Pascack Valley Regional High School District Pascack Hills High School, Montvale, New Jersey Pascack Valley High School, Hillsdale, New Jersey **Course Name: AP Precalculus** Born On: August, 2016 Previous Revision: August, 2020 Current Revision: August, 2023 Board Approval: 8/28/23

Course: AP PreCalculus PVRHSD CURRICULUM MAP Grade Level: 10 – 12

Course Description:

AP Precalculus is a full year, five-credit course in pre-college mathematics. Students integrate concepts and skills acquired in prior algebra and geometry courses in a study of functions. Additional topics include analytic geometry, polar coordinates, sequences and series, counting theory, and probability. Students also begin the study of calculus through an introduction to limit theory. This course will prepare students for the Precalculus advanced placement examination. A student who satisfactorily completes the requirements of this course is prepared for a course in Advanced Placement Calculus, either AB or BC level.

All mathematics courses in the Pascack Valley Regional High School District are designed to address multiple learning styles and needs, and accommodations and modifications are made for students with disabilities, multilingual students, students at risk of failure, gifted and talented students, and students with 504 plans. *AP Precalculus* builds on concepts learned and skills developed in *Honors Algebra II w/ Trigonometry* and *Honors Geometry*, while also spiraling in those concepts and skills to reinforce and strengthen students' algebraic foundation. Additionally, *AP Precalculus* anticipates higher-level mathematics that will be learned in *AP Calculus* and beyond, and enrichment opportunities are provided to challenge students and engage them in rich, interesting mathematics. Students are encouraged to analyze data using tools and models to make valid and reliable claims (9.4.12.IML.3), and various technologies are integrated throughout the curriculum, including scientific calculators, graphing calculators, specialized software, and various Internet programs and subscriptions. These tools enrich the curriculum by giving students' access to additional mathematical representations, and they also help to differentiate by providing students with additional options to engage with mathematical tasks.

The Pascack Valley Regional High School Mathematics Department integrates 21st century life and career skills across its courses, with the dual goal of informing students about careers and fields of study that use mathematics (9.3.ST.5, 9.3.ST-ET.5 and 9.3.ST-SM.2), and helping students improve the quantitative, mathematical, and statistical reasoning skills they will need to be effective producers and consumers of quantitative information in their everyday lives (9.2.12.CAP.2). Mathematics courses address the New Jersey Student Learning Standards for Career Readiness, Life Literacies and Key Skills, with a particular emphasis on demonstrating the ability to reflect, analyze and use creative skills and ideas (9.4.12.CI.1), investigating new challenges and opportunities for personal growth, advancement and transition (9.4.12.CI.3), identifying problem-solving strategies used in the development of an innovative product or practice (9.4.12.CT.1), and explaining the potential benefits of collaborating to enhance critical thinking and problem solving (9.4.12.CT.2). Mathematics courses also address the New Jersey Student Learning Standards for English Language Arts Companion Standards, with a particular focus on following complex multistep procedures (RST.9-10.3/RST.11-12.3), determining the meaning of symbols, key terms, and other domain-specific words and phrases (RST.9-10.4/RST.11-12.3), and translating quantitative or technical information expressed in words into visual forms and translating information expressed visually or mathematically into words (RST.9-10.7). Similarly, the mathematics department seeks to support students by providing them with opportunities to use quantitative, statistical, and mathematical reasoning in interdisciplinary contexts, in contexts that are meaningful to students, and in contexts that attend to the contributions and perspectives of historically marginalized groups. Specifically, mathematics courses will look to incorporate, when appropriate, contributions and experiences of

people from the LGBTQ+ community and individuals with disabilities, and references to issues of social and cultural relevance, including climate change.

Course: AP Precalculus PVRHSD CURRICULUM MAP Grade Level: 10-12

Content/Topic:	Key Learning Items/Concepts and Pacing Guide	Observable Proficiencies and Skills:	NJSLS	Formative, Summative, Benchmark, and Alternative Assessments	Core Instructional and Supplemental Materials/ Modifications and Accommodations
Unit 1 – Trigonometry	Key learning items/concepts: THE UNIT CIRCLE (TUC) TUC-2 Linear & Angular Speed,	 - Measure angles in both degrees and radians easily translating from one to the other. - Identify the class of angles coterminal 	NJSLS Content Standards	Students will be assessed regularly throughout this	Selection of primary sources Suggestion(s): Texts: Precalculus with Limits, Larson, Hostetler, Edwards;
weeks (see column 2 for a more detailed breakdown)	DMS (PWL 4.1 and AM 7-2) (2 days) - Arc Length and Sectors of Circles TUC-3 Evaluating Trigonometric Functions of Any Angle (PWL 4.2, 4.4, and AM 7- 3 – 7-5) (3 days) - Angles in standard position, degrees and radians, value of the six trig functions for any angle TUC-4 The Unit Circle (PWL 4.2, 4.4, and AM 7-3 – 7-5) (3 days) TUC-5 Graphs of Trigonometric Functions (Sine and Cosine) (PWL 4.5 - 4.6 and AM 7-3 – 7-4) (3 days) - Graphs of all the Trigonometric Functions (PWL 4.5-4.6 and AM 8.2 – 8.3)	with a given angle in standard position. - Define an angle which measures one radian. - Find arc length and area of a sector and apply this to solving problems involving apparent size. - Derive arc length and area formulas. - Define the 6 trig functions. - Compare values of the sine (or cosine) of two angles w/o calculator. - Determine w/o calculators, exact values of the 6 trig functions for special angles. - Graph the 6 trig functions. - Utilize previous knowledge of translations and reflections to graph out-of-phase and shifted-sine and cosine functions. - Identify the name of a function whose graph is given—be able to name as either a sine or a cosine, a tangent or a cotangent. - Use knowledge of trig functions and their graphs to solve applied problems such as: tsunami, Ferris wheel, pebble in the tire.	F-TF 1-9 G-C 5 G-SRT 6-11 F-BF 1-2 F-IF 4-6 N-CN 1, 4-6 NJSLS SMP MP1. Make sense of problems and persevere in solving them MP2. Construct viable arguments and critique the reasoning of others	course, with a focus on both conceptual understanding and procedural fluency. Assessment tools may include the following: - quizzes (F) - tests (S) - performance tasks (F/S) - projects (S) - homework (F) - discussions (F) - journals (F) - Form A, B, or C benchmark (B)	Houghton Mifflin Company, 2008 (on grade level); Advanced Mathematics, Brown; Houghton Mifflin Company, 1994 (on grade level); Calculus with Analytic Geometry, Larson, Hostetler; D. C. Heath and Company, 1990 (advanced); Deltamath (remediation, on grade level, and advanced) Additional Resources: o The Basic Practice of Statistics, Moore; W. H. Freeman & Co o Precalculus with Trigonometry, Foerster; Key Curriculum Press o Exploring Precalculus with The Geometer's Sketchpad, version 4, Scher, Kunkel, Lyublinskaya, and Steketee

