Shasta Union High School District

Curriculum Guide

Course: PRECALCULUS

Description
PreCalculus is an upper level course containing a variety of topics, the understanding of which is necessary for success in calculus. This course includes trigonometry, theory of algebraic equations, sequences, series, limits, exponentials, logarithms and functions analysis.

Meets Requirements for:
SUHSD - One Year Advanced Course of Math
U.C./C.S.U.

Length of Course:
One year

Prerequisite course(s):
Successful completion of Algebra II
or consent of the Math Department

Units:
10

Requisite Skills:
California Standards for Algebra 1, Geometry & Algebra 2

Essential Content (CA Standards) and Skills include but are not limited to:

Trigonometry (TRIG)

Trigonometry uses the techniques that students have previously learned from the study of algebra and geometry. The trigonometric functions studied are defined geometrically rather than in terms of algebraic equations. Facility with these functions as well as the ability to prove basic identities regarding them is especially important for students intending to study calculus, more advanced mathematics, physics and other sciences, and engineering in college.

1.0 Students understand the notion of angle and how to measure it, in both degrees and radians. They can convert between degrees and radians.

2.0 Students know the definition of sine and cosine as *y*- and *x*-coordinates of pointes on the unit circle and are familiar with the graphs of the sine and cosine functions.

3.0 Students know the identity of $\cos^2(x) + \sin^2(x) = 1$.

3.1 Students prove that this identity is equivalent to the Pythagorean theorem (i.e., students can prove this identity by using the Pythagorean theorem and, conversely, they can prove the Pythagorean theorem as a consequence of this identity).

3.2 Students prove other trigonometric identities and simplify others by using the identity $\cos^2(x) + \sin^2(x) = 1$. For example, students use this identity to prove that $\sec^2(x) = \tan^2(x) + 1$.

4.0 Students graph functions of the form $f(t) = A \sin(Bt + C)$ or $f(t) = A \cos(Bt + C)$ and interpret *A*, *B*, and *C* in terms of amplitude, frequency, period, and phase shift.

5.0 Students know the definitions of the tangents and cotangent functions and can graph time.

6.0 Students know the definitions of the secant and cosecant functions and can graph them.

7.0 Students know that the tangent of the angle that a line makes with the *x*-axis is equal to the slope of the line.

8.0 Students know the definitions of the inverse trigonometric functions and can graph the functions.

9.0 Students compute, by hand, the values of the trigonometric functions and the inverse trigonometric functions at various standard points.

10.0 Students demonstrate an understanding of the addition formulas for sines and cosines and their proofs and can use those formulas to prove and/or simplify other trigonometric identities.

11.0 Students demonstrate an understanding of half-angle and double-angle formulas for sines and cosines and can use those formulas to prove and/or simplify other trigonometric identities.

12.0 Students use trigonometry to determine unknown sides or angles in right triangles.

13.0 Students know the law of sines and the law of cosines and apply those laws to solve problems.

14.0 Students determine the area of a triangle, given one angle and the two adjacent sides.

15.0 Students are familiar with polar coordinates. In particular, they can determine polar coordinates of a point given in rectangular coordinates and vice versa.

16.0 Students represent equations given in rectangular coordinates in terms of polar coordinates.

17.0 Students are familiar with complex numbers. They can represent a complex number in polar form and know how to multiply complex numbers in their polar form.

18.0 Students know DeMoivre's theorem and can give the *n*th roots of a complex number given in polar form.

19.0 Students are adapt at using trigonometry in a variety of applications and word problems**.**

Mathematical Analysis (MA)

This discipline combines many of the trigonometric, geometric, and algebraic techniques needed to prepare students for the study of calculus and strengthens their conceptual understanding of problems and mathematical reasoning in solving problems. These standards take a functional point of view toward those topics. The most significant new concept is that of limits. Mathematical analysis is often combined with a course in trigonometry or perhaps with one in linear algebra to make a yearlong precalculus course.

Students are familiar with, and can apply, polar coordinates and vectors in the plane. In particular, they can translate between polar and rectangular coordinates and can interpret polar coordinates and vectors graphically.

Students are adept at the arithmetic of complex numbers. They can use the trigonometric form of complex numbers and understand that a function of a complex variable can be viewed as a function of two real variables. They know the proof of DeMoivre's theorem.

Students can give proofs of various formulas by using the technique of mathematical induction.

Students know the statement of, and can apply, the fundamental theorem of algebra.

Students are familiar with conic sections, both analytically and geometrically:

5.1 Students can take a quadratic equation in two variables; put it in standard form by completing the square and using rotations and translations, if necessary; determine what type of conic section the equation represents; and determine its geometric components (foci, asymptotes, and so forth).

5.2 Students can take a geometric description of a conic section—for example, the locus of points whose sum of its distances from (1, 0) and (-1, 0) is 6—and derive a quadratic equation representing it.

Students find the roots and poles of a rational function and can graph the function and locate its asymptotes.

Students demonstrate an understanding of functions and equations defined parametrically and can graph them.

Students are familiar with the notion of the limit of a sequence and the limit of a function as the independent variable approaches a number or infinity. They determine whether certain sequences converge or diverge.

Suggested Calendar of Instruction

SUHSD Suggested Pacing Chart – Trig/PreCalculus

Precaclculus – Graphical, Numerical, Algebraic, 7th edition, Demana, Waits, Foley Kennedy

Begin First Semester
(77 Days)

Chapter P Prerequisites			
Chapter-Section	**Days**	**Topic**	**CA Standards**
P.1	1	Real Numbers	ALG 1: 1.0, 2.0
P.2	1	Cartesian Coordinates	ALG 1: 3.0 ALG 2: 1.0
P.3	1	Linear Equations and Inequalities	ALG 1: 1.0, 4.0, 7.0
P.4	2	Lines in a Plane	ALG 1: 6.0, 7.0, 8.0, 9.0
P.5	1	Solving Equations Graphically, Numerically, and Algebraically	ALG 1: 6.0, 9.0, 14.0
P.6	1	Complex Numbers	ALG 1: 8.0; ALG 2: 5.0, 6.0
P.7	1	Solving Inequalities Algebraically and Graphically	ALG 1: 3.0, 8.0; ALG 2: 2.0, 8.0
Review	2	**Suggested Assessments:** Quiz Sections P.1 – P.4 Quiz Sections P.5 – P.7 Chapter Test	
Assessments	3		
TOTAL	**13**		

Chapter 1 Functions and Graphs			
Chapter-Section	**Days**	**Topic**	**CA Standards**
1.1	2	Modeling and Equation Solving	ALG 1: 14.0; 24.0
1.2	4	Functions and Their Properties	ALG 1: 16.0, 17.0, 18.0; ALG 2: 10.0; MA 6.0
1.3	2	12 Basic Functions	ALG 2: 9.0, 10.0
1.4	2	Building Functions from Functions	ALG 2: 24.0
1.5	2	Parametric Relations and Inverses	ALG 2: 9.0; MA: 7.0
1.6	2	Graphical Transformations	ALG 2: 8.0
1.7	2	Modeling with Functions	
Review	2	**Suggested Assessments:**	
Assessments	3	Quiz Sections 1.1 – 1.3 Quiz Sections 1.4 – 1.7	
TOTAL	**21**	Chapter Test	

Chapter 2 Polynomial, Power, and Rational Functions			
Chapter-Section	**Days**	**Topic**	**CA Standards**
2.1	3	Polynomial Functions; Linear Correlation and Modeling; Application of Quadratic Functions	ALG 2: 10.0; AP STAT: 12.0
2.2	3	Power Functions and Variations Graphs of Power Functions & Modeling with Power Functions	MA: 4.0
2.3	3	Graphing, Modeling & End Behavior of Polynomial Functions of Higher Degree	MA: 4.0
2.4	2	Zeros of Polynomials Functions; Long & Synthetic Division; Remainder and Factor Theorems	ALG 2: 3.0
2.5	2	Complex Zeros and the Fundamental Theorem of Algebra	MA: 4.0

2.6	2	Graphs of Rational Functions	ALG 2: 7.0; MA: 6.0
2.7	2	Solving Rational Equations in One Variable	MA: 6.0
2.8	2	Solving Rational Inequalities in One Variable	MA: 6.0
Review	2	**Suggested Assessments:** Quiz Sections 2.1 – 2.4 Quiz Sections 2.5 – 2.8 Chapter Test	
Assessments	3		
TOTAL	**24**		

Chapter 3 Exponential, Logistic, and Logarithmic Funtions			
Chapter-Section	**Days**	**Topic**	**CA Standards**
3.1	2	Exponential & Logistic Functions and Graphs	ALG 2: 11.0
3.2	3	Exponential Growth and Decay; Logistic Models	ALG 2: 12.0
3.3	2	Logarithmic Functions and Graphs	ALG 2: 11.0, 13.0
3.4	2	Properties of Logarithmic Functions	ALG 2: 11.0, 13.0
3.5	2	Solving Exponential and Logarithmic Functions; Logarithmic Regression	ALG 2: 12.0, 13.0
3.6	3	Mathematics of Finance	ALG 2: 12.0
Review	2	**Suggested Assessments:** Quiz Sections 2.1 – 2.4 Quiz Sections 2.5 – 2.8 Chapter Test	
Assessments	3		
TOTAL	**19**		

END FIRST SEMESTER

Begin Second Semester
(72 Days)

Chapter 4 Trigonometric Functions			
Chapter-Section	**Days**	**Topic**	**CA Standards**
4.1	2	Angles and Their Measures: DMS, Radians, Arc Length; Angular & Linear Motion	TRIG: 1.0
4.2	2	Trigonometric Functions of Acute Angles: Right Triangle Trig; Calculator Trig.; Finding θ & Trig. Applications	TRIG: 1.0, 12.0
4.3	2	Trigonometry: The Circular Functions: Trig. w/ any Angle; The Unit Circle	TRIG: 2.0, 9.0
4.4	3	Graphs of Sine and Cosine: Sinusoids (Amplitude, Period, Frequency, Phase Shift); Sinusoids; $f(x) = a \sin b(x - h) + k$; Curve Fitting	TRIG: 4.0
4.5	3	Graphs of Tangent & Cotangent; Graphs of Secant & Cosecant	TRIG: 5.0, 6.0
4.6	opt	Graphs of Composite Trigonometric Functions	TRIG: 4.0
4.7	2	Inverse Trigonometric Functions	TRIG: 8.0, 9.0
4.8	3	Solving Problems with Trigonometry	TRIG: 19.0
Review	2	**Suggested Assessments:** Quiz Sections 4.1 – 4.3 Quiz Sections 4.4 – 4.5 Quiz Sections 4.7 – 4.8 Chapter Test	
Assessments	4		
TOTAL	**24**		

Chapter 5 Analytic Trigonometry			
Chapter-Section	**Days**	**Topic**	**CA Standards**
5.1	3	Fundamental Identities	TRIG: 3.0, 3.1
5.2	3	Proving Trigonometric Identities	TRIG: 3.1; MA: 3.0
5.3	2	Sum and Difference Identities	TRIG: 10.0
5.4	2	Multiple and Half Angle Identities	TRIG: 11.0
5.5	2	Law of Sines	TRIG: 13.0
5.6	2	Law of Cosines	TRIG: 13.0
Review	2	**Suggested Assessments:** Quiz Sections 5.1 – 5.2 Quiz Sections 5.3 – 5.4 Quiz Sections 5.5 – 5.6 Chapter Test	
Assessments	4		
TOTAL	**16**		

