Revised 02-07-2017

El Monte Union High School District

Course Outline

District:EMUHSD
High School: ALL

Title: PRECALC/TRIG P_____

Transitional*_____(Eng. Dept. Only)

Sheltered (SDAIE)*___Bilingual*___

AP**_____Honors**_____

Department: _Mathematics___

CTE/VOC ED :
Industry Sector:_____
Pathways:_____
Check One
Introductory:_____
Concentrator:_____
Capstone:_____

Grade Level (s):_____

Semester_____Year__XX___

Year of State Framework Adoption_____

This course meets graduation requirements:

( ) English
( ) Fine Arts
( ) Foreign Language
( ) Health & Safety
(x) Math
( ) Physical Education
( ) Science
( ) Social Science
( ) Elective

Department/Cluster Approval	Date
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

*Instructional materials appropriate for English Language Learners are required.

**For AP/Honors course attach a page describing how this course is above and beyond a regular course. Also, explain why this course is the equivalent of a college level class.

1. Prerequisite(s):
   Integrated Math 3 with C or better grade, or with C- and teacher's recommendation
   Or Integrated Math 3 Honors with C or better grade.

2. Short description of course which may also be used in the registration manual:

   Precalculus is a year course which focus on latter Integrated Math 3 concepts, Trigonometry, some Mathematical Analysis and Linear Algebra. This course will cover 10 chapters in 36 weeks and relies heavily on individual effort and individual learning process. Technology, including the use of internet, is incorporated into the course work, and the use of a graphing calculator (TI 82 or above) is a must.
   The goal of the course is:
   1) to develop the skills within the student to move directly into a college level calculus course at a college
   2) to develop a strong foundation in Precalculus concepts to aid the student in successfully completing a year of calculus in the following year at the high school.

3. Describe how this course integrates the schools SLO (former ESLRs- Expected School-wide Learning Results):

   Students will be empowered to think independently using reason, research and imagination. Students will be adaptable to changing technologies as well gracious in victory. In addition all pupils will be literate in communicating clearly and effectively. It is expected that they become ethical citizens in our global community. Students will be smart, resilient and ready.

4. Describe the additional efforts/teaching techniques/methodology to be used to meet the needs of English Language Learners:

   When needed, Bilingual or Spanish version materials will be used/created. The instructors of sheltered and bilingual courses have received training in sheltered and/or bilingual instruction. If possible, an LEP student will be seated near a student with the same native language but with better English skills.

5. Describe the interdepartmental articulation process for this course:

   Students will be prepared to enter a calculus course at the college level either in the first or second semester of the course

6. Describe how this course will integrate academic and vocational concepts, possibly through connecting activities. Describe how this course will address work-based learning/school to career concepts:

   At the end of the units of differentiation and integration, real world applications exercises are assigned to the students. This course is a preparation for college calculus, which is a mathematical foundation for college courses.

7. Materials of Instruction (Note: Materials of instruction for English Language Learners are required and should be listed below.)

   A. Textbook(s) and Core Reading(s):

      Precalculus with Limits - A Graphing Approach 7e
      by Ron Larson (Cengage Learning)

   B. Supplemental Materials and Resources:

      Retired AP Exams, Accelerated Math, Resources Package including solutions, assessment, and teacher's guide. Online resources from Larsonprecalculus.com and cengage learning.

   C. Tools, Equipment, Technology, Manipulatives, Audio-Visual:

      Graphing calculators, online video resources and online videos from Larsonprecalculus.com Tutorial by CalcChat.com, LCD projector, Google Chromebooks, and graph paper.

8.

- **Objectives of Course**
- **Unit detail including projects and activities including duration of units (pacing plan)**
- **Indicate references to state framework(s)/standards (If state standard is not applicable then national standard should be used)**
- **Student performance standards**
- **Evaluation/assessment/rubrics**
- **Include minimal attainment for student to pass course**

