Texas University Interscholastic League

Contest Event: Mathematics

The 40-minute, 60-question contest is designed to test knowledge and understanding in the areas of algebra I and II, geometry, trigonometry, math analysis, analytic geometry, pre-calculus and elementary calculus.

The Texas Essential Knowledge and Skills are categorized by course area and grade level.
The following are course area abbreviations used for the TEKS in Mathematics:
Algebra 1= Alg1; Algebra 2 = Alg2; Geometry = Geo; Precalculus = Pc; Mathematical Models = MM.

Each TEKS begins with the outline number for the appropriate course area.

Texas Essential Knowledge and Skills	Contest Knowledge and Skills
<u>Foundations for Functions Knowledge and Skills:</u> A1. Understands that a function represents a dependence of one quantity on another and can be described in a variety of ways. (Alg1) A2 & 2A1. Uses the properties and attributes of functions. (Alg1, Alg2) A3. Understands how algebra can be used to express generalizations and recognizes and uses the power of symbols to represent situations. (Alg1) A4 & 2A2. Understands the importance of the skills required to manipulate symbols in order to solve problems and uses the necessary algebraic skills required to simplify algebraic expressions and solve equations and inequalities in problem situations. (Alg1, Alg2)	<u>Foundations for Functions Knowledge and Skills:</u> - Given the value of x find the value of F(x). - Find the domains and/or ranges of various functions. - Determine if a relation is a function using a given equation, a domain and range, a set of ordered pairs, or a graph of the relation. - Find the factors of algebraic expressions and use factors of algebraic expressions to solve algebraic equations. - Simplify algebraic expressions. - Use algebraic concepts to solve equations and inequalities in real-life problem applications. - Use direct variations and indirect variations to solve problems. - Translate word problems into mathematical symbols and algebraic expressions to solve problems. - Identify appropriate examples of real number properties such as commutative, associative, closure, distributive, etc.
<u>Linear Functions Knowledge and Skills:</u> A5. Understands that linear functions can be represented in different ways and translates among their various representations. (Alg1) A6. Understands the meaning of the slope and intercepts of the graphs of linear functions and zeros of linear functions and interprets and describes the effects of changes in parameters of linear functions in real-world and mathematical situations. (Alg1)	<u>Linear Functions Knowledge and Skills:</u> - Recognize a linear function from an equation, a graph, or a set of points. - Formulate equations or inequalities of linear equations from a graph, given points and slopes, or real-world situation. - Identify the slope of a line from an equation, a graph, or a pair of points.

A7 & 2A3. Formulates equations and inequalities based on linear functions, uses a variety of methods to solve them, and analyzes the solutions in terms of the situation. (Alg1, Alg2) A8 & 2A3. Formulates systems of linear equations from problem situations, uses a variety of methods to solve them, and analyzes the solutions in terms of the situation. (Alg1, Alg2) 2A4. Connects algebraic and geometric representations of functions. (Alg2)	- Put equations of lines into standard form, point-slope form, and slope-intercept form. - Solve linear equations or inequalities using algebraic transformations, substitution, plotting points, etc. - Find slopes of parallel and perpendicular lines. - Form systems of linear equations from given data and find their point of intersection. - Solve systems of equations using substitution, equation transformations, graphs, etc. - Formulate and solve systems of equations from real-life situations involving distance/rate/time problems, mixture problems, age problems, rate of work problems, etc.
<u>Other Nonlinear Functions - Quadratic, Square Root, Rational, Exponential, Logarithmic, Trigonometric - Knowledge and Skills</u>: A9. Understands that the graphs of quadratic functions are affected by the parameters of the function and can interpret and describe the effects of changes in the parameters of quadratic functions. (Alg1) A10. Understands there is more than one way to solve a quadratic equation and solves it using appropriate methods. (Alg1) A11. Understands there are situations modeled by functions that are neither linear nor quadratic and models the situations. (Alg1) 2A6. Understands that quadratic functions can be represented in different ways and translates among their various representations. (Alg2) 2A7. Interprets and describes the effects of changes in the parameters of quadratic functions in applied and mathematical situations. (Alg2) 2A8, 2A9, 2A10 & 2A11. Formulates equations and inequalities based on other nonlinear functions, uses a variety of methods to solve them, and analyzes the solutions in terms of the situation. (Alg2) P1. Defines functions, describes characteristics of functions, and translates among verbal, numerical, graphical, and symbolic representations of functions. (Pc)	<u>Other Nonlinear Functions - Quadratic, Square Root, Rational, Exponential, Logarithmic, Trigonometric - Knowledge and Skills:</u> - Identify and recognize all of the parent functions given in symbolically and graphically. - Know and use how the coefficients affect the parent functions, especially the quadratic function and the trigonometric functions. - Know and use how the parameters, domains, ranges, and limitations affect the parent functions. - Solve quadratic functions using factoring, substitution, the quadratic formula, completing the square, and graphing. - Determine the nature of the roots of a quadratic function based on its discriminant. - Determine the nature of the roots of higher degree polynomials using Descartes Rule of Signs. - Identify graphs from given functions or identify the given function from the given graph. - Find solutions to other non-linear functions. - Find the inverses of other non-linear functions and evaluate the inverses at specified points. - Work with composite functions, domains and ranges of functions, and identify special types of