Course: AP Precalculus PVRHSD CURRICULUM MAP Grade Level: 10-12

AP Precalculus: AP Precalculus is a full year, five-credit course in pre-college mathematics. Students integrate concepts and skills acquired in prior algebra and geometry courses in a study of functions. Additional topics include analytic geometry, polar coordinates, sequences and series, and statistics. Students also begin the study of calculus through an introduction to limit theory. A student who satisfactorily completes the requirements of this course is prepared for a course in *Advanced Placement Calculus*, either AB or BC level.

1 8
vertical shifts in radians and
degrees
- Models and applications
involving sine and cosine graphs
- Writing Equations of
Trigonometric Functions (PWL

- Graphs including horizontal and

Trigonometric Functions (PWL 4.5-4.6 and AM 8.2 – 8.3) TUC-6 The Inverse Trigonometric Functions (PWL 4.7 and AM 7-6) (2 days)

TRIANGLE TRIGONOMETRY (TT)

Right Triangle

Trigonometry (PWL 4.3 and 4.8 and AM 9-1) (2 days) TT-2 The Area of an Oblique Triangle (PWL 6.1 and AM 9-2) (2 days) - The area formula given 2 sides and the included angle. - Area of a segment and sector. The Law of Sines (PWL 6.1 AND AM 9-3) (2 days) TT-4 The Law of Cosines (PWL 6.2 AND AM 9-4) (2 days) - Derivations of all formulas TT-5 Applications of Law of Sines and Cosines (2 days) - navigation, triangles and area of quadrilaterals

IDENTITIES & EQUATIONS

- Determine the values of inverse trigonometric functions - Identify the domain and range of the inverse trig functions. - Determine values involving inverse trig functions with or w/o calculators. - Solve triangle problems involving right triangles using appropriate ratios including angle of elevation and angle of depression problems. - Determine the area of a segment of a circle. - Determine area of a triangle using two sides with the Sine of the included angle. - Determine area of quadrilaterals by triangulating. - Solve oblique triangles using Law of Sines and Law of Cosines. - Prove Law of Sines and Law of Cosines - Given a set of information, identify where Law of Sines or Law of Cosines applies. - Use calculators to their highest potential solving problems involving Law of Cosines. - Identify when the ambiguous case of the Law of Sines appears and describe how to determine whether the solution consists of 0,1, or 2 triangles. If two triangles, be able to defend the method of solving for the second triangle. - Convey, through example first, then theoretically justify why using the Law of Sines for solving a potential obtuse triangle can lead to incorrect answers.

- Connect inverse trig functions to the

explanation.

MP3. Reason - alternative abstractly and assessments quantitatively (A) MP4. Model - Take home with exams and mathematics investigations MP5. Attend to precision - Bio Rhythm MP6. Use Project (S) - Weather appropriate tools Project (S) strategically - The Unit MP7. Look for Circle Activity and make use (F) of structure MP8. Look for Administration and express of previous AP regularity in exam sections repeated and questions based on reasoning relevant topics NJSLS for (F) ELA Companion Standards RST.9-10.3 RST.9-10.4 RST.9-10.7 RST.11-12.3 RST.11-12.4 NJSLS-CLKS - 21st Century Life and **Careers**

o Exploring Calculus with The Geometer's Sketchpad, version 4. Clements. Rantozzi and Steketee o Exploring Conics with The Geometers' Sketchpad, Scher and Daniel o Conquering the New SAT Math. Postman and Postman o Grapher o Geometer's Sketchpad o Calculus-in-Motion o TI-83/TI-84 graphing calculator Calculators: The TI-83, TI-83+, or TI-84 graphing calculators

Modifications and Accommodations: Students with special needs:

Teachers and support staff will attend to all modifications and accommodations listed in students' IEPs and 504s.

Teachers will incorporate manipulatives, extra time, alternative assessments, scaffolding, spiraling, technology, and flexible grouping to support student learning.

Multilingual students: Teachers and support staff will work to support multilingual students in their first language and in

AP Precalculus: AP Precalculus is a full year, five-credit course in pre-college mathematics. Students integrate concepts and skills acquired in prior algebra and geometry courses in a study of functions. Additional topics include analytic geometry, polar coordinates, sequences and series, and statistics. Students also begin the study of calculus through an introduction to limit theory. A student who satisfactorily completes the requirements of this course is prepared for a course in Advanced Placement Calculus, either AB or BC level.

