

Standard(s)	Unit/Topic	Essential Skills: What do students absolutely need for the next level?	Resources Used	Assessment
A.SSE A.REI F.IF F.BF F.LE	Functions and Fundamental Skills (September-October)	<ul style="list-style-type: none"> • Represent explicit equations in different ways. • Manipulate equations using a combination of: adding, subtracting, combining like terms, multiplying, dividing, square roots, factoring, etc • Evaluate expressions following proper order of operations PEMDAS • Solve equations of varying types. • Recognize properties of functions and know how to determine unknown properties with technology. 	<ul style="list-style-type: none"> • All Things Algebra – PreCalculus Curriculum • Flamingo Math - PreCalculus Curriculum • Youtube videos by: Brian McLogan, The Organic Chemistry Tutor, others • Jmap - Algebra 2 Regents Exam Items • Delta Math - PreCalculus • IXL - PreCalculus • Desmos activities 	<ul style="list-style-type: none"> • Practice Problems: <ul style="list-style-type: none"> • Delta Math • IXL • Desmos • Khan Academy • Formative in-class activities <p>Written / Multiple Choice exam</p>

<p>A.REI A.SSE F.BF.B F.IF A.APR N.CN</p>	<p>Polynomial Functions (October - November)</p>	<p>-Manipulate equations and explain -Identify key features of graph and equations -Change forms of equations using familiar structures -Find solutions to systems involving polynomials -Solve equations to find zeroes (factor, complete the square, graph, using square root) -Identify complex zeroes algebraically and graphically -Factor equations into linear factors -Polynomial Long Division -graph polynomials: Factors, zeroes, end behavior -Compare polynomials in different forms -Transformations and relationships between types of polynomials</p>	<ul style="list-style-type: none"> • All Things Algebra – PreCalculus Curriculum • Flamingo Math - PreCalculus Curriculum • Youtube videos by: Brian McLogan, The Organic Chemistry Tutor, others • Jmap - Algebra 2 Regents Exam Items • Delta Math - PreCalculus • IXL - PreCalculus • Desmos activities 	<ul style="list-style-type: none"> • Practice Problems: <ul style="list-style-type: none"> • Delta Math • IXL • Desmos • Khan Academy • Formative in-class activities <p>Written / Multiple Choice exam</p> <p>Story Project</p>
<p>A.REI.D A.SSE.A F.IF.B A.APR F.IF.7 A.REI.A</p>	<p>Rational Functions (November)</p>	<p>-Graph and analyze systems including rational equations -View parts of equation as single unit (ex: denominator, products) -Rewrite expressions and equations -Key features of rational function graphs</p>	<ul style="list-style-type: none"> • All Things Algebra – PreCalculus Curriculum • Flamingo Math - PreCalculus Curriculum • Youtube videos by: Brian McLogan, The Organic Chemistry Tutor, others • Jmap - Algebra 2 Regents Exam Items • Delta Math - PreCalculus • IXL - PreCalculus • Desmos activities 	<ul style="list-style-type: none"> • Practice Problems: <ul style="list-style-type: none"> • Delta Math • IXL • Desmos • Khan Academy • Formative in-class activities <p>Written / Multiple Choice exam</p>

		-Domain of rational functions -Solve Equations; explain extraneous solutions		Picture Project
A.REI.D A.SSE.B A.SSE.A F.BF.A F.BF.B F.IF.B F.IF.C F.BF.B	Exponential and Log Functions (December – January)	-Graph Exponential and Log equations -Recognize pieces of the equations and their meaning in real world context -Rewrite interest and growth and Decay equations using properties of exponents -Inverse relationships between Exponential and Log functions -Combine function types -Graph showing Key features of graph -Interpret expressions using properties of exponents to rewrite expression -Compare different forms	<ul style="list-style-type: none"> • All Things Algebra – PreCalculus Curriculum • Flamingo Math - PreCalculus Curriculum • Youtube videos by: Brian McLogan, The Organic Chemistry Tutor, others • Jmap - Algebra 2 Regents Exam Items • Delta Math - PreCalculus • IXL - PreCalculus • Desmos activities 	<ul style="list-style-type: none"> • Practice Problems: <ul style="list-style-type: none"> • Delta Math • IXL • Desmos • Khan Academy • Formative in-class activities <p>Written / Multiple Choice exam</p> <ul style="list-style-type: none"> • Project – Real world examples
Various NYSCC State Standards	PSAT / SAT Review (January)	-Understand the layout of the PSAT and SAT exams - Review content from previous math courses	<ul style="list-style-type: none"> • Khan Academy • https://blog.prepscholar.com/whats-actually-tested-on-sat-math-topics • https://collegereadiness.collegeboard.org/sat 	<ul style="list-style-type: none"> • PSAT or SAT by student choice

<p>F.IF.B. F.IF.C F.BF.B</p>	<p>Trig Functions (February)</p>	<p>-Unit circle basics -Measure angles in Degrees and Radians -Properties of Triangles -Graph Trig functions and Identify key features of graphs -Transformations -Real world context for Trig models</p>	<ul style="list-style-type: none"> • All Things Algebra – PreCalculus Curriculum • Flamingo Math - PreCalculus Curriculum • Youtube videos by: Brian McLogan, The Organic Chemistry Tutor, others • Jmap - Algebra 2 Regents Exam Items • Delta Math - PreCalculus • IXL - PreCalculus • Desmos activities 	<ul style="list-style-type: none"> • Practice Problems: <ul style="list-style-type: none"> • Delta Math • IXL • Desmos • Khan Academy • Formative in-class activities <p>Written / Multiple Choice exam</p> <p>Project – modeling trig functions</p>
<p>F.TF.A F.TF.B F.TF.C G.SRT.D</p>	<p>Trig Identities and Equations (March)</p>	<p>-Law of Sines and Cosines -Solve Trig equations using familiar models -Pythagorean Thm with Trig Identities -Trig Inverses</p>	<ul style="list-style-type: none"> • All Things Algebra – PreCalculus Curriculum • Flamingo Math - PreCalculus Curriculum • Youtube videos by: Brian McLogan, The Organic Chemistry Tutor, others • Jmap - Algebra 2 Regents Exam Items • Delta Math - PreCalculus • IXL - PreCalculus • Desmos activities 	<ul style="list-style-type: none"> • Practice Problems: <ul style="list-style-type: none"> • Delta Math • IXL • Desmos • Khan Academy • Formative in-class activities <p>Written / Multiple Choice exam</p>
<p>S.IC.B S.ID S.CP S.MD</p>	<p>Statistics and Probability (April) (September for the 2021-2022 school year)</p>	<p>-Basic Probability rules (Conditional, etc.) -Probability in real life -Bell curve and standard deviation percentages -Vocabulary -Analyze sample data using bell curve -Identify statistical significance</p>	<ul style="list-style-type: none"> • All Things Algebra – PreCalculus Curriculum • Flamingo Math - PreCalculus Curriculum • Youtube videos by: Brian McLogan, The Organic Chemistry Tutor, others • Jmap - Algebra 2 Regents Exam Items • Delta Math - PreCalculus • IXL - PreCalculus • Desmos activities 	<ul style="list-style-type: none"> • Practice Problems: <ul style="list-style-type: none"> • Delta Math • IXL • Desmos • Khan Academy • Formative in-class activities <p>Written / Multiple Choice exam</p>

				Project – conducting a data study
F.BF A.SSE	Series (April – May)	-Review series types -Different forms: function, explicit, recursive, sigma -Identify patterns	<ul style="list-style-type: none"> • All Things Algebra – PreCalculus Curriculum • Flamingo Math - PreCalculus Curriculum • Youtube videos by: Brian McLogan, The Organic Chemistry Tutor, others • Jmap - Algebra 2 Regents Exam Items • Delta Math - PreCalculus • IXL - PreCalculus • Desmos activities 	<ul style="list-style-type: none"> • Delta Math • IXL • Desmos • Formative in-class activities <p>Written / Multiple Choice exam</p> <p>Modeling Series Project</p>
N.VM	Vectors and Matrices (May)	-Matrix data structure -Perform Matrix operations: add, subtract, multiply -Matrix determinant -Matrix inverses	<ul style="list-style-type: none"> • All Things Algebra – PreCalculus Curriculum • Flamingo Math - PreCalculus Curriculum • Youtube videos by: Brian McLogan, The Organic Chemistry Tutor, others • Jmap - Algebra 2 Regents Exam Items • Delta Math - PreCalculus • IXL - PreCalculus • Desmos activities 	<ul style="list-style-type: none"> • Delta Math • IXL • Desmos • Formative in-class activities <p>Written / Multiple Choice exam</p> <p>Coding with Matrices</p>