	functions. - Translate verbal problems or graphs into functions using numerical and symbolic representations and use various methods to solve them.
<u>Algebra and Geometry Connections Knowledge and Skills:</u> 2A4. Connects algebraic and geometric representations of functions. (Alg2) 2A5. Knows the relationship between the geometric and algebraic descriptions of conic sections. (Alg2)	<u>Algebra and Geometry Connections Knowledge and Skills:</u> - Find complementary or supplementary angle measures algebraically and/or given a geometric representation.
<u>Geometric Structure Knowledge and Skills:</u> G1. Understands the structure of, and relationships within, an axiomatic system. (Geo) G2. Analyzes geometric relationships in order to make and verify conjectures. (Geo) G3. Applies logical reasoning to justify and prove mathematical statements. (Geo) G4. Uses a variety of representations to describe geometric relationships and solve problems. (Geo)	<u>Geometric Structure Knowledge and Skills:</u> - Identify properties from given examples. - Solve problems by using geometric properties, axioms and theorems. - Given several statements about geometric figures, drawings, and graphs, find the true or false statements. - Translate word problems into mathematical symbols and geometric representations to solve problems.
<u>Geometric Patterns Knowledge and Skills:</u> G5. Uses a variety of representations to describe geometric relationships and solve problems. (Geo)	<u>Geometric Patterns Knowledge and Skills:</u> - Formulate algebraic expressions based on patterns and figures to solve problems. - Find missing attributes of various polygons based on geometric properties and definitions of polygons. - Find missing attributes of similar polygons including common ratios, angle measures, and side lengths. - Transform points and/or figures using horizontal and vertical translations, reflections, and rotations. - Use Pythagorean relations to find missing parts of right triangles.
<u>Two and Three Dimensional Figures Knowledge and Skills:</u> G6. Analyzes the relationship between three-dimensional geometric figures and related two-dimensional representations and uses these	<u>Two and Three Dimensional Figures Knowledge and Skills:</u> - Identify three dimensional figures from given nets.

representations to solve problems. (Geo) G7. Understands that coordinate systems provide convenient and efficient ways of representing geometric figures and uses them accordingly. (Geo)	- Find points of intersections lines, planes, and various geometric figures. - Find points, equations of lines, slopes, etc. from a Cartesian Coordinate system. - Use properties of parallel lines, perpendicular lines, intersecting lines to determine equations of lines. - Given attributes of polygons identify the specific polygon.
<u>Properties and Relationships of Figures Knowledge and Skills:</u> G8, 88 and 89. Uses tools to determine measurements of geometric figures and extends measurement concepts to find perimeter, area, and volume in problem situations. (Geo, PK8) G9. Analyzes properties and describes relationships in geometric figures. (Geo) G10. Applies the concept of congruence to justify properties of figures and solve problems. (Geo) G11. Applies the concepts of similarity to justify properties of figures and solve problems. (Geo)	<u>Properties and Relationships of Figures Knowledge and Skills:</u> - Given the area of various geometric figures, find the perimeters, lengths of sides, and heights. - Use definitions of geometric figures to find missing data. - Use theorems to find measures of angles, arcs, sides, etc. - Use vocabulary about circles to determine radius/diameter/chord lengths. - Use formulas and given data to determine perimeter and area of polygons. - Use formulas and given data to determine circumference, area, and other missing parts of circles. - Use formulas and given data to determine surface area, volume, and missing parts of various polyhedra and Platonic Solids. - Determine congruence and similarity of figures to assist in solving problems. - Use properties of congruence and/or similarity to find relationships between geometric figures.
<u>Symbolic Representation Knowledge and Skills:</u> P2. Interprets the meaning of the symbolic representations of functions and operations on functions to solve meaningful problems. (Pc)	<u>Symbolic Representation Knowledge and Skills:</u> - Work with parent functions by doing symbolic transformations and function compositions. - Find inverses of functions and evaluate functions and inverse functions at specific points.

Probability and Statistics Knowledge and Skills: M4. Uses probability models to describe everyday situations involving chance. (MM)	Probability and Statistics Knowledge and Skills: - Find the probability and/or odds of experiments and situations. - Use the probability to determine mathematical expectations of game situations and everyday problems. - Use the fundamental counting principle to determine the number of possible outcomes.
Problem Solving Knowledge and Skills: P3. Uses functions and their properties, tools and technology, to model and solve meaningful problems. (Pc) P4. Uses sequences and series as well as tools and technology to represent, analyze, and solve real-life problems. P6. Uses vectors to model physical situations. (Pc) M1. Uses a variety of strategies and approaches to solve both routine and non-routine problems. (MM) M2. Uses graphical and numerical techniques to study patterns and analyze data. (MM). M5. Uses functional relationships to solve problems related to personal income. (MM) M8. Uses algebraic and geometric models to describe situations and solve problems. (MM) M9. Uses algebraic and geometric models to represent patterns and structures. (MM)	Problem Solving Knowledge and Skills: - Find values of the basic trigonometric functions given an angle or radian measure. - Apply trigonometric functions to analyze and solve problems and to make predictions. - Apply the Laws of Sines, Law of Cosines, and other trigonometric laws and properties to solve problems. - Convert degree measures to radian measures and vice versa. - Find missing terms of sequences and series. - Find the sums and limits of sequences and series. - Use sequences and series to find solutions to problems. - Use the binomial expansion to find missing coefficients of polynomials. - Convert parametric, rectangular, and Complex forms of numbers and equations to appropriate forms in order to graph or solve problems. - Use vectors, bearings, etc. to solve problems involving directions, locations, and navigation. - Make conclusions based on graphs and statistical data. - Find means, medians, modes, and ranges from given data. - Use means, medians, modes, and ranges to find solutions to everyday problems.

	- Use linear functions, direct variations, indirect variations, etc. to solve everyday problems. - Use a graphing calculator to graph trigonometric functions and other periodic functions to determine solutions and/or make predictions.