TIE-1 Simplifying and Verifying Trigonometric | Apply knowledge of triangles to solve applied problems in surveying and | 9.4.12.CI.1 | English, providing materials and/or resources to support

requirements of this course is pro-	requirements of this course is prepared for a course in <i>Advanced Placement Calculus</i> , either AB or BC level.							
TIE-1 Simplifyin	ng and - Apply know	vledge of triangles to solve	9.4.12.CI.1		English, providing materials			
Verifying Trigonon	netric applied probl	lems in surveying and	9.4.12.CI.3		and/or resources to support			
Identities (PWL 5.	1 - 5.2 AND navigation ar	nd bearing.	9.4.12.CT.1		students' understanding.			
AM 8-4) (3 days)		areas of irregular triangles	9.4.12.CT.2		Students will be given additional			
TIE-2 Simple Tri	igonometric based on abil	lities to draw and apply			time, as appropriate, and			
Equations (PWL 5.	3.3 AND AM previous kno	wledge.	- Technology		translation tools will be utilized			
8.1, 8.5) (2 days)	- Use system	s of equations involving Law	9.4.12.IML.3		as needed.			
TIE-3 More Diffi	ficult of Cosines to	solve for angles of a			Students at risk of school			
Trigonometric Equa	ations (PWL quadrilateral	inscribed in a circle.	- Career		<u>failure</u> :			
5.3 AND AM 8.5) ((3 days) - Solve simple	le trig equations algebraically	Education		Formative and summative data			
- Solving trig equat		rified domain.	9.2.12.CAP.2		will be used to monitor student			
multiple angles (PV	WL 5.4-5.5 and - Relate incli	nation of a line with the slope	9.3.ST.5		success, and students at risk of			
AM 10-4)	of that line.		9.3.ST-ET.5		failure will receive additional			
TIE-4 Applicatio		uation of a line utilizing the	9.3.ST-SM.2		supports and services, which			
Trigonometric Equa					may include parent consultation,			
8.1) (2 days)		e relationships among the trig	NJSLS –		extra help, and differentiation			
- Angle of inclination	on and the functions inc	luding: reciprocal, even/odd,	CSDT		strategies, including small group			
angle between two		and co-function.	8.1.12.DA.1		instruction, group work,			
		gonometric expressions	8.1.12.DA.5		scaffolding, and spiraling.			
TRIGONOMETR		g knowledge of algebra along	8.1.12.DA.6		Gifted and Talented Students:			
ADDITION FORM		ships among the functions.	8.1.12.AP.1		Students who excel in their			
(TAF)	- Simplify tri		8.2.12.ETW.2		mastery of course standards will			
TAF-1 Sum and I	1	olex trig equations utilizing			be further challenged with more			
Formulas (PWL 5-4	-	actoring, quadratic formula			complex tasks, extensions of			
- 10.2) (2 days)	square rootin				concepts and skills, and extended			
TAF-2 Double Ar		ers to trig equations in exact			problem solving and critical			
& Half-Angle Form		possible w/o calculators,			thinking opportunities.			
5.5 and AM 10.3) (1		urn answers in either degrees						
TAF-3 Trigonome								
with Double Angles		apply formulas for cos () and						
5.5 and AM 10-4) (
- Derivations of		formulas to determine exact						
		pressions, including those						
POLAR COORDI		verse trigonometric functions.						
	- Derive and	apply formulas for: tan().						

(
9.6, 9.7, 6.5 and AM) (3 days)
- Converting polar coordinates
and equations to Cartesian and
vice-versa.
PC-2 Graphing Polar (PWL
9.7 and AM 11-1) (3 days)
- Graphing points and equations
using polar coordinates.
PC-3 Powers of Complex
Numbers (AM 11-3) (3 days)
- DeMoivre's Theorem
PC-4 Roots of Complex
Numbers (AM 11-4) (3 days)

PC-1

Polar Coordinates (PWL

Content-specific modifications and accommodations

 technology and multiple representations will be utilized to support conceptual understanding
 differentiated problem sets can be used to support and challenge students

Interdisciplinary/additional connections

various graphs may be explored, including those with contexts that draw on the experiences of diverse people and contexts that relate to climate change
applications to circular motion, navigation, and sinusoidal phenomena

- Connect the concept of inclination of a line with addition formula for the tangent function in order to determine the angle between two lines.
- Derive and apply double and half angle formulas for sine, cosine, and tangent.
- Use graphing calculators to sketch the graphs of trigonometric functions involving double or half angles and determine the range and period of the function.
- Prove identities as an aid in manipulating trigonometric functions for future applications in calculus.
- Solve more complex trigonometric equations analytically and graphically within a given domain.
- Identify different names for a point on the polar plane.
- Graph polar equations.
- Convert easily among: rectangular coordinates, rectangular form, polar coordinates, polar form of complex numbers.
- Geometrically represent complex numbers.
- Multiply and divide complex numbers in their polar form.
- Apply DeMoivre's Theorem to find powers of complex numbers in polar form.
- Use the inverse of DeMoivre's Theorem to determine the roots of a complex number in polar form.

Content/Topic:	Key Learning Items/Concepts and Pacing Guide	Observable Proficiencies and Skills:	NJSLS	Formative, Summative, Benchmark, and Alternative Assessments	Core Instructional and Supplemental Materials/ Modifications and Accommodations
Unit 2 –	Key learning	- Recognize vector quantities as having both	NJSLS	Students will be	Selection of primary sources
Vectors,	items/concepts:	magnitude and direction. Represent vector	Content	assessed regularly	Suggestion(s):
Conics,		quantities by directed line segments and use	Standards	throughout this	Texts: Precalculus with Limits,
Sequences &	- Adding and subtracting	appropriate symbols for vectors and their		course, with a	Larson, Hostetler, Edwards;
Series	vectors (PWL 6.3 and AM	magnitudes (e.g. v , $ v $, $ v $, v).	N-VM 1-5	focus on both	Houghton Mifflin Company,
	12.1) (2 days)	- Find the components of a vector by	G-GPE 1-4	conceptual	2008 (on grade level); Advanced
Time: 8-10	- Decomposing & resolving	subtracting the coordinates of an initial point	F-IF 3, 8	understanding and	Mathematics, Brown; Houghton
weeks (see	vectors (PWL 6.3) (2 days)	from the coordinates of a terminal point.	G-MD 1	procedural	Mifflin Company, 1994 (on
column 2 for a	- Application problems with	- Solve problems involving velocity and other	A-REI 7, 11	fluency.	grade level); Calculus with
more detailed	vectors. (PWL 6.3, 6.4 and	quantities that can be represented by vectors.	F-BF 1-2	Assessment tools	Analytic Geometry, Larson,
breakdown)	AM 12.1 – navigation) (2	- Add and Subtract Vectors.	F-LE 2	may include the	Hostetler; D. C. Heath and
	days)	a) Add vectors end-to-end, component wise	A-SSE 4	following:	Company, 1990 (advanced);
	- The dot product of two	and by the parallelogram rule. Understand	A-88E 4	- quizzes (F)	Deltamath (remediation, on
	vectors. (PWL 6.4 and AM	that the magnitude of a sum of two vectors is		- tests (S)	grade level, and advanced)
	12-4) (2 days)	typically not the sum of the magnitudes.	NJSLS SMP	- performance	4.11% 1B
	- Angle between vectors.	b) Given two vectors in magnitude and		tasks (F/S)	Additional Resources:
	(PWL 6.4) (2 days)	direction form, determine the magnitude and	MP1. Make sense of	- projects (S)	
	- CS-1 Parabolas (PWL 9-1	direction of their sum.	problems and	- homework (F)	o The Basic Practice of
	and AM 6-5) – graphs,	c) Understand vector subtraction v – w as	persevere in	- discussions (F)	Statistics, Moore; W. H.
	writing equations,	v+(-w), where -w as the additive inverse of w,	solving them	- journals (F)	Freeman & Co
	applications (focus) (2 days)	with the same magnitude as w and pointing in	MP2.	- Form A, B, or C	o Precalculus with
	- CS-2 Circles (PWL 9-1	the opposite direction.	Construct	benchmark (B) - alternative	Trigonometry, Foerster; Key
	and AM 6-2) – graphs,	- Multiply a vector by a scalar.	viable		Curriculum Press
	writing equations,	a) Represent scalar multiplication graphically	arguments and	assessments (A)	o Exploring Precalculus with
	applications (equidistance) (2	by scaling vectors and possibly reversing their	critique the	- Take home	The Geometer's Sketchpad, version 4, Scher, Kunkel,
	days) - CS-3 Ellipses (PWL 9-2	direction; perform scalar multiplication component wise.	reasoning of	exams and	Lyublinskaya, and Steketee
	and AM 6-3) – graphs,	- Prove theorems from geometry by using	others	investigations (F)	o Exploring Calculus with The
	writing equations,	coordinates.	onicis	- Administration	Geometer's Sketchpad, version
	applications (sound/light	Coordinates.		of previous AP	Geometer's Sketchpaa, verston

and statistics. Students also begin the study of calculus through an introduction to limit theory. A student who satisfactorily completes the							
requirements of this course is prepared for	requirements of this course is prepared for a course in <i>Advanced Placement Calculus</i> , either AB or BC level.						
integration, architecture) (2	- Determine equations of circles from verbal	MP3. Reason	exam sections and	4, Clements, Rantozzi and			
days)	descriptions and general form equations using	abstractly and	questions based	Steketee			
- CS-4 Hyperbolas (PWL	completing the square. Identify center, radius,	quantitatively	on relevant topics	o Exploring Conics with The			
9-3 and AM 6-4) – graphs	domain and range.	MP4. Model	(F)	Geometers' Sketchpad, Scher			
and writing equations,	- Apply circles as solutions to equidistance	with	- Conic discovery	and Daniel			
applications (echolocation) (2	problems	mathematics	activities (F)	o Conquering the New SAT			
days)	- Determine point(s) of intersection	MP5. Attend		Math, Postman and Postman			
- CS-5 Systems of Conics	(algebraically) of a circle and a line, or two	to precision		o Grapher			
and Classifying Conics in	circles.	MP6. Use		o Geometer's Sketchpad			
standard form (2 days)	- Use the concepts of translation and the	appropriate		o Calculus-in-Motion			
- S&S-1 Sequences -	definition of a parabola to sketch the graph	tools		o TI-83/TI-84 graphing			
Neither, Geometric and	- Determine equations of parabolas from	strategically		calculator			
Arithmetic Sequences,	verbal descriptions (utilizing distance to	MP7. Look for		Calculators: The TI-83, TI-83+,			
Recursive and Explicit	vertex, location of directrix, etc) and by using	and make use		or TI-84 graphing calculators			
Definitions, (PWL 8.1-8.3	completing the square	of structure					
and AM 13.1 – 13.2) (2 days)	- Apply parabolas as solutions to focus	MP8. Look for		Modifications and			
- S&S-2 Finite Geometric	problems	and express		Accommodations:			
and Arithmetic Series (AM	- Utilize the concepts of translation and the	regularity in		Students with special needs:			
13.3 and PWL 8.2 – 8.3) (2	definition of an ellipse to sketch the graph.	repeated		Teachers and support staff will			
days)	- Determine equations of ellipses from verbal	reasoning		attend to all modifications and			
- S&S-3 Limits of Infinite	descriptions (utilizing major axis, minor axis,			accommodations listed in			
Sequences (AM 13-4 and	etc) and by using completing the square	NJSLS for		students' IEPs and 504s.			
PWL 11-4) (2 days)	- Apply ellipses as solutions to architecture	ELA		Teachers will incorporate			
- S&S-4 Infinite Geometric	and sound/light integration problems	Companion		manipulatives, extra time,			
Series (AM 13-5 and PWL 8-	- Utilize the concepts of translation and the	Standards		alternative assessments,			
3) (2 days)	definition of a hyperbola to sketch the graph.	RST.9-10.3		scaffolding, spiraling,			
- S&S-5 Sigma Notation	- Determine equations of hyperbolas and their	RST.9-10.4		technology, and flexible			
(AM 13-6 and PWL 8.1 –	asymptotes from verbal descriptions (utilizing	RST.9-10.7		grouping to support student			
8.3) (2 days)	distance between foci, distance between	RST.11-12.3		learning.			
- S&S-6 Sums of powers of integers and proof by	vertices, etc) and by using completing the square	RST.11-12.4		Multilingual students: Teachers and support staff will work to			
mathematical induction	- Apply hyperbolas as solutions to	NJSLS-CLKS		support multilingual students in			
(AM13-6,7, PWL 8-4) (2	echolocation problems	- 21st Century		their first language and in			
days)	•	Life and		English, providing materials			
		Careers		and/or resources to support			

and statistics.	Students also begin the stud	y of calculus through an introduction to l	imit theory. A s	student who satisfactorily completes the	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
requirements of	of this course is prepared for	r a course in Advanced Placement Calcula	us, either AB or		
	Content-specific	- Solve systems of second-degree equations	9.4.12.CI.1	students' understanding.	
	modifications and	algebraically and graphically, singularly and	9.4.12.CI.3	Students will be given addi	itional
	accommodations	in combination.	9.4.12.CT.1	time, as appropriate, and	
	- technology and multiple	- Incorporate the concept of eccentricity to	9.4.12.CT.2	translation tools will be util	lized
	representations will be	give a singular definition for all the conic		as needed.	
	utilized to support conceptual	sections.	- Technology	Students at risk of school	
	understanding	- Identify an arithmetic or geometric sequence	9.4.12.IML.3	<u>failure</u> :	
	- differentiated problem sets	and determine an explicit/recursive formula		Formative and summative of	
	can be used to support and	for nth term—derive the explicit formulas.	- Career	will be used to monitor stud	
	challenge students	- Determine an explicit/recursive formula for	Education	success, and students at risl	
		the nth term of sequences which are neither	9.2.12.CAP.2	failure will receive addition	
	Interdisciplinary/additional	arithmetic nor geometric.	9.3.ST.5	supports and services, which	
	connections	- Apply formulas to solve problems—	9.3.ST-ET.5	may include parent consult	
	- problems may include	recursive definitions for population models,	9.3.ST-SM.2	extra help, and differentiati	
	applications to science or	annuity problems, Fibonacci number		strategies, including small	group
	engineering	problems, and Newton's Law of Cooling.	NJSLS –	instruction, group work,	
	- applications to navigation,	- Derive the sum of the first n terms of	CSDT	scaffolding, and spiraling.	
	sound and light waves, and	arithmetic and geometric series.	8.1.12.DA.1	Gifted and Talented Stud	ents:
	echolocation	- Determine the limit of an infinite sequence	8.1.12.DA.5	Students who excel in their	
		or determine that no limit exists.	8.1.12.DA.6	mastery of course standards	
		- Establish criteria necessary to be able to	8.1.12.AP.1	be further challenged with	
		determine the sum of the infinite geometric	8.2.12.ETW.2	complex tasks, extensions of	
		series.		concepts and skills, and ext	
		- Use infinite series to express repeating		problem solving and critical	ાો
		decimals as a rational number.		thinking opportunities.	
		- Determine the interval of convergence for an			
		infinite geometric series.			
		- Apply sum formulas to verbal problems,			
		including finance problems and converting a			
		repeating decimal to a fraction			
		- Represent series using sigma notation.			
		- Establish properties of summations.			
		- Express a given series using sigma notation			
		and evaluate using established properties and			
		formulas.			

AP Precalculus: AP Precalculus is a full y	AP Precalculus: AP Precalculus is a full year, five-credit course in pre-college mathematics. Students integrate concepts and skills acquired in					
prior algebra and geometry courses in a s	prior algebra and geometry courses in a study of functions. Additional topics include analytic geometry, polar coordinates, sequences and series,					
and statistics. Students also begin the students	dy of calculus through an introduction to li	mit theory. A s	student who satisfa	actorily completes the		
requirements of this course is prepared for	or a course in Advanced Placement Calculi	us, either AB or	r BC level.			
	- Use mathematical induction to prove that a					
	statement is true					

Content/Topic:	Key Learning Items/Concepts and Pacing Guide	Observable Proficiencies and Skills:	NJSLS	Formative, Summative, Benchmark, and Alternative Assessments	Core Instructional and Supplemental Materials/ Modifications and Accommodations
Unit 3 –	Key learning items/concepts:	- Write line equations and expressions	NJSLS	Students will be	Selection of primary sources
Functions		from verbal and geometric descriptions	Content	assessed regularly	Suggestion(s):
	LEF-1 Equations from geometry,	- Solve inequalities with absolute value	Standards	throughout this	Texts: Precalculus with Limits,
Time: 9-11	linear equations and inequalities	functions		course, with a	Larson, Hostetler, Edwards;
weeks (see	(AM 1.1-1.4,, 3.1, PWL 1-1) (2	- Perform function operations	G-GPE 6	focus on both	Houghton Mifflin Company,
column 2 for a	days)	(including composition) algebraically	A-REI 11	conceptual	2008 (on grade level); Advanced
more detailed	LEF-2 Function operations,	and graphically, and determining	F-IF 7-9	understanding and	Mathematics, Brown; Houghton
breakdown)	composition, including rule,	domain and range	F-BF 1, 3-5	procedural	Mifflin Company, 1994 (on
	domain, range. (2 days)	- Invert functions algebraically and	G-GMD 3	fluency.	grade level); Calculus with
	- Algebraically, graphically,	graphically, including situations that	A-SSE 3	Assessment tools	Analytic Geometry, Larson,
	verbally (AM 4.2 and PWL 1-2, 3,	require domain restrictions		may include the	Hostetler; D. C. Heath and
	5)	- Transform function graphs using rigid	A-APR 2, 6	following:	Company, 1990 (advanced);
	LEF-3 Function Inverses:	and non-rigid transformations and	F-LE 1, 4, 5	- quizzes (F)	Deltamath (remediation, on
	Domain restrictions to make	combinations of both		- tests (S)	grade level, and advanced)
	invertible, rule, domain and range	- Learn to evaluate and graph periodic		- performance	
	(PWL 1-6 and AM 4-5) (2 days)	and step functions	NJSLS SMP	tasks (F/S)	Additional Resources:
	LEF-4 Periodic Functions:	- Write functions to describe verbal	MP1. Make	- projects (S)	
	amplitude, period, values "off the	situations and find optimal values	sense of	- homework (F)	o The Basic Practice of
	graph" (AM 4-4) (2 days)	- Sketch and find equations for	problems and	- discussions (F)	Statistics, Moore; W. H.
	LEF-5 Step functions, Function	quadratic and polynomial functions	persevere in	- journals (F)	Freeman & Co
	transformations: rigid, nonrigid,	- Solve quadratic and polynomial	solving them	- Form A, B, or C	o Precalculus with
	combinations of both,	inequalities	MP2.	benchmark (B)	Trigonometry, Foerster; Key
	transformations of periodic	- Describe function characteristics,	Construct	- alternative	Curriculum Press
	functions (AM 4-4, 4-6, 4-7, Pre	including	viable	assessments	o Exploring Precalculus with
	1.4) (2 days)	- One-to-one	arguments and	(A)	The Geometer's Sketchpad,
	LEF-6 Function writing and	- Odd/even	critique the	- Take home	version 4, Scher, Kunkel,
	optimization using the graphing	- Increasing/decreasing	reasoning of	exams and	Lyublinskaya, and Steketee
	calculator (AM 4-7) (3 days)	- Boundedness	others	investigations (F)	o Exploring Calculus with The
	NLF - 1 Quadratic and Polynomial	- Maxima/minima		- Administration	Geometer's Sketchpad, version
	graphs and functions, plus	- Continuity		of previous AP	