Subject: PreCalculus

Grade: 11th grade

Month : Full Year class

<p>PLUS <u>State Standards for NYS</u> (p. 157 – 168)</p> <p><i>(+) standards rely on knowledge from the foundational standards found in Algebra 1, Geometry, and Algebra 2 classes.</i></p>	<p>Final Exam (June)</p>	<p>All topics for the year</p>	<ul style="list-style-type: none">• Emathinstrction - Algebra 2 with Trigonometry Curriculum• All Things Algebra – PreCalculus Curriculum• Flamingo Math – PreCalculus Curriculum• Delta Math video & Practice questions• Jmap - PreCalculus• IXL - PreCalculus	<p>Algebra 2 Regents Exam (examples)</p>
--	---------------------------	--------------------------------	--	--

Alternate topics: Conic Sections (Analytic Geometry), Intro to Limits, Polar and Parametric Equations

https://jmap.org/htmlstandard/JMAP_PRECALCULUS.htm

<h2>STATE STANDARDS</h2> <h3>Precalculus</h3>	
<h4>NUMBER AND QUANTITY</h4>	
<h5>The Complex Number System</h5>	
<h5>A. Perform arithmetic operations with complex numbers</h5>	
<p><u>N.CN.A.3+</u></p>	<p>Find the conjugate of a complex number; use conjugates to find moduli and quotients of complex numbers.</p>
<h5>B. Represent complex numbers and their operations on the complex plane</h5>	
<p><u>N.CN.B.4+</u></p>	<p>a. Represent complex numbers on the complex plane in rectangular and polar form (including real and imaginary numbers), and convert between rectangular and polar forms of a given complex number. b. Determine whether rectangular or polar form is more efficient given the context.</p>
<p><u>N.CN.B.5+</u></p>	<p>Represent addition, subtraction, multiplication, and conjugation of complex numbers geometrically on the complex plane; use properties of this representation for computation.</p>
<p>N.CN.B.6+</p>	<p>a. Calculate the distance between two points in the complex plane. b. Find the midpoint of the segment whose endpoints are in the complex plane.</p>
<h5>C. Use complex numbers in polynomial identities and equations</h5>	
<p>N.CN.C.8+</p>	<p>Extend polynomial identities to the complex numbers.</p>
<p>N.CN.C.9+</p>	<p>State the Fundamental Theorem of Algebra and use it to find roots of polynomials.</p>
<h4>Vector and Matrix Quantities</h4>	
<h5>A. Represent and model with vector quantities</h5>	
<p>N.VM.A.1+</p>	<p>Represent a vector analytically and geometrically</p>
<p>N.VM.A.2+</p>	<p>Find the magnitude and direction of a given vector</p>

<u>N.VM.A.3+</u>	Solve problems using vectors analytically and geometrically
B. Perform operations on vectors	
<u>N.VM.B.4+</u>	Add and subtract vectors analytically and geometrically
<u>N.VM.B.5+</u>	Multiply a vector by a scalar analytically and geometrically
C. Perform operations on matrices and use matrices in applications	
<u>N.VM.C.6+</u>	Use matrices to represent and model real world situations
<u>N.VM.C.7+</u>	Multiply matrices by scalars
<u>N.VM.C.8+</u>	Add, subtract, and multiply matrices
<u>N.VM.C.9+</u>	Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties
<u>N.VM.C.11+</u>	Use matrices to perform linear transformations in the plane
<u>N.VM.C.12+</u>	Calculate and interpret the determinant of a matrix
ALGEBRA	
Arithmetic with Polynomials & Rational Expressions	
C. Use polynomial identities to solve problems	
<u>A.APR.C.4+</u>	Prove polynomial identities and use them to describe numerical relationships
<u>A.APR.C.5+</u>	Use the Binomial Theorem for the expansion of $(x + y)^n$ for a positive integer n
D. Rewrite rational expressions	
<u>A.APR.D.7+</u>	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
Reasoning with Equations & Inequalities	