Chapter 6 Applications of Trigonometry			
Chapter-Section	**Days**	**Topic**	**CA Standards**
6.1	2	Vectors in a Plane	TRIG: 19.0; MA: 1.0
6.2	2	Dot Products of Vectors	TRIG: 19.0; MA: 1.0
6.3	3	Parametric Equations and Motion	TRIG: 19.0; MA: 7.0
6.4	2	Polar Coordinates	TRIG: 15.0, 16.0 19.0; MA: 1.0
6.5	3	Graphs of Polar Equations	TRIG: 15.0; MA: 1.0
6.6	2	De Moivre's Theorem and *n*th roots	TRIG: 17.0, 18.0; MA: 2.0
Review	2	**Suggested Assessments:** Quiz Sections 6.1 – 6.3 Quiz Sections 6.4 – 6.6 Chapter Test	
Assessments	3		
TOTAL	**19**		

Chapter 7 Systems and Matrices			
Chapter-Section	**Days**	**Topic**	**CA Standards**
7.1	opt.	Solving Systems of Two Equations	ALG 2: 2.0
7.2	opt.	Matrix Algebra	ALG 2: 2.0
7.3	opt.	Multivariate Linear Systems and Row Operations	ALG 2: 2.0
7.4	3	Partial Fractions Decomposition	ALG 2: 2.0, 7.0
7.5	opt.	Systems of Inequalities in Two Variables	ALG 2: 2.0
Review		**Suggested Assessments:**	
Assessment	1	Quiz Section 7.4	
TOTAL	**4**		

Chapter 8 Analytic Geometry in Two and Three Dimensions			
Chapter-Section	**Days**	**Topic**	**CA Standards**
8.1	opt.	Conic Sections and Parabolas	MA: 5.0; ALG 2: 16.0
8.2	opt.	Ellipses	MA: 5.0; ALG 2: 16.0
8.3	opt.	Hyperbolas	MA: 5.0; ALG 2: 16.0
8.4	opt.	Translation and Rotation of Axes	MA: 5.0; ALG 2: 16.0
8.5	opt.	Polar Equations of Conics	MA: 1.0, 5.0
8.6	opt.	Three-Dimensional Cartesian Coordinate System	MA: 1.0; ALG 2: 2.0
Review			
Test			
TOTAL			

Chapter 9 Discrete Mathematics			
Chapter-Section	**Days**	**Topic**	**CA Standards**
9.1		Basic Combinatorics	ALG 2: 18.0
9.2		The Binomial Theorem	ALG 2: 20.0
9.3		Probability	ALG 2: 19.0
9.4	2	Sequences	ALG 2: 22.0; MA: 8.0
9.5	2	Series	ALG 2: 23.0; MA: 8.0
9.6	2	Mathematical Induction	ALG 2: 21.0, 22.0; MA: 3.0
9.7		Statistics and Data (Graphical)	
9.8		Statistics and Data (Algebraic)	
Review	1	**Suggested Assessments:** Quiz Sections 9.4 – 9.5 Test Sections 7.4, 9.4 – 9.6	
Assessments	2		
TOTAL	**9**		

Chapter 10 An Introduction to Calculus: Limits, Derivatives, and Integrals			
Chapter-Section	**Days**	**Topic**	**CA Standards**
10.1	opt.	Limits and Motion: The Tangent Problem	
10.2	opt.	Limits and Motion: The Area Problem	
10.3	opt.	More on Limits	
10.4	opt.	Numerical Derivatives and Integrals	
Review			
Test			
TOTAL			
END SECOND SEMESTER			

Vocabulary (includes but is not limited to):

circular functions
composition
curve fitting
degrees
equation
exponential
expression
factors
function
identity
inverse
laws of sines and cosines
logarithmic
one-to-one
vectors
parametric
polar coordinate
polynomial functions
radians
rational functions
real roots or zeros
rectangular coordinate
relation
sequence
series
synthetic division
transformation
trigonometry
unit circle