requirements of	f this course is prepared for a cou	ırse in Advanced Placement Calculı	us, either AB on	BC level.	
	inequalities (PWL 2.1, 2.2, AM 1-7,	- Write quadratic and polynomial	MP3. Reason	exam sections and	4, Clements, Rantozzi and
	1-8, 2-3, 3-2) (2 days)	models from verbal descriptions and	abstractly and	questions based	Steketee
	NLF - 2 Polynomial function	find optimal values	quantitatively	on relevant topics	o Exploring Conics with The
	models (AM 2-4) (2 days)	- Use synthetic substitution to evaluate	MP4. Model	(F)	Geometers' Sketchpad, Scher
	NLF - 3 Synthetic substitution, root	functions and for division	with	- Function	and Daniel
	theorems (PWL 2.3, AM 2-7) (2	- Employ theorems of polynomial roots	mathematics	modeling task (F)	o Conquering the New SAT
	days)	- Graph rational functions and solve	MP5. Attend		Math, Postman and Postman
	NLF - 4 Rational function graphs	rational inequalities	to precision		o Grapher
	and inequalities (PWL 2.6 AM 3-3)	- Evaluate, graph, and model with	MP6. Use		o Geometer's Sketchpad
	(2 days)	parametric equations	appropriate		o Calculus-in-Motion
	NLF - 5 Parametric equations	- Simplify complicated exponential	tools		o TI-83/TI-84 graphing
	(PWL 9.5) (3 days)	expressions	strategically		calculator
	EL - 1 Simplifying exponential	- Expand and condense logarithmic	MP7. Look for		Calculators: The TI-83, TI-83+,
	expressions (AM 5-1,2) (2 days)	expressions	and make use		or TI-84 graphing calculators
	EL - 2 Expanding and condensing	- Write and graph logarithmic and	of structure		
	logarithmic expressions. (PWL 3.3,	exponential functions, including using	MP8. Look for		Modifications and
	AM 5-6) (2 days)	their inverse relationship	and express		Accommodations:
	EL - 3 Writing and graphing	- Solve logarithmic and exponential	regularity in		Students with special needs:
	logarithmic and exponential	equations	repeated		Teachers and support staff will
	functions (PWL 3.1-3.2 and AM 5-	- Apply exponential and logarithmic	reasoning		attend to all modifications and
	1,2) (2 days)	models, including finance,			accommodations listed in
	EL - 4 Solving logarithmic	growth/decay, half-life, decibels	NJSLS for		students' IEPs and 504s.
	equations. (PWL 3.4) (2 days)		ELA		Teachers will incorporate
	EL - 5 Applications of logarithms		Companion		manipulatives, extra time,
	(PWL 3.2, 3.3, 3.4, AM 5-5)		Standards		alternative assessments,
	(Financial applications, growth and		RST.9-10.3		scaffolding, spiraling,
	decay applications, half-life		RST.9-10.4		technology, and flexible
	applications, decibels) (3 days)		RST.9-10.7		grouping to support student
			RST.11-12.3		learning.
	Content-specific modifications		RST.11-12.4		Multilingual students: Teachers
	and accommodations				and support staff will work to
	- use multiple representations to		NJSLS-CLKS		support multilingual students in
	support conceptual understanding		- 21st Century		their first language and in
	- use technology to enhance student		Life and		English, providing materials
	engagement		Careers		and/or resources to support

requirements of this course is prepared for a course in <i>Advanced Placement Calculus</i> , either AB or BC level.					
	9.4.12.CI.1	students' understanding.			
Interdisciplinary/additional	9.4.12.CI.3	Students will be given additional			
connections	9.4.12.CT.1	time, as appropriate, and			
- explore exponential and	9.4.12.CT.2	translation tools will be utilized			
logarithmic applications in the		as needed.			
Richter scale, ph scale, compounded	- Technology	Students at risk of school			
interest and climate change	9.4.12.IML.3	<u>failure</u> :			
- explore population growth for		Formative and summative data			
different groups around the world	- Career	will be used to monitor student			
and in the United States	Education	success, and students at risk of			
	9.2.12.CAP.2	failure will receive additional			
	9.3.ST.5	supports and services, which			
	9.3.ST-ET.5	may include parent consultation,			
	9.3.ST-SM.2	extra help, and differentiation			
		strategies, including small group			
	NJSLS –	instruction, group work,			
	CSDT	scaffolding, and spiraling.			
	8.1.12.DA.1	Gifted and Talented Students:			
	8.1.12.DA.5	Students who excel in their			
	8.1.12.DA.6	mastery of course standards will			
	8.1.12.AP.1	be further challenged with more			
	8.2.12.ETW.2	complex tasks, extensions of			
		concepts and skills, and extended			
		problem solving and critical			
		thinking opportunities.			