A. Objectives of Course	1. know the basic properties of functions(algebraic, trigonometric, exponential, and logarithmic) 2. know the properties of particular functions with an emphasis on the fundamental identities of trigonometry 3. be able to solve real life application problems that require trig identities and principles. 4. have an understanding of limits and continuity including maximum and minimum. 5. understand the concepts of natural logarithm and the exponential functions.	
B & C Unit Detail	1. Functions and Their Graphs. a. Lines in the Plane b. Functions c. Graphs of functions d. Shifting, Reflecting, and Stretching Graphs e. Combinations of Functions f. Linear Model and Scatter Plots 2. Polynomial and Rational Functions a. Quadratic Functions b. Polynomial Functions of Higher Degree c. Real Zeros of Polynomial Functions d. Complex Numbers e. Fundamental Theorem of Algebra. f. Rational Functions and Asymptotes g. Graphs of Rational Functions h. Quadratic Models 3. Exponential and Logarithmic Functions a. Exponential Functions and Their Graphs b. Logarithmic Functions and Their Graphs c. Properties of Logarithms	Examples of Mathematical Practices: ● Students expand their repertoire of expressions and functions that can be used to solve problems. They grapple with understanding the connection between complex numbers, polar coordinates, and vectors. ● Students understand the connection between transformations and matrices, seeing a matrix as an algebraic representation of a transformation of the plane.

	d. Solving Exponential and Logarithmic Equations e. Exponential and Logarithmic Models f. Nonlinear Models 4. Trigonometric Functions a. Radian and Degree Measure b. Trigonometric Functions: Unit Circle c. Right Triangle Trigonometry d. Graphs of Sine and Cosine Functions e. Graphs of Other Trigonometric Functions f. Inverse Trigonometric Functions g. Applications and Models 5. Analytic Trigonometric a. Using Fundamental Identities b. Verifying Trigonometric Identities c. Solving Trigonometric Equations d. Sum and Difference Formulas e. Multiple-Angle and Product-to-Sum Formulas 6. Additional Topics in Trigonometry a. Law of Sines b. Law of Cosines c. Vectors in a Plane d. Vectors and Dot Products e. Trigonometric Form of a Complex Number 7. Linear Systems and Matrices a. Solving Systems of Equations b. Systems of Linear Equations in Two Variables c. Multivariable Linear Systems d. Matrices and Systems of Equations e. Operations with Matrices f. The Inverse of a Square Matrix g. The Determinant of a Square Matrix h. Applications of Matrices and Determinants 8. Sequences, Series, and Probability a. Sequences and Series b. Arithmetic Sequences and Partial Sums c. Geometric Sequences and Series d. The Binomial Theorem	● Students continue to reason through the solution of an equation and justify their reasoning to their peers. They defend their choice of a function to model a real-world situation. ● Students apply their new mathematical understanding to real-world problems. They also discover mathematics through experimentation and by examining patterns in data from real-world contexts. ● Students continue to use graphing technology to deepen their understanding of the behavior of polynomial, rational, square root, and trigonometric functions. ● Students make note of the precise definition of complex number, understanding that real numbers are a subset of complex numbers. They pay attention to units in real-world problems and use unit analysis as a method for verifying answers. ● Students understand that matrices form an algebraic system in which the order of

	e. Counting Principles f. Probability 9. Topics in Analytic Geometry a. Circles and Parabolas b. Ellipses c. Hyperbolas and Rotation of Conics d. Parametric Equations e. Polar Coordinates f. Graphs of Polar Equations g. Polar Equations of Conics 10. Limits and an Introduction to Calculus a. Introduction to Limits b. Techniques for Evaluating Limits c. The Tangent Line Problem d. Limits of Infinity and Limits of Sequences e. The Area Problem **The eight Standards for Mathematical Practice are:** ● Make sense of problems and persevere in solving them. ● Reason abstractly and quantitatively. ● Construct viable arguments and critique the reasoning of others. ● Model with mathematics. ● Use appropriate tools strategically. ● Attend to precision. ● Look for and make use of structure.	multiplication matters, especially when solving linear systems using matrices. 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. ● Students multiply several vectors by matrices and observe that some matrices produce rotations or reflections. They compute with complex numbers and generalize the results to understand the geometric nature of their operations.

D. Standard No.	Common Core Standards	Chapters/Sections (where the standards are met)
	NUMBER AND QUANTITY	
Domain	**THE COMPLEX NUMBER SYSTEM**	
Cluster	**Perform arithmetic operations with complex numbers.**	
N-CN 3.	(+) Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.	2.4
Cluster	**Represent complex numbers and their operations on the complex plane.**	
N-CN 4.	(+) Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and explain why the rectangular and polar forms of a given complex number represent the same number.	2.5, 6.5
N-CN 5.	(+) Represent addition, subtraction, multiplication, and conjugation of complex numbers geometrically on the complex plane; use properties of this representation for computation. *For example, $(–1 + \sqrt{3}\, i)^3 = 8$ because $(–1 + \sqrt{3}\, i)$ has modulus 2 and argument 120°.*	2.4, 2.5, 6.5
N-CN 6.	(+) Calculate the distance between numbers in the complex plane as the modulus of the difference, and the midpoint of a segment as the average of the numbers at its endpoints.	10.1, 6.5 ??
Domain	**Vector and Matrix Quantities**	
Cluster	**Represent and model with vector quantities.**	
N-VM 1.	(+) Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g., $\boldsymbol{v}$, $\lvert\boldsymbol{v}\rvert$, $\lVert\boldsymbol{v}\rVert$, v).	6.3
N-VM 2.	(+) Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point.	6.3
N-VM 3.	(+) Solve problems involving velocity and other quantities that can be represented by vectors.	6.3, 6.4

Cluster	**Perform operations on vectors.**	
N-VM 4a.	(+) Add and subtract vectors. Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two vectors is typically not the sum of the magnitudes.	6.3, 10.2
N-VM 4b.	(+) Add and subtract vectors. Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum.	6.3, 10.2
N-VM 4c.	(+) Add and subtract vectors. Understand vector subtraction $\boldsymbol{v} - \boldsymbol{w}$ as $\boldsymbol{v} + (-\boldsymbol{w})$, where $-\boldsymbol{w}$ is the additive inverse of $\boldsymbol{w}$, with the same magnitude as $\boldsymbol{w}$ and pointing in the opposite direction. Represent vector subtraction graphically by connecting the tips in the appropriate order, and perform vector subtraction component-wise.	6.3, 10.2
N-VM 5a.	(+) Multiply a vector by a scalar. Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication component-wise, e.g., as $c(v_x, v_y) = (cv_x, cv_y)$.	6.3
N-VM 5b.	(+) Multiply a vector by a scalar. Compute the magnitude of a scalar multiple $c\boldsymbol{v}$ using $\|\|c\boldsymbol{v}\|\| = \|c\|\boldsymbol{v}$. Compute the direction of $c\boldsymbol{v}$ knowing that when $\|c\|\boldsymbol{v} \neq 0$, the direction of $c\boldsymbol{v}$ is either along $\boldsymbol{v}$ (for $c > 0$) or against $\boldsymbol{v}$ (for $c < 0$).	6.3, 10.3
Cluster	**Perform operations on matrices and use matrices in applications.**	
N-VM 6.	(+) Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network.	7.4
N-VM 7.	(+) Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled.	7.5

N-VM 8.	(+) Add, subtract, and multiply matrices of appropriate dimensions.	7.5
N-VM 9.	(+) Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties.	7.5, 7.6
N-VM 10.	(+) Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse.	7.5, 7.6
N-VM 11.	(+) Multiply a vector (regarded as a matrix with one column) by a matrix of suitable dimensions to produce another vector. Work with matrices as transformations of vectors.	7.5
N-VM 12.	(+) Work with 2 × 2 matrices as transformations of the plane, and interpret the absolute value of the determinant in terms of area.	7.7, 7.8
	ALGEBRA	
Domain	**Seeing Structure in Expressions**	
Cluster	**Interpret the structure of expressions.**	
A-SSE 1a.	Interpret expressions that represent a quantity in terms of its context. Interpret parts of an expression, such as terms, factors, and coefficients.	Pre-requisite courses (IM 1, IM 2, IM 3)
A-SEE 1b.	Interpret expressions that represent a quantity in terms of its context. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret* $P(1+r)^n$ *as the product of P and a factor not depending on P.*	Pre-requisite courses (IM 1, IM 2, IM 3)
A-SEE 2.	Use the structure of an expression to identify ways to rewrite it. *For example, see* $x^4 - y^4$ *as*	Pre-requisite courses (IM 1, IM 2, IM 3)