C. Solve systems of equations	
<u>A.REI.C.6+</u>	b. Solve systems of linear equations in three variables
A.REI.C.8+	Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. <i>For example, find the points of intersection between the line $y = -3x$ and the circle $x^2 + y^2 = 3$.</i>
<u>A.REI.C.9+</u>	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)
FUNCTIONS	
Interpreting Functions	
C. Analyze functions using different representations	
<u>F.IF.C.7+</u>	d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available
Building Functions	
A. Build a function that models a relationship between two quantities	
<u>F.BF.A.1+</u>	c. Compose functions and state resulting domain
B. Build new functions from existing functions	
<u>F.BF.B.3+</u>	c. Determine algebraically whether or not a function is even or odd
<u>F.BF.B.4+</u>	b. Verify by composition that one function is the inverse of another c. Given the graph or table of an invertible function, determine coordinates of its inverse d. Determine an invertible function from a non-invertible function by restricting the domain
<u>F.BF.B.5+</u>	b. Use inverse relationships to solve problems involving logarithms and exponents c. Apply the properties of logarithms to rewrite logarithmic expressions in equivalent forms and solve logarithmic equations
Trigonometric Functions	
A. Extend the domain of trigonometric functions using the unit circle	
F.TF.A.3+	c. Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$, $\pi/4$ and $\pi/6$, and use the unit circle to express the values of sine, cosines, and tangent for x , $\pi + x$, and $2\pi - x$ in terms of their values for x , where x is any real number

B. Model periodic phenomena with trigonometric functions	
<u>F.TF.B.6+</u>	Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed
<u>F.TF.B.7+</u>	Solve trigonometric equations: analytically with inverse functions and graphically with technology; and interpret solutions in terms of the context
C. Prove and apply trigonometric identities	
<u>F.TF.C.9+</u>	Prove the sum and difference formulas for sine, cosine, and tangent and use them to solve problems
GEOMETRY	
Similarity, Right Triangles and Trigonometry	
D. Apply trigonometry to general triangles	
<u>G.SRT.D.10+</u>	Prove the Law of Sines and the Law of Cosines and apply in all cases, including the ambiguous case
<u>G.SRT.D.11+</u>	Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles
Circles	
A. Understand and apply theorems about circles	
<u>G.C.A.4+</u>	Construct a tangent line from a point outside a given circle to the circle
Expressing Geometric Properties with Equations	
A. Translate between the geometric description and the equation for a conic section	
<u>G.GPE.A.2+</u>	Explore the relationship among the parabola, focus, and directrix and use the equation to model a real-life situation, using technology as appropriate
<u>G.GPE.A.3+</u>	a. Derive the equations of ellipses and hyperbolas given the foci b. Use these equations to model real life situations
Geometric Measurement and Dimension	
A. Explain volume formulas and use them to solve problems	
<u>G.GMD.A.2+</u>	Give an informal argument using Cavalieri's principle for the formulas for the volume of a sphere and other solid figures
Statistics & Probability	

Interpreting Categorical & Quantitative Data	
B. Summarize, represent, and interpret data on two categorical and quantitative variables	
<u>S.ID.B.6+</u>	b. Informally assess the fit of a function by plotting and analyzing residuals
Conditional Probability & the Rules of Probability	
B. Use the rules of probability to compute probabilities of compound events in a uniform probability model	
<u>S.CP.B.9+</u>	Solve problems using permutations and combinations to compute probabilities of compound events
Using Probability to Make Decisions	
A. Calculate expected values and use them to solve problems	
S.MD.A.1+	a. Define a random variable for a quantity of interest b. Graph a probability distribution for a discrete random variable based on either empirical or theoretical probabilities
S.MD.A.2+	Calculate and interpret the expected value of a random variable
B. Use probability to evaluate outcomes of decisions	
S.MD.B.5+	Use expected values from probability distributions to evaluate and compare the outcomes of decisions
S.MD.B.6+	Use probabilities to make fair decisions
S.MD.B.7+	Using probability concepts, evaluate decisions and strategies