requirements of	of this course is prepared for	requirements of this course is prepared for a course in Advanced Placement Calculus, either AB or BC level.						
Content/Topic:	Key Learning Items/Concepts and Pacing Guide	Observable Proficiencies and Skills:	NJSLS	Formative, Summative, Benchmark, and Alternative Assessments	Core Instructional and Supplemental Materials/ Modifications and Accommodations			
Unit 4 – Limits	Key learning	- Given the graph of a function,	NJSLS Content	Students will be	Selection of primary sources			
and	items/concepts:	or combinations of functions,	Standards	assessed	Suggestion(s):			
Derivatives	_	determine: whether or not a		regularly	Texts: Precalculus with Limits,			
	LD - 1 Evaluating limits	functional value exists for a	This unit builds on many	throughout this	Larson, Hostetler, Edwards; Houghton			
Time: 4 weeks	(PWL 11.1-11.3) (1 week)	specific element of the domain,	of the concepts and skills	course, with a	Mifflin Company, 2008 (on grade			
(see column 2	LD - 2 Using limits to find	whether or not a limit exists for	learned in the New	focus on both	level); Advanced Mathematics,			
for a more	the derivatives of functions	a specific element of the	Jersey Student Learning	conceptual	Brown; Houghton Mifflin Company,			
detailed	(PWL 11.4) (1 week)	domain.	Standards	understanding	1994 (on grade level); Calculus with			
breakdown)	LD - 3 Derivatives of	- Connect the intuitive concept		and procedural	Analytic Geometry, Larson, Hostetler			
	polynomials, sine and cosine,	of a continuous function with		fluency.	D. C. Heath and Company, 1990			
	including tangent line	the existence of a limit.	NJSLS SMP	Assessment tools	(advanced);			
	problems (Calculus 2.1-2.2)	- Use properties of limits and	MP1. Make sense of	may include the	Deltamath (remediation, on grade			
	(1 week)	apply to functions with	problems and persevere	following:	level, and advanced)			
	LD - 4 Product, Quotient,	removable and non-removable	in solving them	- quizzes (F)				
	and Chain Rules (Calculus	discontinuities	MP2. Construct viable	- tests (S)	Additional Resources:			
	2.3-2.4) (1 week)	- Determine analytically limits	arguments and critique	- performance				
		of polynomial functions,	the reasoning of others	tasks (F/S)	o The Basic Practice of Statistics,			
	Content-specific	rational function with limits	MP3. Reason abstractly	- projects (S)	Moore; W. H. Freeman & Co			
	modifications and	going to infinity, rational	and quantitatively	- homework (F)	o Precalculus with Trigonometry,			
	accommodations	functions with a common	MP4. Model with	- discussions (F)	Foerster; Key Curriculum Press			
	- this unit will spiral in	denominator, vertical	mathematics	- journals (F)	o Exploring Precalculus with The			
	concepts and skills that	asymptotes showing limits	MP5. Attend to precision	- Form A, B, or	Geometer's Sketchpad, version 4,			
	students learned in previous	going to infinity	MP6. Use appropriate	C benchmark (B)	Scher, Kunkel, Lyublinskaya, and			
	courses	- Determine analytically limits	tools strategically	- alternative	Steketee			
	- differentiated problem sets	of polynomial functions using	MP7. Look for and make	assessments	o Exploring Calculus with The			
	can be used to support and	methods of simplification,	use of structure	(A)	Geometer's Sketchpad, version 4,			
	challenge students	rationalizing	MP8. Look for and	- Take home	Clements, Rantozzi and Steketee			
		denominators/numerators.	express regularity in	exams and	o Exploring Conics with The			
	Interdisciplinary/additional	- Derive special trigonometric	repeated reasoning	investigations	Geometers' Sketchpad, Scher and			
	connections	function limits	-	(F)	Daniel			

and statistics. Students also begin the study of calculus through an introduction to limit theory. A student who satisfactorily completes the						
requirements of this course is prepared for a course in Advanced Placement Calculus, either AB or BC level.						
	- various graphs may be	- Find one-sided limits and	NJSLS for ELA	- Administration	o Conquering the New SAT Math,	
	explored, including those	continuity on a closed interval.	Companion Standards	of previous AP	Postman and Postman	
	with contexts that draw on	- Use the limit definition of a	RST.9-10.3	exam sections	o Grapher	
	the experiences of diverse	derivative to compute the slope	RST.9-10.4	and questions	o Geometer's Sketchpad	
	people and contexts that	and a formula for the slope of a	RST.9-10.7	based on relevant	o Calculus-in-Motion	
	relate to climate change	given function	RST.11-12.3	topics (F)	o TI-83/TI-84 graphing calculator	
	- problems may include	- Apply formulas for taking	RST.11-12.4		Calculators: The TI-83, TI-83+, or	
	applications in science or	derivatives of polynomial			TI-84 graphing calculators	
	engineering	functions	NJSLS-CLKS			
		- Apply the product, quotient,	- 21st Century Life and		Modifications and	
		and chain rules for derivatives	Careers		Accommodations:	
		- Use derivatives to find the	9.4.12.CI.1		Students with special needs:	
		equation of a tangent line	9.4.12.CI.3		Teachers and support staff will attend	
			9.4.12.CT.1		to all modifications and	
			9.4.12.CT.2		accommodations listed in students'	
					IEPs and 504s. Teachers will	
			- Technology		incorporate manipulatives, extra time,	
			9.4.12.IML.3		alternative assessments, scaffolding,	
					spiraling, technology, and flexible	
			- Career Education		grouping to support student learning.	
			9.2.12.CAP.2		Multilingual students: Teachers and	
			9.3.ST.5		support staff will work to support	
			9.3.ST-ET.5		multilingual students in their first	
			9.3.ST-SM.2		language and in English, providing	
					materials and/or resources to support	
			NJSLS – CSDT		students' understanding. Students will	
			8.1.12.DA.1		be given additional time, as	
			8.1.12.DA.5		appropriate, and translation tools will	
			8.1.12.DA.6		be utilized as needed.	
			8.1.12.AP.1		Students at risk of school failure:	
			8.2.12.ETW.2		Formative and summative data will be	
					used to monitor student success, and	
					students at risk of failure will receive	
					additional supports and services,	
					which may include parent	

AP Precalculus : <i>AP Precalculus</i> is a full year, five-credit course in pre-college mathematics. Students integrate concepts and skills acquired in prior algebra and geometry courses in a study of functions. Additional topics include analytic geometry, polar coordinates, sequences and series, and statistics. Students also begin the study of calculus through an introduction to limit theory. A student who satisfactorily completes the requirements of this course is prepared for a course in <i>Advanced Placement Calculus</i> , either AB or BC level.					
		consultation, extra help, and differentiation strategies, including small group instruction, group work, scaffolding, and spiraling. Gifted and Talented Students: Students who excel in their mastery of course standards will be further challenged with more complex tasks, extensions of concepts and skills, and extended problem solving and critical thinking opportunities.			

