



Township of Ocean Schools

Assistant Superintendent
Office of Teaching and Learning

SPARTAN MISSION:

Meeting the needs of all students with a proud tradition of academic excellence.

DEPARTMENT Mathematics

COURSE Advanced Pre-Calculus

Curriculum Development Timeline

School: Ocean Township High School

Course: Advanced Pre-Calculus

Department: Mathematics

Board Approval	Supervisor	Notes
July 2012	Janet Bluefield	Born Date
August 2017	Nichole Kerney	Revisions
August 2019	Nichole Kerney	Revisions
August 2022	Gerard Marrone	Alignment to Standards
August 2025	Greg Colon	Alignment to Standards

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Cycle	Marking Period 1	Cycle	Marking Period 3
1	Functions and Operations with Functions	21	Exponential & Logarithmic Functions
2	Functions and Operations with Functions	22	Trigonometry (Triangles, Angles, Unit Circle)
3	Functions and Operations with Functions	23	Trigonometry (Triangles, Angles, Unit Circle)
4	Functions and Operations with Functions	24	Trigonometry (Triangles, Angles, Unit Circle)
5	Functions and Operations with Functions	25	Trigonometry (Triangles, Angles, Unit Circle)
6	Functions and Operations with Functions	26	Trigonometry (Triangles, Angles, Unit Circle)
7	Functions and Operations with Functions	27	Trigonometric Graphs
8	Functions and Operations with Functions	28	Trigonometric Graphs
9	Polynomial & Rational Functions	29	Trigonometric Graphs
10	Polynomial & Rational Functions	30	Trigonometric Graphs
		31	Analytic Trigonometry
Cycle	Marking Period 2	Cycle	Marking Period 4
11	Polynomial & Rational Functions	32	Analytic Trigonometry
12	Polynomial & Rational Functions	33	Analytic Trigonometry
13	Polynomial & Rational Functions	34	Analytic Trigonometry
14	Polynomial & Rational Functions	35	Analytic Trigonometry

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15	Polynomial & Rational Functions	36	Analytic Trigonometry
16	Polynomial & Rational Functions	37	Polar Coordinates and Functions and Vectors
17	Exponential & Logarithmic Functions	38	Polar Coordinates and Functions and Vectors
18	Exponential & Logarithmic Functions	39	Introduction to Limits and Continuity
19	Exponential & Logarithmic Functions	40	Introduction to Limits and Continuity
20	Exponential & Logarithmic Functions	41	Introduction to Limits and Continuity
		42	Introduction to Limits and Continuity

Core Instruction: Precalculus- Pearson ©2016

Supplemental: IXL Math

Special Education and ELL Supplemental: Purplemath.com for foundational topics

Time Frame	8 cycles (24 - 56 minute cycles)
Functions and Operations of Functions (Purple Ch2 all, 5.1-5.2)	
F.IF.1: Understand that a function assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output. 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. F.IF.7b: Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value 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. 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	

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b(x), using inspection, long division, or, for the more complicated examples, a computer algebra system.

SWBAT answer the following questions:

- How are functions and their graphs related?
- How can technology be used to investigate properties of families of functions and their graphs?
- How does explaining a process help me to better understand the idea?
- What are some patterns in the manipulation or changes in function?

SWBAT demonstrate understanding of the following:

- Graphs and equations are alternative ways for depicting and analyzing patterns of non-linear change.
- Mathematical models can be used to describe physical relationships; these are often non-linear.
- Creating a graph is not the same as interpreting the information displayed.
- A variety of families of functions and methods can be used to model and solve real world situations.
- Function families have common characteristics.
- We can use Algebra to help graph functions.
- Technology is a resource for discoveries and investigations.
- There is a difference between using technology to find the answer compared to using technology to aid in supporting the answer.

Learning Activities:

- Determine if a relationship represents a function and values of such.
- *Find the difference quotient by substituting (x+h) into the equation. REMIND THEM THAT THIS WILL COME BACK IN THE LAST UNIT OF STUDY
- Determine the inverse of a function and find the domain.
- Determine 1-1 functions.
- Determine whether a function is odd, even or neither – algebraically or graphically.
- Graph the basic parent functions; including linear, absolute value, quadratic, square root, cube root, exponential, logarithmic and reciprocal with and without the use of technology.
- Identify the key characteristic of the parent functions using domain, range, local maxima and minima, global maxima and minima, and intervals of increasing and decreasing.
- Write and graph transformations of each of the parent graphs. Given an equation, be able to explain the transformations without graphing.
- Write absolute value functions as piecewise functions.
- Graph piecewise functions and describe domain and range.
- Identify key characteristics of a quadratic function; including vertex intercepts, and axis of symmetry, using both algebraic and graphical approaches.
- Solve real-world problems involving a variety of functions.

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- Form the sum, difference, product, and quotient of two functions, both polynomial and rational, and find its domain.
- Form the composite function and find the domain.
- Find the components of a composite function.
- Discover multiple compositions and decompositions for a given function.
- CBL Activities – Matching the Graph
- Time v. Distance
- Modeling Step Functions.
- Scatter Plots – Creating Best Fit Lines; analyze goodness of fit, use for prediction.
- Graphing Calculator Discovery – Characteristics of Family of Curves
- Effects of Transformations.

Formative:

- Rich Thinking Tasks
- Classroom Observation
- Student Reflections and Math Talks
- Targeted Practice via IXL

Summative:

- Mid-unit Quizzes
- Topic Tests
- Performance Tasks/Projects

Alternative:

- AP PreCalculus Released Problems

Science:

HS-ETS1-2: Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

In this quadratics unit students will design a solution to a complex real-world problem involving maximum/minimum/projectile motion by breaking it down into smaller, more manageable problems that can be solved through engineering.

CS&DT: 8.1.12.DA.1: Create interactive data visualizations using software tools to help others better understand real world phenomena, including climate change.

9.4.12.CI.1 – Creativity and Innovation

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COURSE Advanced Pre-Calculus

- **Use a variety of strategies to generate and refine solutions to problems.**

Students apply operations on functions (addition, subtraction, multiplication, division, and composition) to model and solve real-world problems, such as optimizing business or engineering systems.

9.4.12.CT.2 – Critical Thinking and Problem Solving

- **Use appropriate tools strategically to solve problems and make decisions.**

Students use graphing calculators, online tools, or software (such as Desmos or GeoGebra) to perform operations on functions and analyze their behavior in real-world applications (e.g., profit maximization, motion, and population modeling).

9.4.12.IML.6 – Information Literacy

- **Use digital tools to gather and analyze data, as well as to create meaningful reports.**

Students gather data and analyze it using function operations to create models for predicting outcomes in various fields (e.g., economics, science, technology).

9.4.12.FI.3 – Financial Literacy

- **Analyze how spending habits affect one's ability to save.**

Students use functions to model and analyze financial scenarios, such as compound interest, loan payments, or savings growth, demonstrating the practical application of operations on functions in personal finance.

9.4.12.TL.4 – Technology Literacy

- **Use digital tools to collaborate and communicate ideas.**

Students work collaboratively with peers using digital platforms to explore, perform, and present findings related to operations on functions (e.g., using shared graphing tools to model and present function transformations).

9.4.12.CT.3 – Creativity and Innovation

- **Use knowledge of technology and tools to create innovative solutions.**

Students design innovative solutions in real-world problems by applying function operations (e.g., optimizing production processes, analyzing engineering systems).

9.4.12.TL.3 – Technology Literacy

- **Analyze the effectiveness of the process and quality of collaborative environments to**

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COURSE Advanced Pre-Calculus

improve results.

Students collaborate on using technology tools to perform function operations, solve problems, and evaluate the most effective solution based on results (e.g., using software to optimize a solution to a problem).

All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaboratively and to create and communicate knowledge.

- 9.4.8.TL.6: Collaborate to develop and publish work that provides perspectives on a real-world problem.

Students will access the Precalculus online ebook to further investigate lesson concepts and demonstrate understanding of standards.

- 9.4.8.TL.3: Select appropriate tools to organize and present information digitally.
- 9.4.5.CT.3: Describe how digital tools and technology may be used to solve problems.
- 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task

Students will use Google Classroom to collaborate, work towards solving authentic problems, or participate in an online classroom discussion utilizing pre-learned etiquette about blended learning platforms.

- 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.

Students will use graphing calculators to use math tools strategically and attend to precision and will use Desmos in order to discover new concepts involving graphing and functions.

- 9.4.8.IML.3: Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping

9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas.

9.4.12.GCA.2: Demonstrate openness to diverse ideas and perspectives through active listening and effective communication.

9.4.12.TL.1: Demonstrate proficiency in the use of digital tools to gather, evaluate, and use information.

9.4.12.TL.2: Create and edit digital artifacts to effectively communicate and express ideas.

9.4.12.TL.3: Collaborate with others using digital tools to produce original works or solve problems.

9.4.12.TL.4: Analyze the impact of emerging technologies on personal and professional productivity.

Time Frame

8 cycles (24 - 56 minute cycles)

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Polynomial and Rational Functions (Purple 4.1-4.6)

N.CN.8: Extend polynomial identities to the complex numbers.

N.CN.9: Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.

A.APR.2: Know and apply the Remainder Theorem: For a polynomial $p(x)$ and a number a , the remainder on division by $x-a$ is $p(a)$, so $p(a)=0$ if and only if $x-a$ is a factor of $p(x)$.

A.APR.3: Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.

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.

F.IF.7c: Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.

SWBAT answer the following questions:

- How do the characteristics of graphs relate to their corresponding equations?
- How can algebra help us get information about a graph from an equation?
- What are common characteristics of polynomials?
- What is the best method for graphing polynomials?
- How can technology assist in the understanding of graphing polynomials?
- What makes rational functions different from others that have been done so far?
- What types of discontinuity are present in rational functions?

SWBAT demonstrate understanding of the following:

- Functions can be written in several ways – certain forms can be helpful under different circumstances.
- Families of functions have common characteristics.
- We can use algebra to help graph functions.
- The vocabulary is just as important as the math.

Learning Activities:

- Examine graphs to determine end behavior.
- Identify polynomial functions and find the degree given both factored and standard form.
- Identify the zeros of a polynomial functions and its multiplicity.
- Investigate the role of multiplicity with respect to the graph of a polynomial.
- Investigate the role of the degree of a polynomial with respect to the number of turning points.

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- Analyze the graph of a polynomial function given both factored and standard form; identify the intercepts, end behavior, and turning points.
- Construct graphs given limited information.
- Form polynomials from zeros and graphs. Build polynomials from given characteristics.
- Investigation of End Behavior of n th-degree Polynomials with positive and negative coefficients.
- Use a graphing utility to approximate values of turning points.
- Factor polynomials of higher degree.
- Divide polynomials with long division and synthetic division.
- Apply the remainder and factor theorems to find remainders and factors.
- Apply the rational zero theorem to the list of potential zeros of a polynomial.
- Find the real and complex zeros of a polynomial.
- Apply the conjugate pair theorem to help write a polynomial in standard form and to help find other zeros.
- Form a polynomial with specified zeros, both real and complex.
- Solve polynomial equations for both real and complex zeros.
- Find the domain of a rational function.
- Determine the vertical asymptotes of a rational function.
- Determine the horizontal and oblique asymptotes of a rational function.
- Analyze the graph of rational function; determining the domain, intercepts symmetry, vertical, horizontal, and oblique asymptotes, and end behavior.
- Sketch the graph of a rational function by hand.
- *Solve polynomial or rational inequalities algebraically and graphically
- **Decompose a rational expression into partial fractions (11.5)
- Model Concentration of Medicine in Blood Stream.
- CBL – Investigating Boyle's Law.

Formative:

- Rich Thinking Tasks
- Classroom Observation
- Student Reflections and Math Talks
- Targeted Practice via IXL

Summative:

- Mid-unit Quizzes
- Topic Tests
- Performance Tasks/Projects

Alternative:

- AP PreCalculus Released Problems

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Science:

HS-ETS1-3 – Evaluate a solution to a complex real-world problem.

Students use polynomial and rational models to evaluate engineering designs or optimize systems, such as improving the efficiency of mechanical or electrical systems in real-world scenarios.

HS-ESS3-6 – Evaluate or model solutions to reduce human impact on the environment.

Students use rational functions to model resource consumption or environmental pollution levels and analyze the effectiveness of proposed solutions (e.g., energy use reduction, waste management).

ELA:

NJSLSA.R7 – Integrate and evaluate content presented in diverse media and formats.

Students analyze and interpret various representations of polynomial and rational functions (tables, graphs, and verbal descriptions) in written and digital media to solve problems and make predictions.

NJSLSA.W2 – Write informative/explanatory texts to examine and convey complex ideas clearly.

Students write clear, detailed explanations of polynomial and rational functions, including how to find their roots, asymptotes, and behavior in real-world contexts, such as economics, engineering, or population modeling.

9.4.12.CT.1 – Critical Thinking and Problem Solving

- **Identify and apply problem-solving strategies.**

Students apply their knowledge of polynomial and rational functions to solve real-world problems, such as optimizing production processes, minimizing costs, or modeling population growth.

9.4.12.IML.5 – Information and Media Literacy

- **Analyze the impact of media and design elements on information.**

Students analyze and interpret how polynomial and rational function models are used in media, such as financial graphs, climate data, or business projections, and assess their

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effectiveness in conveying information.

9.4.12.FI.3 – Financial Literacy

- **Analyze how spending habits affect one's ability to save.**
Students model financial situations involving compound interest, investment returns, or loan payments using polynomial functions, demonstrating real-life applications in budgeting and saving.

9.4.12.TL.4 – Technology Literacy

- **Synthesize and publish information about a local or global issue.**
Students use technology tools (e.g., graphing calculators, software like GeoGebra) to model and analyze real-world problems involving polynomial and rational functions, and share their findings using digital platforms.

9.4.12.CT.2 – Critical Thinking and Problem Solving

- **Use appropriate tools strategically to solve problems and make decisions.**
Students strategically apply polynomial and rational functions to solve complex problems, such as determining optimal pricing strategies, analyzing supply-demand curves, or forecasting future trends in business and economics.

9.4.12.IML.7 – Information and Media Literacy

- **Use information from a variety of sources for a specific purpose.**
Students gather data from different sources and use polynomial or rational function models to analyze trends, solve problems, or predict outcomes in fields such as economics, science, or engineering.

9.4.12.CT.3 – Critical Thinking and Problem Solving

- **Evaluate multiple solutions to a problem and determine which is the most effective.**
Students explore multiple methods for solving problems involving polynomial and rational functions (e.g., synthetic division, factoring, graphing) and evaluate which method is most effective for different situations.

9.4.12.TL.5 – Technology Literacy

- **Assess the process and quality of collaborative environments to improve results.**
Students collaborate using technology tools (e.g., digital simulations or online graphing tools) to model polynomial and rational functions and assess their solutions collectively.

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All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaboratively and to create and communicate knowledge.

- 9.4.8.TL.6: Collaborate to develop and publish work that provides perspectives on a real-world problem.

Students will access the Precalculus online ebook to further investigate lesson concepts and demonstrate understanding of standards.

- 9.4.8.TL.3: Select appropriate tools to organize and present information digitally.
- 9.4.5.CT.3: Describe how digital tools and technology may be used to solve problems.

Supplemental instruction and math games will be presented using IXL Math

- 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task

Students will use Google Classroom to collaborate, work towards solving authentic problems, or participate in an online classroom discussion utilizing pre-learned etiquette about blended learning platforms.

- 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.

Students will use graphing calculators to use math tools strategically and attend to precision and will use Desmos in order to discover new concepts involving graphing and functions.

- 9.4.8.IML.3: Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping

9.4.12.CI.1: Demonstrate the ability to reflect, analyze, and use creative skills and ideas.

9.4.12.CI.2: Identify career pathways that highlight personal talents, skills, and abilities.

9.4.12.CI.3: Use a variety of digital tools to design and develop digital artifacts that demonstrate creative thinking and problem-solving skills.

9.4.12.TL.1: Demonstrate proficiency in the use of digital tools to gather, evaluate, and use information.

9.4.12.TL.2: Create and edit digital artifacts to effectively communicate and express ideas.

9.4.12.TL.3: Collaborate with others using digital tools to produce original works or solve problems.

9.4.12.TL.4: Analyze the impact of emerging technologies on personal and professional productivity.

Time Frame	5 cycles (15 - 56 minute cycles)
Exponential and Logarithmic Functions (Purple 5.3-5.9)	

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F.IF.4: Interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing these features given a verbal description of the relationship.

F.IF.7e: Graph exponential and logarithmic functions, showing intercepts and end behavior..

F.IF.C.7f (+) Graph trigonometric functions, showing period, midline, and amplitude.

F.LE.4: For exponential models, express the solution to equations of the form $ab^{ct} = d$ as a logarithm, and evaluate the logarithm using technology.

SWBAT answer the following questions:

- How can an exponential function represent a real-world scenario?
- How can the properties of logarithms be used to solve equations?
- Why does simplifying or expanding a logarithmic expression help us solve problems?
- Why is the number e important?
- What is the purpose of a logistic model?

SWBAT demonstrate understanding of the following:

- Functions families have common characteristics.
- We can use algebra to help graph functions.
- Knowing how to read an equation is essential for graphing the function.
- Mathematics applies to the sciences.

Learning Activities:

- Evaluate exponential functions.
- Graph exponential functions and transformations of such. M&M Lab – modeling exponential decay.
- Define the number e .
- Compound versus Simple Interest Activity
- Solve exponential equations.
- Change exponential expressions to logarithmic expressions and vis-versa.
- Evaluate logarithmic functions.
- Determine the domain of a logarithmic function.
- Graph logarithmic functions and transformations of such.
- Solve logarithmic equations.
- Expand and condense logarithmic expressions.
- Use properties of logarithms and exponents to solve equations algebraically.
- Use exponential and logarithmic functions to describe real world scenarios including growth and decay.
- Use exponential models to create financial models with compound, simple interest.
- Discover that using log base 10 and natural log will result in the same answer when solving equations. Why is that?
- CBL – Newton's Law of Cooling
- **Logistic – spread of a rumor/virus
- **Develop motivation for Logistic Model by conjecturing the conditions that population

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growth is limited.

Formative:

- Rich Thinking Tasks
- Classroom Observation
- Student Reflections and Math Talks
- Targeted Practice via IXL

Summative:

- Mid-unit Quizzes
- Topic Tests
- Performance Tasks/Projects

Alternative:

- AP PreCalculus Released Problems

Science:

HS-LS1-4: Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

In analyzing populations students will use a model to illustrate the role of cellular division and differentiation in producing and maintaining complex organisms mathematically using growth, decay, half-life, and logistic models.

9.1.12.CDM.8: In the logarithmic unit students will compare and compute interest and compound interest and develop an amortization table using business tools.

9.1.12.CDM.6: When learning exponential equations students will compute and assess the accumulating effect of interest paid over time when using a variety of sources of credit (e.g., student loans, credit cards, auto loans, mortgages, etc.)

All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaboratively and to create and communicate knowledge.

- 9.4.8.TL.6: Collaborate to develop and publish work that provides perspectives on a real-world problem.

Students will access the Precalculus online ebook to further investigate lesson concepts and demonstrate understanding of standards.

- 9.4.8.TL.3: Select appropriate tools to organize and present information digitally.
- 9.4.5.CT.3: Describe how digital tools and technology may be used to solve problems.

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- 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task

Students will use Google Classroom to collaborate, work towards solving authentic problems, or participate in an online classroom discussion utilizing pre-learned etiquette about blended learning platforms.

- 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.

Students will use graphing calculators to use math tools strategically and attend to precision and will use Desmos in order to discover new concepts involving graphing and functions.

- 9.4.8.IML.3: Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping

9.4.12.CI.1 – *Demonstrate the ability to reflect, analyze, and use creative skills and ideas.*

9.4.12.TL.1 – *Demonstrate proficiency in the use of technology to gather, evaluate, and use information to support academic and technical tasks.*

9.4.12.IML.1 – *Evaluate sources of information for reliability and relevance when learning independently or using academic knowledge in real-world settings.*

9.4.12.CT.1 – *Identify problem-solving strategies used in the workplace and explain when they are used effectively.*

9.4.12.CT.2 – *Explain the importance of persistence, effort, and motivation in problem-solving and accomplishing long-term goals.*

9.4.12.CI.3 – *Use a variety of digital tools to design and develop digital artifacts that demonstrate creative thinking and problem-solving skills.*

9.4.12.TL.3 – *Collaborate with others using digital tools to solve problems.*

Time Frame

5 cycles (15 - 56 minute cycles)

Trigonometry: Triangles, Angles, Unit Circle (Purple 6.1-6.2)

A.REI.4: Solve quadratic equations in one variable.

F.TF.1(+): Understand radian measure of angles as the length of the arc on the unit circle subtended by the angle.

F.TF.2(+): Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles.

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F.TF.3: 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, cosine, and tangent for angles in all quadrants.

G.SRT.8: Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

SWBAT answer the following questions:

- Mathematically speaking, how does what you learned today connect with what you learned yesterday, and what you will learn tomorrow?
- How can we find out information for all different types of triangles?

SWBAT demonstrate understanding of the following:

- Precalculus connects discrete pieces of mathematics from your past learning.
- Trigonometry allows for indirect measurement of triangles when given limited information.
- There exists a distinct and definite bridge between the worlds of algebra and algebraic thinking and the field of geometry.

Learning Activities:

- Review, discuss, and practice algebra skills from summer assignment which include equations in one variable, linear equations in two variables, function notation, quadratic equations, synthetic substitution and division, radicals, rational expressions and domain.
- Review, discuss, and practice trigonometry skills from summer assignment which include right triangle trigonometry and problems involving angles of elevation and depression.
- Relate right triangle trigonometry to the ratio of sides of a triangle relating it to the algorithm used in a calculator.
- Identify co-terminal and reference angles using degrees.
- Create a unit circle from its relationship to right triangle trigonometry.
- Use the unit circle to evaluate all six trigonometric relations; use the calculator to evaluate each relation.
- Evaluate trigonometric functions of any angle using reference angles.
- CBL – Gathering temperatures at certain time intervals to determine period and amplitude.
- Angular/Linear Speed Relationship – given one speed find the other and convert to appropriate units.

Formative:

- Rich Thinking Tasks
- Classroom Observation
- Student Reflections and Math Talks
- Targeted Practice via IXL

Summative:

- Mid-unit Quizzes

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- Topic Tests
- Performance Tasks/Projects

Alternative:

- AP PreCalculus Released Problems

Science:

HS-ETS1-3 – Evaluate a solution to a complex real-world problem.

Students apply trigonometric functions to design and evaluate engineering solutions, such as creating accurate models for structures, satellite communications, or the motion of mechanical systems.

9.4.12.CT.2 – Critical Thinking and Problem Solving

- **Use appropriate tools strategically to solve problems and make decisions.**
Students apply trigonometric models and the unit circle in various contexts such as engineering, construction, and computer science to solve practical problems (e.g., determining angles for building structures, calculating distances in GPS systems).

9.4.12.IML.5 – Information and Media Literacy

- **Analyze the impact of media and design elements on information.**
Students use trigonometric graphs and models in media (e.g., in animations or data visualization) to analyze trends or create visual representations of periodic phenomena.

9.4.12.TL.4 – Technology Literacy

- **Synthesize and publish information about a local or global issue.**
Students use graphing tools (e.g., GeoGebra, Desmos) to model and publish solutions to real-world problems involving trigonometry, such as modeling the behavior of tides, electricity waves, or architectural structures.

9.4.12.FI.3 – Financial Literacy

- **Analyze how spending habits affect one's ability to save.**
Students can use trigonometric models to analyze cyclical trends in the economy, such as seasonal spending or market fluctuations, through the lens of periodic functions.

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All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaboratively and to create and communicate knowledge.

- 9.4.8.TL.6: Collaborate to develop and publish work that provides perspectives on a real-world problem.

Students will access the Precalculus online ebook to further investigate lesson concepts and demonstrate understanding of standards.

- 9.4.8.TL.3: Select appropriate tools to organize and present information digitally.
- 9.4.5.CT.3: Describe how digital tools and technology may be used to solve problems.

Supplemental instruction and math games will be presented using IXL Math

- 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task

Students will use Google Classroom to collaborate, work towards solving authentic problems, or participate in an online classroom discussion utilizing pre-learned etiquette about blended learning platforms.

- 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.

Students will use graphing calculators to use math tools strategically and attend to precision and will use Desmos in order to discover new concepts involving graphing and functions.

- 9.4.8.IML.3: Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping

9.4.12.CI.1 – *Demonstrate the ability to reflect, analyze, and use creative skills and ideas.*

9.4.12.CI.2 – *Identify career pathways that highlight personal talents, skills, and abilities (e.g., visual arts, music, STEM).*

9.4.12.CI.3 – *Use a variety of digital tools to design and develop digital artifacts that demonstrate creative thinking and problem-solving skills.*

9.4.12.CT.1 – *Identify problem-solving strategies used in the workplace and explain when they are used effectively.*

9.4.12.CT.2 – *Explain the importance of persistence, effort, and motivation in problem-solving and accomplishing long-term goals.*

9.4.12.TL.3 – *Collaborate with others using digital tools to solve problems.*

9.4.12.CI.3 – *Use a variety of digital tools to design and develop digital artifacts that demonstrate creative thinking and problem-solving skills.*

Time Frame

4 cycles (12 - 56 minute cycles)

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Trigonometric Graphs (Purple 6.3-6.6)

F.IF.7e: Graph exponential and logarithmic functions, showing intercepts and end behavior.

F.TF.4: Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.

F.TF.5(+): Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.

F.TF.6: Understand that restricting a trigonometric function to a domain on which it is one-to-one enables the construction of an inverse function.

SWBAT answer the following questions:

- How do we use the unit circle to create a graph for each of the six trigonometric functions?
- Where do the common characteristics of sinusoidal functions come from?
- How does the equation for a function affect the graph of that function?
- What does it mean to find an exact value?

SWBAT demonstrate understanding of the following:

- The unit circle is a gateway between geometry and algebra.
- Members within a family of functions have common characteristics.
- Inverse functions can be found and verified in a variety of ways.
- Decimals can be good approximations of exact values.

Learning Activities:

- Graph sine and cosine functions applying the knowledge of the unit circle.
- Sketch the graph of tangent and cotangent functions.
- Sketch the graph of secant and cosecant functions using the graphs of cosine and sine as aides.
- Describe important characteristics of the graphs of the six trigonometric functions (domain, range, max/min, increasing, decreasing, x-intercepts, y-intercepts).
- Sketch the graphs of the sine and cosine functions both by hand and with graphing technology using the concepts of amplitude and period including those with transformations.
- Write equations for transformed sine and cosine functions.
- Determine the restrictions on the domain for the sine function and the cosine function in order for the inverse to also be a function.
- Calculate both exact and approximate values for inverse sine and cosine.
- CBL – Tuning Fork Lab (sinusoid)
- Discover applications of sinusoids (tides, Ferris Wheel, average temp (temp versus month), harmonic motion, etc)

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Formative:

- Rich Thinking Tasks
- Classroom Observation
- Student Reflections and Math Talks
- Targeted Practice via IXL

Summative:

- Mid-unit Quizzes
- Topic Tests
- Performance Tasks/Projects

Alternative:

- AP PreCalculus Released Problems

Science:

HS-PS2-4 – Use mathematical representations to describe a physical system.

Trigonometric graphs are used to model oscillatory and wave phenomena, such as sound waves, light waves, and mechanical vibrations, which are fundamental concepts in physics.

HS-PS4-1 – Use mathematical representations to support a claim regarding relationships among frequency, wavelength, and speed.

Students use trigonometric graphs to model and analyze the relationship between frequency, wavelength, and speed in various types of waves (e.g., electromagnetic, acoustic).

ELA:

SL.9-10.4 – Present information, findings, and supporting evidence clearly and logically.

Students present the results of their analysis of trigonometric graphs (e.g., sine, cosine, tangent) in real-world applications like music theory, physics, or finance, providing visual and numerical evidence to support their conclusions.

9.4.12.IML.5 – Information and Media Literacy

- **Analyze the impact of media and design elements on information.**
Students analyze how trigonometric graphs are used in media to represent periodic phenomena (e.g., sound waves in music, repeating cycles in economics, or seasonal data in

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environmental studies).

9.4.12.CT.3 – Critical Thinking and Problem Solving

- **Evaluate multiple solutions to a problem and determine which is the most effective.**
Students apply their knowledge of trigonometric graphs to solve real-world problems, such as optimizing the design of wave-based technologies, analyzing signals in telecommunications, or improving product cycles in manufacturing.

9.4.12.TL.3 – Technology Literacy

- **Analyze the effectiveness of the process and quality of collaborative environments to improve results.**
Students use graphing tools (e.g., GeoGebra, Desmos) to create, analyze, and collaborate on trigonometric graphs, improving their ability to communicate mathematical concepts in group settings.

9.4.12.FI.2 – Financial Literacy

- **Use math and financial tools to explain economic trends and projections.**
Students use trigonometric graphs to model economic data that exhibit periodicity, such as seasonal sales trends, investment cycles, or the effects of economic cycles on industries like agriculture and tourism.

All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaboratively and to create and communicate knowledge.

- 9.4.8.TL.6: Collaborate to develop and publish work that provides perspectives on a real-world problem.

Students will access the Precalculus online ebook to further investigate lesson concepts and demonstrate understanding of standards.

- 9.4.8.TL.3: Select appropriate tools to organize and present information digitally.
- 9.4.5.CT.3: Describe how digital tools and technology may be used to solve problems.

Supplemental instruction and math games will be presented using IXL Math.

- 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task

Students will use Google Classroom to collaborate, work towards solving authentic problems, or participate in an online classroom discussion utilizing pre-learned etiquette about blended learning platforms.

- 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.

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Students will use graphing calculators to use math tools strategically and attend to precision and will use Desmos in order to discover new concepts involving graphing and functions.

- 9.4.8.IML.3: Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping

9.4.12.CI.1 – Demonstrate the ability to reflect, analyze, and use creative skills and ideas.

9.4.12.CI.2 – Identify career pathways that highlight personal talents, skills, and abilities (e.g., visual arts, music, STEM).

9.4.12.CI.3 – Use a variety of digital tools to design and develop digital artifacts that demonstrate creative thinking and problem-solving skills.

9.4.12.CT.1 – Identify problem-solving strategies used in the workplace and explain when they are used effectively.

9.4.12.CT.2 – Explain the importance of persistence, effort, and motivation in problem-solving and accomplishing long-term goals.

9.4.12.TL.3 – Collaborate with others using digital tools to solve problems.

9.4.12.CI.3 – Use a variety of digital tools to design and develop digital artifacts that demonstrate creative thinking and problem-solving skills.

Time Frame

6 cycles (18 - 56 minute cycles)

Analytic Trigonometry: Equations and Identities (Ch7)

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.

F.TF.8(+): Prove the Pythagorean identity $\sin^2(\theta) + \cos^2(\theta) = 1$, and use it to find $\sin(\theta)$, $\cos(\theta)$, or $\tan(\theta)$ given the value of one and the quadrant of the angle.

F.TF.9: Prove and apply trigonometric identities.

SWBAT answer the following questions:

- What does it mean when we solve a trigonometric equation?
- How do we represent multiple solutions on a given domain?
- What does it mean to prove an identity?
- How can we use identities to simplify the process involved in solving an equation?

SWBAT demonstrate understanding of the following:

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- The solutions to an equation can be represented graphically as the intersection of two functions.
- Sinusoidal functions have an infinite number of solutions that are the same interval apart.
- Equivalent expressions can be written in a variety of formats.
- There exists a distinct and definite connection between the fields of geometry and algebra

Learning Activities:

- Solve equations involving sine and cosine using algebraic and graphical techniques.
- Solving equations involving frequency changes of sine and cosine using algebraic and graphical techniques.
- Find exact values of trigonometric functions using sum and difference formulas.
- Find exact values of trigonometric functions using double angle and half angle identities.
- Prove trigonometric identities using Pythagorean, reciprocal, and quotient identities.
- Connections to Algebra – Relate familiar factoring skills to trigonometric relations to solve trigonometric equations.
- Verifying Trigonometric Identities – A Graphical Approach
- Solving Trigonometric Equations – A Graphical Approach

Formative:

- Rich Thinking Tasks
- Classroom Observation
- Student Reflections and Math Talks
- Targeted Practice via IXL

Summative:

- Mid-unit Quizzes
- Topic Tests
- Performance Tasks/Projects

Alternative:

- AP PreCalculus Released Problems

Science: HS-LS2-1: Students will use mathematical and/or computational representations to support explanations of factors that affect the carrying capacity of ecosystems at different scales when analyzing trigonometric graphs.

9.4.12.CT.1 – Critical Thinking and Problem Solving

- Identify and apply problem-solving strategies.

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COURSE Advanced Pre-Calculus

Students use trigonometric identities to solve complex real-world problems in various fields, including engineering, physics, and computer science, applying analytical techniques to optimize solutions in real-world situations (e.g., structural design, signal processing).

9.4.12.IML.5 – Information and Media Literacy

- **Analyze the impact of media and design elements on information.**

Students use trigonometric identities to analyze data visualizations in media (e.g., waveforms in sound or music, patterns in marketing data), assessing how mathematical models are used to create or interpret visual information.

9.4.12.FI.2 – Financial Literacy

- **Use math and financial tools to explain economic trends and projections.**

Students apply trigonometric equations and identities to model seasonal trends or cyclical behaviors in economics, such as stock market cycles, interest rates, or supply and demand patterns.

9.4.12.TL.5 – Technology Literacy

- **Assess the process and quality of collaborative environments to improve results.**

Students collaborate using technology tools (e.g., MATLAB, Wolfram Alpha, or graphing calculators) to solve trigonometric equations and apply identities in engineering or scientific research, improving problem-solving and communication skills.

9.4.12.CT.3 – Critical Thinking and Problem Solving

- **Evaluate multiple solutions to a problem and determine which is the most effective.**

Students analyze multiple methods for solving trigonometric equations, comparing different approaches (e.g., using identities to simplify or solve equations versus graphical methods) to determine the most efficient solution for various contexts.

All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaboratively and to create and communicate knowledge.

- 9.4.8.TL.6: Collaborate to develop and publish work that provides perspectives on a real-world problem.

Students will access the Precalculus online ebook to further investigate lesson concepts and demonstrate understanding of standards.

- 9.4.8.TL.3: Select appropriate tools to organize and present information digitally.
- 9.4.5.CT.3: Describe how digital tools and technology may be used to solve problems.

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- 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task

Students will use Google Classroom to collaborate, work towards solving authentic problems, or participate in an online classroom discussion utilizing pre-learned etiquette about blended learning platforms.

- 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.

Students will use graphing calculators to use math tools strategically and attend to precision and will use Desmos in order to discover new concepts involving graphing and functions.

- 9.4.8.IML.3: Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping

9.4.12.IML.1 – Evaluate sources of information for reliability and relevance when learning independently or using academic knowledge in real-world settings.

9.4.12.TL.1 – Demonstrate proficiency in the use of technology to support academic and technical tasks.

9.4.12.CI.1 – Demonstrate the ability to reflect, analyze, and use creative skills and ideas.

9.4.12.CT.1 – Identify problem-solving strategies used in the workplace and explain when they are used effectively.

9.4.12.CT.2 – Explain the importance of persistence, effort, and motivation in problem-solving and accomplishing long-term goals.

9.4.12.CI.3 – Use a variety of digital tools to design and develop digital artifacts that demonstrate creative thinking and problem-solving skills.

9.4.12.TL.3 – Collaborate with others using digital tools to solve problems.

Time Frame

3 cycles (9 - 56 minute cycles)

Polar Coordinates/Graphs and Vectors (9.1-9.2, 9.4)

G.SRT.9: Derive the formula $A = \frac{1}{2} ab \sin(C)$ for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.

G.SRT.10: Prove the Laws of Sines and Cosines and use them to solve problems.

G.SRT.11: Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in real-world and mathematical problems, including ambiguous cases.

N.VM.1: Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols.

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N.VM.2: Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point.

N.VM.3: Solve problems involving velocity and other quantities that can be represented by vectors.

N.VM.4: Add and subtract vectors.

N.VM.5: Multiply a vector by a scalar.

SWBAT answer the following questions:

- How do we use algebra to manipulate expressions to do what we want them to do?
- How can representing physics applications using vectors help us determine the resultant effect of multiple forces on an object?

SWBAT demonstrate understanding of the following:

- There exists a definite and distinct bridge between the fields of trigonometry and physics.
- Characteristics of sinusoidal functions can affect how we use them to solve right triangles.
- Multiple ways of representing real world phenomena can be used to solve problems.
- What is the difference between a rectangular and polar graph? How can we convert between the two?

Learning Activities:

- Represent vectors as a directed line segment.
- Write vectors in component form, perform basic vector operations with vectors, and find the direction angle of a vector.
- Find the resultant of two vectors.
- Use vectors to solve real life problems including, but not limited to, velocity.
- Plotting polar coordinates, converting from polar to rectangular and vis-versa.
- Graphing polar equations from rectangular form.
- Applications of Right Triangle Trigonometry.

Formative:

- Rich Thinking Tasks
- Classroom Observation
- Student Reflections and Math Talks
- Targeted Practice via IXL

Summative:

- Mid-unit Quizzes
- Topic Tests
- Performance Tasks/Projects

Alternative:

- AP PreCalculus Released Problems

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Science:

HS-PS2-4 – Use mathematical representations to describe a physical system.

Polar coordinates and vectors are used to model physical systems that involve rotational motion or directional quantities, such as in physics problems dealing with angular velocity, circular motion, or force vectors acting at an angle.

HS-PS4-1 – Use mathematical representations to support a claim regarding relationships among frequency, wavelength, and speed.

Vectors and polar coordinates are used to model wave phenomena, such as electromagnetic waves, sound waves, or light waves, and their interactions in different media.

HS-ESS2-6 – Use a model to explain the role of water in the Earth's climate system.

Students use polar coordinates and vectors to model cyclical processes in the Earth's climate system (e.g., ocean currents or wind patterns), understanding how direction and magnitude play a role in environmental processes.

9.4.12.CT.2 – Critical Thinking and Problem Solving

- **Use appropriate tools strategically to solve problems and make decisions.**
Students apply vector and polar coordinate methods to solve real-world engineering problems, such as calculating resultant forces or determining the direction and magnitude of motion in various fields (e.g., mechanical engineering, robotics).

9.4.12.TL.5 – Technology Literacy

- **Assess the process and quality of collaborative environments to improve results.**
Students use digital tools (e.g., GeoGebra, MATLAB, or simulation software) to explore and analyze polar coordinate systems and vectors, collaborating with peers to model and solve engineering or scientific problems.

9.4.12.IML.7 – Information and Media Literacy

- **Use information from a variety of sources for a specific purpose.**
Students use data from different sources (e.g., geographical data, engineering designs) to model and analyze real-world problems involving polar coordinates and vectors, presenting their results through digital platforms.

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9.4.12.FI.3 – Financial Literacy

- **Analyze how spending habits affect one's ability to save.**
Students use vector analysis and polar coordinate systems to model financial trends or cyclical data in economics, such as market trends or business cycles.

9.4.12.CT.3 – Critical Thinking and Problem Solving

- **Evaluate multiple solutions to a problem and determine which is the most effective.**
Students explore multiple methods for solving real-world problems involving vectors and polar coordinates (e.g., calculating distances, optimizing paths, or analyzing forces) and determine the most efficient approach for different applications.

All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaboratively and to create and communicate knowledge.

- 9.4.8.TL.6: Collaborate to develop and publish work that provides perspectives on a real-world problem.

Students will access the Precalculus online ebook to further investigate lesson concepts and demonstrate understanding of standards.

- 9.4.8.TL.3: Select appropriate tools to organize and present information digitally.
- 9.4.5.CT.3: Describe how digital tools and technology may be used to solve problems.

Supplemental instruction and math games will be presented using IXL Math.

- 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task

Students will use Google Classroom to collaborate, work towards solving authentic problems, or participate in an online classroom discussion utilizing pre-learned etiquette about blended learning platforms.

- 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.

Students will use graphing calculators to use math tools strategically and attend to precision and will use Desmos in order to discover new concepts involving graphing and functions.

- 9.4.8.IML.3: Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping

9.4.12.TL.1 – Demonstrate proficiency in the use of technology to support academic and technical tasks.

9.4.12.IML.1 – Evaluate sources of information for reliability and relevance when learning independently or using academic knowledge in real-world settings.

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9.4.12.CI.2 – Identify career pathways that highlight personal talents, skills, and abilities (e.g., visual arts, music, STEM).

9.4.12.CI.3 – Use a variety of digital tools to design and develop digital artifacts that demonstrate creative thinking and problem-solving skills.

9.4.12.CI.1 – Demonstrate the ability to reflect, analyze, and use creative skills and ideas.

9.4.12.CI.3 – Use a variety of digital tools to design and develop digital artifacts that demonstrate creative thinking and problem-solving skills.

9.4.12.TL.3 – Collaborate with others using digital tools to solve problems.

9.4.12.CI.2 – Identify career pathways that highlight personal talents, skills, and abilities, especially in creative fields like design and innovation.

Time Frame	4 cycles (12 - 56 minute cycles)
Introduction to Limits and Continuity (14.1-14.4)	
F.IF.6: Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. F.IF.7d: Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior. 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.	
SWBAT answer the following questions: • What characteristics does a function need to have for a limit to exist? • What does it mean to have a limit equal to infinity? • Why does the slope of a secant line change as x approaches a point? • What is the average rate of change and how can functions and graphs help model it? • Is a function continuous at a particular value of x? • Is a function considered a continuous function? • What is the derivative? What is its purpose? How does it relate to what we have already done? SWBAT demonstrate understanding of the following: • What does it mean to have a limit equal to infinity?	

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- Why does the slope of a secant line change as x approaches a point?
- What is the rate of change and how can functions and graphs help model it?
- What is the difference between the average rate of change and instantaneous rate of change?
- Is a function continuous at a particular value of x ?
- Is a function considered a continuous function?

Learning Activities:

- *Define a limit.
- *Find the value of a limit graphically and as a table, including limits at infinity.
- *Find the limit algebraically
- *Find one sided limits graphically and algebraically.
- *Determine the x -values at which a function is continuous/discontinuous
- **Find the average rate of change of a secant line for a function.
- **Find the slope of a line tangent to a function at a given point using limits.
- *Find limits and determine continuity of piecewise functions.
- Graph piecewise functions by hand.
- *Use graphs to determine, one-sided limits and continuity of those functions.

Formative:

- Rich Thinking Tasks
- Classroom Observation
- Student Reflections and Math Talks
- Targeted Practice via IXL

Summative:

- Mid-unit Quizzes
- Topic Tests
- Performance Tasks/Projects

Alternative:

- AP PreCalculus Released Problems

ELA:

W.11-12.1: Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

When students are justifying their reasoning on short answer and extended constructed response questions they write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.

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9.4.12.CT.2 – *Develop logical reasoning and abstract thinking skills through problem-solving.*

Students use the formal definition of a limit and explore continuity to reason through non-linear real-world behavior, such as in business trends or logistics models.

9.4.12.IML.5 – *Analyze and interpret complex information from multiple sources.*

Students examine graphical, numerical, and algebraic representations to determine continuity and limit behavior, applying this in interdisciplinary fields like finance, engineering, and computer science.

9.4.12.TL.4 – *Use digital tools to enhance the design process.*

Students use graphing technology (e.g., Desmos, TI-Nspire, GeoGebra) to explore the behavior of functions approaching limits, testing hypotheses and designing function models.

9.4.12.CI.2 – *Create and implement solutions to authentic problems.*

Students model scenarios like rates of change, thresholds, or breakpoints (e.g., in economics, health data, or engineering loads) to understand the utility of approaching a boundary value.

All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaboratively and to create and communicate knowledge.

- 9.4.8.TL.6: Collaborate to develop and publish work that provides perspectives on a real-world problem.

Students will access the Precalculus online ebook to further investigate lesson concepts and demonstrate understanding of standards.

- 9.4.8.TL.3: Select appropriate tools to organize and present information digitally.
- 9.4.5.CT.3: Describe how digital tools and technology may be used to solve problems.

Supplemental instruction and math games will be presented using IXL Math.

- 9.4.12.TL.1: Assess digital tools based on features such as accessibility options, capacities, and utility for accomplishing a specified task

Students will use Google Classroom to collaborate, work towards solving authentic problems, or participate in an online classroom discussion utilizing pre-learned etiquette about blended learning platforms.

- 9.4.12.TL.4: Collaborate in online learning communities or social networks or virtual worlds to analyze and propose a resolution to a real-world problem.

Students will use graphing calculators to use math tools strategically and attend to precision and will use Desmos in order to discover new concepts involving graphing and functions.

- 9.4.8.IML.3: Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping

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Assistant Superintendent
Office of Teaching and Learning

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Meeting the needs of all students with a proud tradition of academic excellence.

DEPARTMENT Mathematics

COURSE Advanced Pre-Calculus

9.4.12.TL.1 – Demonstrate proficiency in the use of technology to support academic and technical tasks.
9.4.12.IML.1 – Evaluate sources of information for reliability and relevance when learning independently or using academic knowledge in real-world settings.
9.4.12.CI.1 – Demonstrate the ability to reflect, analyze, and use creative skills and ideas.
9.4.12.CI.2 – Identify career pathways that highlight personal talents, skills, and abilities (e.g., visual arts, music, STEM).
9.4.12.CT.1 – Identify problem-solving strategies used in the workplace and explain when they are used effectively.
9.4.12.CT.2 – Explain the importance of persistence, effort, and motivation in problem-solving and accomplishing long-term goals.
9.4.12.TL.3 – Collaborate with others using digital tools to solve problems.
9.4.12.CI.3 – Use a variety of digital tools to design and develop digital artifacts that demonstrate creative thinking and problem-solving skills.

ELL:

- Work toward longer passages as skills in English increase
- Use visuals
- Introduce key vocabulary before lesson
- Teacher models reading aloud daily
- Provide peer tutoring
- Use of Bilingual Dictionary
- Guided notes and/or scaffold outline for written assignments
- Provide students with English Learner leveled readers.

Supports for Students With IEPs:

- Allow extra time to complete assignments or tests
- Guided notes and/or scaffold outline for written assignments
- Work in a small group
- Allow answers to be given orally or dictated
- Use large print books, Braille, or books on CD (digital text)
- Follow all IEP modifications

At-Risk Students:

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DEPARTMENT Mathematics

COURSE Advanced Pre-Calculus

- Guided notes and/or scaffold outline for written assignments
- Introduce key vocabulary before lesson
- Work in a small group
- Lesson taught again using a differentiated approach
- Allow answers to be given orally or dictated
- Use visuals / Anchor Charts
- Leveled texts according to ability

Gifted and Talented:

- Create an enhanced set of introductory activities (e.g. advance organizers, concept maps, concept puzzles)
- Provide options, alternatives and choices to differentiate and broaden the curriculum
- Organize and offer flexible small group learning activities
- Provide whole group enrichment explorations
- Teach cognitive and methodological skills
- Use center, stations, or contracts
- Organize integrated problem-solving simulations
- Propose interest-based extension activities
- Expose students to beyond level texts.

Supports for Students With 504 Plans:

- Follow all the 504 plan modifications
- Text to speech/audio recorded selections
- Amplification system as needed
- Leveled texts according to ability
- Fine motor skill stations embedded in rotation as needed
- Modified or constrained spelling word lists
- Provide anchor charts with high frequency words and phonemic patterns

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