs, and matrices (with and without technology).	ability to accurately interpret statistical data displayed through tables, graphs, and matrices.
5.12.2 Select and apply appropriate statistical measures in mathematical and practical situations.	<p>ability to find the measure of central tendencies when given procedural prompts.</p> <p>difficulty applying the measure of central tendencies to a practical situation.</p>	<p>ability to select the appropriate statistical measure.</p> <p>difficulty applying it in mathematical and practical situations.</p>	ability to select and apply appropriate statistical measures in mathematical and practical situations.	ability to select, compare, and apply statistical measures in mathematical situations.
5.12.3 Distinguish between a sample and a census.	ability to distinguish between a sample and a census with prompts.	difficulty determining the difference between a sample and a census.	ability to distinguish between a sample and a census.	ability to explain the validity of a census compared to a sample and what is appropriate or necessary.
Identify sources of bias and their effect on data representations and statistical conclusions.	difficulty identifying sources of bias.	<p>ability to identify bias.</p> <p>difficulty understanding how bias effects data representations.</p>	ability to identify sources of bias and their effect on data representations and statistical conclusions.	ability to understand bias and its effect on data representations and statistical conclusions through arguments and justification.
Use the shape of a normal distribution to compare and analyze data from a sample.	<p>ability to enter data into a graphing calculator and determine the mean standard deviation.</p> <p>inability to compare these data to a normal curve.</p>	ability to calculate mean and standard deviation and can answer basic questions related to the shape of a normal distribution of the data.	ability to use the shape of a normal distribution to compare and analyze data from a sample.	ability to use the shape of a normal distribution to compare and interpret data with measures of central tendency and other statistical applications.

Achievement Indicators for Math
Grade 9-12

Content Standard 5.0 (continued)				
Students will collect, organize, display, interpret, and analyze data to determine statistical relationships and probability projections to solve problems, communicate, reason and make connections within and beyond the field of mathematics.				
Content Standard Indicator	Work at the Emergent/Developing level may indicate...	Work at the Approaches level may indicate...	Work at the Meets level demonstrates...	Work at the Exceeds level demonstrates...
5.12.4 Apply permutations and combinations to mathematical and practical situations, including the Fundamental Counting Principle.	ability to calculate problems using the Fundamental Counting Principle, permutations, and combinations with procedural prompts.	ability to calculate problems using the Fundamental Counting Principle. inability to differentiate between permutations and combinations.	ability to apply permutations and combinations to mathematical and practical situations, including the Fundamental Counting Principle.	ability to apply permutations, combinations, and the Fundamental Counting Principle to probability problems.
5.12.5 Determine the probability of an event with and without replacement using sample spaces. Design, conduct, analyze, and effectively communicate the results of multi-stage probability experiments.	difficulty organizing and representing data using sample spaces. ability to conduct experiments with procedural direction.	difficulty differentiating between with and without replacement. ability to determine the probability of an event with replacement. ability to conduct experiments inability to set-up complete designs. difficulty analyzing the results or being able to communicate their results.	ability to determine the probability of an event with and without replacement using sample spaces. ability to design, conduct, analyze, and effectively communicate the results of multi-stage probability experiments.	ability to analyze the theoretical probability of an event and compare it to the experimental probability. ability to design, conduct, analyze, and communicate the results of probability experiments and compare their results to the theoretical expectations.

Content Standard 5.0 (continued)

Students will collect, organize, display, interpret, and analyze data to determine statistical relationships and probability projections to solve problems, communicate, reason and make connections within and beyond the field of mathematics.

Content Standard Indicator	Work at the Emergent/Developing level may indicate...	Work at the Approaches level may indicate...	Work at the Meets level demonstrates...	Work at the Exceeds level demonstrates...
<p>5.12.6 Design, construct, analyze, and select an appropriate type of graphical representations to communicate the results of a statistical experiment.</p> <p>Formulate and justify inferences based on a valid data sample.</p>	<p>ability to perform statistical experiments with assistance.</p> <p>ability to formulate inferences with prompts in fill in the blank templates.</p>	<p>difficulty designing, constructing, analyzing, or selecting the appropriate type of graphical representations independently.</p> <p>ability to formulate and justify inferences with guidance.</p>	<p>ability to design, construct, analyze, and select an appropriate type of graphical representation to communicate the results of a statistical experiment.</p> <p>ability to formulate and justify inferences based on a valid data sample.</p>	<p>ability to design, construct, analyze, select an appropriate type of graphical representation, and communicate the results of statistical experiments and compare the results to their initial hypothesis.</p> <p>ability to formulate, justify, and defend inferences based on a valid data sample.</p>