Content/Topic:	Key Learning Items/Concepts and Pacing Guide	Observable Proficiencies and Skills:	NJSLS	Formative, Summative, Benchmark, and Alternative Assessments	Core Instructional and Supplemental Materials/ Modifications and Accommodations
Unit 5 –	Key learning items/concepts:	Understand	NJSLS Content	Students will be	Selection of primary sources
Statistics		and evaluate	Standards	assessed	Suggestion(s):
	1. Surveys, experiments,	random		regularly	Texts: Precalculus with Limits, Larson, Hostetler,
Time: 2-4	observational studies; compare	processes	S-IC 1-6	throughout this	Edwards; Houghton Mifflin Company, 2008 (on grade
weeks (see	two treatments; margin of	underlying	S-ID 4	course, with a	level); Advanced Mathematics, Brown; Houghton
column 2 for a	error (1 week)	statistical		focus on both	Mifflin Company, 1994 (on grade level); Calculus
more detailed	2. Estimate population	experiments.	NJSLS SMP	conceptual	with Analytic Geometry, Larson, Hostetler; D. C.
breakdown)	percentages and areas under		MP1. Make sense of	understanding	Heath and Company, 1990 (advanced);
	the normal curve (1 week)	Make	problems and persevere	and procedural	Deltamath (remediation, on grade level, and
	3. Estimate population mean	inferences and	in solving them	fluency.	advanced)
	or proportion (1 week)	justify	MP2. Construct viable	Assessment tools	
		conclusions	arguments and critique	may include the	Additional Resources:
	Content-specific	from sample	the reasoning of others	following:	
	modifications and	surveys,	MP3. Reason abstractly	- quizzes (F)	o The Basic Practice of Statistics, Moore; W. H.
	accommodations	experiments,	and quantitatively	- tests (S)	Freeman & Co
	- use multiple representations	and	MP4. Model with	- performance	o Precalculus with Trigonometry, Foerster; Key
	and technology to support	observational	mathematics	tasks (F/S)	Curriculum Press
	conceptual understanding	studies.	MP5. Attend to precision	- projects (S)	o Exploring Precalculus with The Geometer's
	- allow calculator use to focus		MP6. Use appropriate	- homework (F)	Sketchpad, version 4, Scher, Kunkel, Lyublinskaya,
	attention on conceptual	Summarize,	tools strategically	- discussions (F)	and Steketee
	understanding	represent, and	MP7. Look for and make	- journals (F)	o Exploring Calculus with The Geometer's Sketchpad,
		interpret data	use of structure	- Form A, B, or	version 4, Clements, Rantozzi and Steketee
	Interdisciplinary/additional	on a single	MP8. Look for and	C benchmark (B)	o Exploring Conics with The Geometers' Sketchpad,
	connections	count or	express regularity in	- alternative	Scher and Daniel
	- draw on contexts with	measurement	repeated reasoning	assessments	o Conquering the New SAT Math, Postman and
	applications from other fields	variable.		(A)	Postman
	- draw on contexts with		NJSLS for ELA	- Take home	o Grapher
	climate change applications		Companion Standards	exams and	o Geometer's Sketchpad

and statistics. Students also begin the study of calculus through an introduction to limit theory. A student who satisfactorily completes the						
requirements of this course is prepared for a course in Advanced Placement Calculus, either AB or BC level.						
- draw on contexts from	RST.9-10.3	investigations	o Calculus-in-Motion			
diverse populations	RST.9-10.4	(F)	o TI-83/TI-84 graphing calculator			
	RST.9-10.7	- Administration	Calculators: The TI-83, TI-83+, or TI-84 graphing			
	RST.11-12.3	of previous AP	calculators			
	RST.11-12.4	exam sections				
		and questions	Modifications and Accommodations:			
	NJSLS-CLKS	based on relevant	Students with special needs: Teachers and support			
	- 21st Century Life and	topics (F)	staff will attend to all modifications and			
	Careers	1 ()	accommodations listed in students' IEPs and 504s.			
	9.4.12.CI.1		Teachers will incorporate manipulatives, extra time,			
	9.4.12.CI.3		alternative assessments, scaffolding, spiraling,			
	9.4.12.CT.1		technology, and flexible grouping to support student			
	9.4.12.CT.2		learning.			
			Multilingual students: Teachers and support staff			
	- Technology		will work to support multilingual students in their first			
	9.4.12.IML.3		language and in English, providing materials and/or			
	9.4.12.TL.2		resources to support students' understanding. Students			
	9.4.12.IML.4		will be given additional time, as appropriate, and			
	9.4.12.IML.9		translation tools will be utilized as needed.			
	9.4.12.IML.10		Students at risk of school failure:			
			Formative and summative data will be used to monitor			
	- Career Education		student success, and students at risk of failure will			
	9.2.12.CAP.2		receive additional supports and services, which may			
	9.3.ST.5		include parent consultation, extra help, and			
	9.3.ST-ET.5		differentiation strategies, including small group			
	9.3.ST-SM.2		instruction, group work, scaffolding, and spiraling.			
			Gifted and Talented Students: Students who excel			
	NJSLS – CSDT		in their mastery of course standards will be further			
	8.1.12.DA.1		challenged with more complex tasks, extensions of			
	8.1.12.DA.5		concepts and skills, and extended problem solving and			
	8.1.12.DA.6		critical thinking opportunities.			
	8.1.12.AP.1					
	8.2.12.ETW.2					