

## Texas University Interscholastic League

### Contest Event: Calculator Applications

The 30-minute contest includes calculations involving basic mathematics skills, trigonometric and inverse trigonometric functions, iterative solutions for transcendental equations, differential and integral calculus, elementary statistics and matrix algebra. In addition to straightforward calculation problems, the contest requires the solving of geometric and stated problems. Since students are allowed to use calculators on AP, SAT and other standardized tests, the contest is a beneficial experience for all participants.

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; Mathematical Models = MM;

Precalculus = Pc; Integrated Physics & Chemistry = IPC; Physics = Phy.

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

<b>Texas Essential Knowledge and Skills</b>	<b>Contest Knowledge and Skills</b>
<p><u>Understands Types of Functions and their Properties:</u></p> <p>A1. Understands that a function represents a dependence of one quantity on another and can be described in a variety of ways. (Alg1)                      A2 &amp; 2A1. Uses the properties and attributes of functions. (Alg1, Alg2)                      A4 &amp; 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)</p>	<p><u>Understands Types of Functions and their Properties:</u></p> <ul style="list-style-type: none"> <li>- Finds the factors of algebraic expressions and use factors of algebraic expressions to solve problems.</li> <li>- Uses algebraic concepts in real-life problem applications.</li> <li>- Uses direct variations and indirect variations to solve problems.</li> <li>- Translates word problems into mathematical symbols and algebraic expressions to solve problems.</li> </ul>
<p><u>Explores Linear Functions and their Relationships:</u></p> <p>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)                      A7 &amp; 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 &amp; 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)                      c5C. Calculate the mechanical energy and</p>	<p><u>Explores Linear Functions and their Relationships:</u></p> <ul style="list-style-type: none"> <li>- Formulates equations or inequalities of linear equations from a graph, given points and slopes, or real-world situation.</li> <li>- Solves linear equations or inequalities using algebraic transformations, substitution, plotting points, etc.</li> <li>- Finds slopes of parallel and perpendicular lines.</li> <li>- Forms systems of linear equations from given data and find their point of intersection.</li> <li>- Solves systems of equations using substitution, equation transformations, graphs, etc.</li> <li>- Formulates and solves systems of equations from real-life situations involving distance/rate/time problems, mixture problems, age problems, rate of work problems, etc.</li> </ul>

<p>momentum in a physical system such as billiards, cars, and trains. (Phy)</p>	<ul style="list-style-type: none"> <li>- Solves problems involving elastic and inelastic collisions.</li> </ul>
<p><u>Explores Nonlinear Functions/Relationships:</u></p> <p>2A7. Interprets and describes the effects of changes in the parameters of quadratic functions in applied and mathematical situations. (Alg2)  2A8, 2A9, 2A10 &amp; 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)</p>	<p><u>Explores Nonlinear Functions/Relationships:</u></p> <ul style="list-style-type: none"> <li>- Solves quadratic functions using factoring, substitution, the quadratic formula, completing the square, and graphing.</li> <li>- Determines the nature of the roots of a quadratic function based on its discriminant.</li> <li>- Finds solutions to other non-linear functions.</li> <li>- Works with composite functions, domains and ranges of functions, and identify special types of functions.</li> <li>- Translates verbal problems or graphs into functions using numerical and symbolic representations and use various methods to solve them.</li> </ul>
<p><u>Understands Geometric Structure and Patterns:</u></p> <p>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)  G5. Uses a variety of representations to describe geometric relationships and solve problems. (Geo)</p>	<p><u>Understands Geometric Structure and Patterns:</u></p> <ul style="list-style-type: none"> <li>- Solves problems by using geometric properties, axioms and theorems.</li> <li>- Translates word problems into mathematical symbols and geometric representations to solve problems.</li> <li>- Formulates algebraic expressions based on patterns and figures to solve problems.</li> </ul>
<p><u>Understands Symbolic Representation:</u></p> <p>P2. Interprets the meaning of the symbolic representations of functions and operations on functions to solve meaningful problems. (Pc)</p>	<p><u>Understands Symbolic Representation:</u></p> <ul style="list-style-type: none"> <li>- Works with parent functions by doing symbolic transformations and function compositions.</li> <li>- Finds inverses of functions and evaluate functions and inverse functions at specific points.</li> </ul>
<p><u>Analyzes and Solves Problems:</u></p> <p>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.</p>	<p><u>Analyzes and Solves Problems:</u></p> <ul style="list-style-type: none"> <li>- Applies trigonometric functions to analyze and solve problems.</li> <li>- Applies the Laws of Sines, Law of Cosines, and other trigonometric laws and properties to solve problems.</li> <li>- Uses sequences and series to find solutions to problems.</li> </ul>

<p>(MM)  M2. Uses graphical and numerical techniques to study patterns and analyze data. (MM).  M8. Uses algebraic and geometric models to describe situations and solve problems. (MM)</p>	<ul style="list-style-type: none"> <li>- Converts parametric, rectangular, and complex forms of numbers and equations to appropriate forms in order to graph or solve problems.</li> <li>- Uses vectors, bearings, etc. to solve problems involving directions, locations, and navigation.</li> <li>- Makes conclusions based on graphs and statistical data.</li> <li>- Uses means, medians, modes, and ranges to find solutions to problems.</li> <li>- Uses linear functions, direct variations, indirect variations, etc. to solve problems.</li> <li>- Graphs trigonometric functions and other periodic functions to determine solutions and/or make predictions.</li> </ul>
<p><u>Explores Kinematics and Vectors:</u></p> <p>c3B. Express laws symbolically and employ mathematical procedures including vector addition and right-triangle geometry to solve physical problems. (Phy)  c4A. Generate and interpret graphs describing motion including the use of real-time technology. (Phy)</p>	<p><u>Explores Kinematics and Vectors:</u></p> <ul style="list-style-type: none"> <li>- Solves freely falling body problems.</li> <li>- Solves projectile motion problems.</li> </ul>
<p><u>Understands Rotational Motion and Static Equilibrium:</u></p> <p>c3B. Express laws symbolically and employ mathematical procedures including vector addition and right-triangle geometry to solve physical problems. (Phy)  c4A. Calculate speed, momentum, acceleration, work, and power in systems such as in the human body, moving toys, and machines. (IPC)</p>	<p><u>Understands Rotational Motion and Static Equilibrium:</u></p> <ul style="list-style-type: none"> <li>- Calculates torque, rotational inertia and rotational kinetic energy.</li> <li>- Calculates rotational kinetic energy.</li> <li>- Finds the moment of inertia of a body.</li> <li>- Solves statics problems.</li> </ul>
<p><u>Explores Oscillations:</u></p> <p>c4A. Calculate speed, momentum, acceleration, work, and power in systems such as in the human body, moving toys, and machines. (IPC)  c4A. Generate and interpret graphs describing motion including the use of real-time technology. (Phy)</p>	<p><u>Explores Oscillations:</u></p> <ul style="list-style-type: none"> <li>- Solves problems involving simple harmonic motion.</li> </ul>
<p><u>Explores Nature of Light:</u></p> <p>c5B. Demonstrate wave interactions including</p>	<p><u>Explores Nature of Light:</u></p> <ul style="list-style-type: none"> <li>- Solves problems involving double slit diffraction</li> </ul>

<p>interference, polarization, reflection, refraction, and resonance within various materials. (IPC) c8A. Examine and describe a variety of waves propagated in various types of media and describe wave characteristics such as velocity, frequency, amplitude, and behaviors such as reflection, refraction, and interference. (Phy)</p>	<p>patterns.</p> <ul style="list-style-type: none"><li>- Solves problems involving thin films.</li><li>- Solves problems involving polarization of light.</li></ul>
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