PRECALCULUS CRITICAL AREAS

For the Pre-Calculus course, instructional time should focus on four critical areas:
(1) Functions   (2) Trigonometry   (3) Analytic Geometry   (4) Linear Systems using Matrices

(1) While many of the standards for functions appeared in previous courses, students now apply them in cases of polynomials of degree greater than two, more complicated rational functions, and exponential or logarithmic functions. Students examine the end behavior of these functions and learn to find asymptotes.   In addition, students will analyze functions using different representations.

(2) Students will expand their understanding of trigonometric functions using the unit circle. They will model periodic phenomena with trigonometric functions, prove and apply trigonometric identities, and apply trigonometry to triangles (law of sines/cosines, vectors, trigonometric form of complex numbers).

(3) Students derive the equations of conics (circles, parabolas, ellipses, and hyperbolas) and translate between their graphs and equations. Students work with parametrics, converting to Cartesian form.   They understand polar coordinates and the graphs of polar functions (circles, cardioids, limacons, roses).

(4) Students expand their knowledge of linear systems by solving application problems using matrices.

Mathematical Practice	Explanation and Examples
	MPs aligned to EL/ELD and NGSS: MP 1, 3, 6
MP.1 Make sense of problems and persevere in solving them.	Students expand their repertoire of expressions and functions that can used to solve problems. They grapple with understanding the connection between complex numbers, polar coordinates, and vectors, and reason about them.
MP.2 Reason Abstractly and quantitatively	Students understand the connection between transformations and matrices, seeing a matrix as an algebraic representation of a transformation of the plane
MP.3 Construct viable arguments and critique the reasoning of others	Students continue to reason through the solution of an equation and justify their reasoning to their peers. Students defend their choice of a function to model a real-world situation.
MP.4 Model with mathematics	Students apply their new mathematical understanding to real-world problems. Students also discover mathematics through experimentation and examining patterns in data from real-world contexts.
MP.5 Use appropriate tools strategically	Students continue to use graphing technology to deepen their understanding of the behavior of polynomial, rational, square root, and trigonometric functions.
MP.6 Attend to precision	Students make note of the precise definition of complex number, understanding that real numbers are a subset of the complex numbers. They pay attention to units in real-world problems and use unit analysis as a method for verifying their answers.
MP.7 Look for and make use of structure	Students understand that matrices form an algebraic system in which the order of multiplication matters, especially when solving linear systems using them. They see that complex numbers can be represented by polar coordinates, and that the structure of the plane yields a geometric interpretation of complex multiplication
MP.8 Look for and express regularity in repeated reasoning	Students multiply several vectors by matrices and observe that some matrices give rotations or reflections. They compute with complex numbers and generalize the results to understand the geometric nature of their operations.

2013:

Number and Quantity

The Complex Number System
- Perform arithmetic operations with complex numbers.
- Represent complex numbers and operations on the complex plane.

Vector and Matrix Quantities
- Represent and model with vector quantities.
- Perform operations on vectors.
- Perform operations on matrices and use matrices in applications.

Algebra

Seeing Structure in Expressions
- Interpret the structure of expressions.

Arithmetic with Polynomials and Rational Expressions
- Rewrite rational expressions.

Creating Equations
- Create equations that describe numbers or relationships.

Reasoning with Equations and Inequalities
- Solve systems of equations

Functions

Interpreting Functions
- Build new functions from existing functions.

Trigonometric Functions
- Expand the domain of trigonometric functions using a unit circle.
- Model periodic phenomena with trigonometric functions.
- Prove and apply trigonometric identities.

Geometry

Similarity, Right Triangles, and Trigonometry
- Apply trigonometry to general triangles.

Expressing Geometric Properties with Equations
- Translate between the geometric description and the equation for a conic section.

Math Core 8 Milestones as background content knowledge and expectations with which students enter Algebra I
Algebra Warm Ups for Geometry Teachers, and others… ~ Keeping it Fresh!

2023: