# PreCalculus: Year at a Glance

## First Semester

| **Unit** | **Sequences & Series On Level: ≈12 days**  **Honors: ≈12 days** | **Non-Trigonometric Functions**  **On Level: ≈32 days**  **Honors: ≈22 days** | **Non-Trigonometric Solving**  **On Level: ≈34 days**  **Honors: ≈29 days** |
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| **TEKS** | 5A, 5B, 5C, 5D, 5E, 5F | 2D, **2F**, 2G, **2I**, **2J**, **2K**, 2L, 2M | 2A, 2B, **2C**, **2E,** **2N,** 5G**, 5H, 5I, 5J,** 5K**,** 5L |
| **Stage One Snapshot** | * Write recursive formulas for a given arithmetic or geometric sequence. * Identify whether a sequence converges or diverges. * Find the sum of a finite arithmetic or geometric series. * Find the sum of an infinite geometric series, if it exists. * Write arithmetic and geometric series using sigma notation. * Expand a binomial expression. * Find a specific term of a binomial expansion. | * Graph, identify attributes, and write equations of all non-trigonometric parent functions (and their transformations). * Determine odd and even functions graphically and algebraically. * Write transformed non-trigonometric parent functions and piecewise-defined functions using function notation. * Graph, evaluate and write equations of piecewise-defined functions, including absolute value as piecewise. * Graph, identify attributes, and write equations of polynomial and rational functions. | * Solve exponential, logarithmic, polynomial, rational, and power (radical) equations. * Solve real-world applications for exponential, logarithmic, and polynomial equations. * Solve polynomial and rational inequalities. * Generate, evaluate, and decompose composite functions. * Model and solve real-world applications using composite functions. * Write the inverse of a function when it exists. |

## Second Semester

| **Unit** | **Trigonometric Fundamentals**  **On Level: ≈34 days**  **Honors: ≈15 days (First Semester)**  **Honors: ≈25 days (Second Semester)** | **Trigonometric Solving & Applications**  **On Level: ≈19 days**  **Honors: ≈19 days** | **Conics, Parametric, Vectors & Polar On Level: ≈32 days**  **Honors: ≈38 days** |
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| **TEKS** | **2F**, 2G, 2H, **2I**, 2O, **2P**, 4A, 4B, **4C,**  4D, 5M | 4E**,** 4F, 4G, 4H, **5N** | 3A, 3B, 3C, 3D, 3E, 3F, 3G, 3H, 3I, 4I,  4J, 4K |
| **Stage One Snapshot** | * Identify radian and degree measures on the unit circle. * Identify coterminal and reference angles. * Calculate angular and linear velocities. * Relate coordinate pairs of special angles to all six trigonometric ratios. * Graph, identify attributes, and write equations of trigonometric parent functions (and their transformations). * Model and solve real-world situations using sinusoidal functions. * Evaluate and graph inverse trigonometric functions. * Evaluate and writing an algebraic expression for compositions containing trigonometric functions and inverse trigonometric functions. * Simplify, evaluate, and verify trigonometric expressions using trigonometric identities. | * Solve trigonometric equations and determining the validity of the solution(s) in context. * Differentiate between general solutions and solutions over specified intervals. * Use trigonometric identities to solve trigonometric equations and determine the validity of the solution(s) in context. * Solve oblique triangles using Law of Sines in context. * Solve ambiguous case triangles in context. * Solve oblique triangles using Law of Cosines in context. * Calculate the area of any triangle. | * Identify conic sections from a double-napped cone and its locus definition. * Graph, identify the attributes, and write equations of ellipses and hyperbolas. * Graph parametric equations. * Convert between rectangular and parametric forms of equations. * Solve real-world applications involving projectile motion. * Represent vectors geometrically and algebraically (magnitude and direction, component form or as a linear combination). * Perform vector operations in mathematical and real-world problems. * Use vectors to model situations involving magnitude and direction. * Graph and identify attributes of polar equations. * Convert coordinates and equations between polar and rectangular.   + Write the polar equation for a given graph.  + Solve systems of polar equations.  + Convert complex numbers between polar and rectangular forms.  + Perform operations with complex numbers in polar form. |

Plano ISD Secondary Academics • June 2023

# Texas Essential Knowledge and Skills

PC.(1) **Mathematical process standards.** The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:

1. apply mathematics to problems arising in everyday life, society, and the workplace;
2. use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution;
3. select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems;  **(D)** communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;
4. create and use representations to organize, record, and communicate mathematical ideas;
5. analyze mathematical relationships to connect and communicate mathematical ideas; and
6. display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

PC.(2) **Functions**. The student uses process standards in mathematics to explore, describe, and analyze the attributes of functions. The student makes connections between multiple representations of functions and algebraically constructs new functions. The student analyzes and uses functions to model real-world problems. The student is expected to:

1. use the composition of two functions to model and solve real-world problems;
2. demonstrate that function composition is not always commutative;
3. represent a given function as a composite function of two or more functions;
4. describe symmetry of graphs of even and odd functions;
5. determine an inverse function, when it exists, for a given function over its domain or a subset of its domain and represent the inverse using multiple representations;
6. graph exponential, logarithmic, rational, polynomial, power, trigonometric, inverse trigonometric, and piecewise defined functions, including step functions;
7. graph functions, including exponential, logarithmic, sine, cosine, rational, polynomial, and power functions and their transformations, including *af(x), f(x) + d, f(x - c), f(bx)* for specific values of *a*, *b*, *c*, and *d*, in mathematical and real-world problems;
8. graph arcsin *x* and arccos *x* and describe the limitations on the domain;
9. determine and analyze the key features of exponential, logarithmic, rational, polynomial, power, trigonometric, inverse trigonometric, and piecewise defined functions, including step functions such as domain, range, symmetry, relative maximum, relative minimum, zeros, asymptotes, and intervals over which the function is increasing or decreasing;
10. analyze and describe end behavior of functions, including exponential, logarithmic, rational, polynomial, and power functions, using infinity notation to communicate this characteristic in mathematical and real-world problems;
11. analyze characteristics of rational functions and the behavior of the function around the asymptotes, including horizontal, vertical, and oblique asymptotes;
12. determine various types of discontinuities in the interval (-∞, ∞) as they relate to functions and explore the limitations of the graphing calculator as it relates to the behavior of the function around discontinuities; (M) describe the left-sided behavior and the right-sided behavior of the graph of a function around discontinuities;
13. analyze situations modeled by functions, including exponential, logarithmic, rational, polynomial, and power functions, to solve real-world problems;
14. develop and use a sinusoidal function that models a situation in mathematical and real-world problems; and  **(P)** determine the values of the trigonometric functions at the special angles and relate them in mathematical and real-world problems.

PC.(3) **Relations and geometric reasoning**. The student uses the process standards in mathematics to model and make connections between algebraic and geometric relations. The student is expected to: (A) graph a set of parametric equations;

1. convert parametric equations into rectangular relations and convert rectangular relations into parametric equations;
2. use parametric equations to model and solve mathematical and real-world problems;
3. graph points in the polar coordinate system and convert between rectangular coordinates and polar coordinates;
4. graph polar equations by plotting points and using technology;
5. determine the conic section formed when a plane intersects a double-napped cone;
6. make connections between the locus definition of conic sections and their equations in rectangular coordinates;
7. use the characteristics of an ellipse to write the equation of an ellipse with center (*h*, *k*); and (I) use the characteristics of a hyperbola to write the equation of a hyperbola with center (*h*, *k*).

PC.(4) **Number and measure**. The student uses process standards in mathematics to apply appropriate techniques, tools, and formulas to calculate measures in mathematical and real-world problems. The student is expected to: (A) determine the relationship between the unit circle and the definition of a periodic function to evaluate trigonometric functions in mathematical and real-world problems;

1. describe the relationship between degree and radian measure on the unit circle;
2. represent angles in radians or degrees based on the concept of rotation and find the measure of reference angles and angles in standard position;
3. represent angles in radians or degrees based on the concept of rotation in mathematical and real-world problems, including linear and angular velocity;
4. determine the value of trigonometric ratios of angles and solve problems involving trigonometric ratios in mathematical and real-world problems;
5. use trigonometry in mathematical and real-world problems, including directional bearing;
6. use the Law of Sines in mathematical and real-world problems;
7. use the Law of Cosines in mathematical and real-world problems;
8. use vectors to model situations involving magnitude and direction;
9. represent the addition of vectors and the multiplication of a vector by a scalar geometrically and symbolically; and
10. apply vector addition and multiplication of a vector by a scalar in mathematical and real-world problems. PC.(5) **Algebraic reasoning**. The student uses process standards in mathematics to evaluate expressions, describe patterns, formulate models, and solve equations and inequalities using properties, procedures, or algorithms. The student is expected to:
11. evaluate finite sums and geometric series, when possible, written in sigma notation;
12. represent arithmetic sequences and geometric sequences using recursive formulas;
13. calculate the *n*th term and the *n*th partial sum of an arithmetic series in mathematical and real-world problems;
14. represent arithmetic series and geometric series using sigma notation;
15. calculate the *n*th term of a geometric series, the *n*th partial sum of a geometric series, and sum of an infinite geometric series when it exists;
16. apply the Binomial Theorem for the expansion of (*a* + *b*)n in powers of *a* and *b* for a positive integer *n*, where *a* and *b* are any numbers;
17. use the properties of logarithms to evaluate or transform logarithmic expressions;
18. generate and solve logarithmic equations in mathematical and real-world problems;
19. generate and solve exponential equations in mathematical and real-world problems;
20. solve polynomial equations with real coefficients by applying a variety of techniques in mathematical and real-world problems;
21. solve polynomial inequalities with real coefficients by applying a variety of techniques and write the solution set of the polynomial inequality in interval notation in mathematical and real-world problems;
22. solve rational inequalities with real coefficients by applying a variety of techniques and write the solution set of the rational inequality in interval notation in mathematical and real-world problems;
23. use trigonometric identities such as reciprocal, quotient, Pythagorean, cofunctions, even/odd, and sum and difference identities for cosine and sine to simplify trigonometric expressions; and
24. generate and solve trigonometric equations in mathematical and real-world problems.