	$(x^2)^2 - (y^2)^2$, *thus recognizing it as a difference of squares that can be factored as* $(x^2 - y^2)(x^2 + y^2)$.	2.5
Domain	**Arithmetic with Polynomials and Rational Expressions**	
Cluster	**Rewrite rational expressions.**	
A-APR 6.	Rewrite simple rational expressions in different forms; write $a(x)/b(x)$ in the form $q(x) + r(x)/b(x)$, where $a(x)$, $b(x)$, $q(x)$, and $r(x)$ are polynomials with the degree of $r(x)$ less than the degree of $b(x)$, using inspection, long division, or, for the more complicated examples, a computer algebra system.	2.3
A-APR 7.	(+) Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions.	Pre-requisite courses (IM 1, IM 2, IM 3)
Domain	**Creating Equations**	
Cluster	**Create equations that describe numbers or relationships.**	
A-CED 1.	Create equations and inequalities in one variable **including ones with absolute value** and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.* **CA**	Pre-requisite courses (IM 1, IM 2, IM 3) + Word Problems in every section
A-CED 2.	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.	1.1, 1.2, 1.3 Pre-requisite courses (IM 1, IM 2, IM 3)
A-CED 3.	Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.*	Pre-requisite courses (IM 1, IM 2, IM 3) 1.7, 2.8, 3.5, 3.6

A-CED 4.	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.*	Pre-requisite courses (IM 1, IM 2, IM 3)
Domain	**Reasoning with Equations and Inequalities**	
Cluster	**Solve systems of equations.**	
A-REI 8.	(+) Represent a system of linear equations as a single matrix equation in a vector variable.	7.3, 7.4
A-REI 9.	(+) Find the inverse of a matrix if it exists and use it to solve systems of linear equations (using technology for matrices of dimension 3 × 3 or greater).	7.6
	FUNCTIONS	
Domain	**Interpreting Functions**	
Cluster	**Interpret functions that arise in applications in terms of the context.**	
F-IF 4.	For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*	1.2, 1.3, 1.4
F-IF 5.	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.*	1.1, 1.2
Cluster	**Analyze functions using different representations.**	

F-IF 7d.	(+) Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.	1.3, 2.3, 2.6, 2.7
F-IF 7e.	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.	3.1, 3.2, 4.5, 4.6, 4.7
F-IF 10.	**(+) Demonstrate an understanding of functions and equations defined parametrically and graph them. CA**	9.4
F-IF 11.	**(+) Demonstrate an understanding of functions and equations defined parametrically and graph them. CA**	9.4
Domain	**Building Functions**	
Cluster	**Build new functions from existing functions.**	
F-BF 3.	Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k\,f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. *Include recognizing even and odd functions from their graphs and algebraic expressions for them.*	1.4, 1.5
F-BF 4b.	(+) Find inverse functions. Verify by composition that one function is the inverse of another.	1.5, 1.6
F-BF 4c.	(+) Find inverse functions. Read values of an inverse function from a graph or a table, given that the function has an inverse.	1.6

F-BF 4d.	(+) Find inverse functions. Produce an invertible function from a non-invertible function by restricting the domain.	1.6
Domain	**Trigonometric Functions**	
Cluster	**Expand the domain of trigonometric functions using a unit circle.**	
F-TF 4.	(+) Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.	4.2, 4.3
Cluster	**Model periodic phenomena with trigonometric functions.**	
F-TF 6.	(+) Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.	4.7
F-TF 7.	(+) Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context.	4.7, 4.8, 5.3, 6.1, 6.2,
Cluster	**Prove and apply trigonometric identities.**	
F-TF 9.	(+) Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.	5.4, 5.5
F-TF 10.	**(+) Prove the half angle and double angle identities for sine and cosine and use them to solve problems. CA**	5.5
	GEOMETRY	
Domain	**Similarity, Right Triangles, and Trigonometry**	
Cluster	**Apply trigonometry to general triangles.**	
G-SRT 9.	(+) Derive the formula $A = 1/2\ ab \sin(C)$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.	6.1

G-SRT 10.	(+) Prove the Laws of Sines and Cosines and use them to solve problems.	6.1, 6.2
G-SRT 11.	(+) Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).	6.1, 6.2, 6.3
Domain	**Expressing Geometric Properties with Equations**	
Cluster	**Translate between the geometric description and the equation for a conic section.**	
G-GPE 3.	(+) Derive the equations of ellipses and hyperbolas given the foci, using the fact that the sum or difference of distances from the foci is constant.	9.1, 9.2, 9.3
G-GPE 3.1	**Given a quadratic equation of the form $ax^2 + by^2 + cx + dy + e = 0$, use the method for completing the square to put the equation into standard form; identify whether the graph of the equation is a circle, ellipse, parabola, or hyperbola and graph the equation. CA**	9.1, 9.2, 9.3