Lakewood School DIstrict Curriculum Guide

Grade: High School	**Content Area: Mathematics - Precalculus**

Original Adoption: 2023 NJSLS English Language Arts and English as a Second Language (8-21-24); Math NJSLS Mathematics (8-21-24); 2020 NJSLS Science, Social Studies, Career Readiness, Life Literacies & Key Skills, Computer Design & Thinking, Visual & Performing Arts, World Language, Comprehensive Health and Physical Education (5-11-22)
Created By:

Recommended Pacing Guide	
Unit 1: Introduction to Functions	25 days
Unit 2: Function operations, compositions and transformations	17 days
Unit 3: Graphing Polynomials by analyzing Roots, end behavior and turning points.	18 days
Unit 4: Rational Function	22 days
Unit 5: Exponential and Logarithmic Functions	27 days
Unit 6: Introduction to Trigonometry	16 days
Unit 7: Trigonometric Identities and Equations	14 days
Unit 8: Graphing Trig Functions & Inverse Trig Functions	17 days

Alignment with State Mandates

The following colors are used throughout this document to indicate areas in which the curriculum is aligned with the following NJSA requirements:

- Holocaust and genocides (N.J.S.A. 18A:35-28)
- History and contributions of African-Americans (Amistad Law) (N.J.S.A. 18A:35-4.43)
- Highlight and promote diversity and inclusion (Diversity & Inclusion Law) (N.J.S.A. 18A:35-4.36a)
- History of disabled and LGBT persons included in middle and high school curriculum (Section 18A:35-4.35)
- Climate Change - to prepare students to understand how and why climate change happens, the impact it has on our local and global communities and to act in informed and sustainable ways. Please click here for specific examples (by subject).

Grade: High School	Content Area: Mathematics - Precalculus

Unit 1: Introduction to Functions	25 days
New Jersey Learning Standards-Mathematics	
F.IF.A.1	Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x).
F.IF.A.2	Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
F.IF.B.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.B.5	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
F.IF.C.7a	Graph linear and quadratic functions and show intercepts, maxima, and minima.
F.IF.C.7b	Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
F.BF.B.3	Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology.

Standards of Mathematical Practices	
MP1. Make sense of problems and persevere in solving them	• Find meaning in problems • Look for entry points • Analyze, conjecture and plan solution pathways • Monitor and adjust • Verify answers • Ask themselves the question: “Does this make sense?”
MP2. Reason abstractly and quantitatively.	• Make sense of quantities and their relationships in problems • Learn to contextualized and decontextualized • Create coherent representations of problems

Grade: High School	Content Area: Mathematics - Precalculus

MP3. Construct viable arguments and critique the reasoning of others.	• Understand and use information to construct arguments • Make and explore the truth of conjectures • Recognize and use counterexamples • Justify conclusions and respond to arguments of others
MP4. Model with Mathematics.	• Apply mathematics to problems in everyday life • Make assumptions and approximations • Identify quantities in a practical situation • Interpret results in the context of the situation and reflect on whether the results make sense
MP5. Use appropriate tools strategically	• Consider the available tools when solving problems • Are familiar with tools appropriate for their grade or course (pencil and paper, concrete models, ruler, protractor, calculator, spreadsheet, computer programs, digital content located on a website, and other technological tools) • Make sound decisions of which of these tools might be helpful
MP6. Attend to precision.	• Communicate precisely to others • Use clear definitions, state the meaning of symbols and are careful about specifying units of measure and labeling axes • Calculate accurately and efficiently
MP7. Look for and make use of structure.	• Discern patterns and structures • Can step back for an overview and shift perspective • See complicated things as single objects or as being composed of several objects

Social and Emotional Learning Standards	
Self-Awareness	• Recognize one's personal traits, strengths, and limitations • Recognize the importance of self-confidence in handling daily tasks and challenges
Self-Management	• Recognize the skills needed to establish and achieve personal and educational goals • Identify and apply ways to persevere or overcome barriers through alternative methods to achieve one's goals
Social Awareness	• Demonstrate an understanding of the need for mutual respect when viewpoints differ
Responsible Decision-Making	• Develop, implement and model effective problem solving and critical thinking skills

Grade: High School	Content Area: Mathematics - Precalculus

Interdisciplinary Connections

	ELA Standards
• **L.SS.11–12.1**	Demonstrate command of the system and structure of the English language when writing or speaking.
• **W.RW.11–12.7**	Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes.
	Science Standards
• **HS-LS1-3**	Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.
• **HS-PS3-1**	Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.

Computer Science & Design Thinking

8.1 Computer Science

- 8.1.5.DA.1: Collect, organize, and display data in order to highlight relationships or support a claim.

8.2 Design Thinking

- 8.2.5.ED.2: Collaborate with peers to collect information, brainstorm to solve a problem, and evaluate all possible solutions to provide the best results with supporting sketches or models.
- 8.2.5.ED.3: Follow step by step directions to assemble a product or solve a problem, using appropriate tools to accomplish the task.
- 8.2.8.ED.3: Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch).

Career Readiness, Life Literacies & Key Skills

9.1 Personal Financial Literacy

- 9.1.5.EG.1: Explain and give examples of what is meant by the term “tax.”
- 9.1.8.FI.4: Analyze the interest rates and fees associated with financial products.
- 9.1.8.FP.7: Identify the techniques and effects of deceptive advertising.

9.4 Life Literacies & Key Skills

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

Lakewood School DIstrict Curriculum Guide

Grade: High School	Content Area: Mathematics - Precalculus

Evidence of Student Learning	
Formative Tasks: ● Oral Questioning ● Student Conference ● Self-Assessment ● Hand Signals ● Communicators ● Graphic Organizers ● Teacher Observation ● DOL ● Quiz Classwork ● NJSLA Released questions ● Problem of the Day	**Alternative Assessments:** ● Teacher-Created Projects ● https://www.illustrativemathematics.org/ ● https://www.khanacademy.org/ ● https://www.engageny.org
Summative Assessments: ● Unit Tests ● Midterm Exam ● Final Exam	**Benchmark Assessments:** ● Quarterly Benchmarks ● Beginning/End of Year Assessment ● Unit Common Assessment

Knowledge & Skills	
Enduring Understandings: ● A function represents a consistent relationship between quantities, and understanding this structure allows students to interpret and model patterns in the world. ● Function notation provides a precise way to communicate how one variable depends on another, and evaluating f(x) connects symbolic expressions to meaningful contexts. ● Graphs embody the behavior of functions, and features such as intercepts, maxima, minima, and intervals describe how quantities change over time or under specific conditions. ● The domain and range of a function are shaped by contextual constraints, showing that mathematical models must be adapted to fit real-world situations. ● Linear and quadratic functions reveal different types of change, and analyzing their graphs helps students interpret trends, thresholds, and turning points.	**Essential Questions:** ● What makes a relationship a function, and why is this structure useful for modeling real-world situations? ● How does function notation help us communicate ideas about changing quantities more effectively than simple equations? ● What can the key features of a graph or table tell us about how two quantities interact? ● How do real-world constraints influence the domain and range of a function? ● How do different types of functions, such as linear or quadratic, represent different patterns of change? ● When is it necessary to use functions like absolute value, radicals, or piecewise definitions to represent a real phenomenon accurately? ● How do changes in parameters transform the graph of a function, and how can these transformations help us interpret or refine a model?

Grade: High School	Content Area: Mathematics - Precalculus

• Square root, cube root, absolute value, and piecewise functions expand the modeling toolkit by capturing non-linear, discontinuous, or restricted behaviors. • Transformations of functions illustrate how modifying parameters shifts, stretches, or reflects graphs, revealing deeper structural connections among families of functions. • Technology strengthens students' ability to visualize patterns, test assumptions, and refine mathematical models based on changing conditions or new information.	• How can technology deepen our understanding of functional behavior and improve the accuracy of our models?
Content *Students will know…* • That function describes relationships where each input corresponds to exactly one output, and this definition applies across diagrams, graphs, tables, and equations. • How function notation represents inputs and outputs and provides a concise way to describe functional relationships. • The characteristics of quadratic, piecewise, and absolute value functions, including continuity, rate of change, and general shape. • How domain and range reflect the set of allowable inputs and resulting outputs for a function. • How equations, graphs, and mapping diagrams represent the same underlying function in different forms. • That piecewise functions require evaluating separate rules over different interval restrictions. • How absolute value equations can be rewritten and interpreted as piecewise-defined expressions. • How various algebraic restrictions (division by zero, even roots of negatives) determine domain constraints.	**Skills** *Students will be able to …* • Including tables, intercepts, vertex form, and transformations. • Determine whether a relation is a function from ordered pairs, graphs, tables, and mapping diagrams. • Analyze equations to decide whether they represent a function based on the definition of uniqueness of outputs. • Use function notation to represent functions and evaluate expressions for specific input values. • Graph piecewise functions and analyze key features, including continuity, domain, range, and interval-based behavior. • Convert absolute value equations into equivalent piecewise functions and analyze their graphs. • Determine the domain and range of functions both graphically and algebraically. • Interpret how restrictions in a function's equation affect valid inputs and corresponding outputs.

Core Instructional & Supplemental Materials	
Suggested Activities/Resources: • HS-F.IF Activities • HS-F.BF Activities	**Supplemental resources:** • https://www.illustrativemathematics.org/ • https://www.khanacademy.org/ • http://www.coolmath.com/ • http://www.mobymax.com/ • https://www.tenmarks.com/ • https://www.ixl.com/math

Grade: High School	Content Area: Mathematics - Precalculus

	• https://nj.digitalitemlibrary.com/home • https://www.radicalmath.org/math-social-justice • African Americans in Math

Suggested Accommodations

English Language Learners:

- Multi-Sensory Instruction
- Flexible Grouping
- Small Group Instruction
- Peer Buddies
- Graphic Organizers
- Chunking Information
- Scaffolded Questioning
- Manipulatives/Concrete Models
- Build Background/Vocabulary
- Math Word Wall/Word Bank
- Gradual Release Model
- Visual Cues
- Visual Models
- Technology Integration
- Hands-On/Experiential Activities
- Native language support when possible
- Sheltered English Instructional Strategies
- Provide additional time

Special Education/Students with Disabilities:

- Extra help opportunities provided
- Credit Recovery
- Allow use of a calculator, when appropriate
- Modified length and time frame of assignments
- Alternate assessments with extended time
- Provide guided notes and study guides as needed
- Preferential Seating
- Extra Practice
- Directions repeated, clarified, and reworded
- Breakdown task into manageable units
- Differentiated instruction
- Use of manipulatives
- Math tool paper available
- Cooperative learning groups
- Supplemental books
- Repeat, reword or clarify directions
- Small group instruction as needed
- Instructional technology as needed/required
- Effective teacher questioning; ranging from fact recall to higher order critical thinking questions

504 Plans:

- Extra help opportunities provided
- Credit Recovery
- Allow use of a calculator, when appropriate
- Modified length and time frame of assignments
- Alternate assessments with extended time
- Provide guided notes and study guides as needed
- Preferential Seating
- Extra Practice
- Directions repeated, clarified, and reworded
- Breakdown task into manageable units
- Differentiated instruction
- Use of manipulatives
- Math tool paper available
- Cooperative learning groups
- Supplemental books
- Repeat, reword or clarify directions
- Small group instruction as needed
- Instructional technology as needed/required
- Effective teacher questioning; ranging from fact recall to higher order critical thinking questions

Gifted and Talented:

- Cooperative Learning Groups
- Enriched Assignments
- Tiered Assignments
- Word Problems
- NJSLA questions
- Model Curriculum Questions
- Inquiry Based Project
- Interest Based/Choice Activities

Students at Risk of Failure:

- Extended Time
- Multi-Sensory Instruction
- Flexible Grouping
- Small Group Instruction
- Peer Buddies
- Graphic Organizers
- Chunking Information
- Scaffolded Questioning
- Tiered Activities
- Manipulatives/Concrete Models
- Build Background/Vocabulary
- Math Word Wall/Word Bank
- Modified Assignments
- Gradual Release Model
- Preferential Seating
- Brain Breaks
- Visual Cues
- Visual Models

Grade: High School	Content Area: Mathematics - Precalculus

- Technology Integration
- Assistive Technology
- Credit Recovery

Economically Disadvantaged:

- Pre-teach vocabulary using visuals and gestures
- Chunk texts
- Summarize as you go
- Preview lessons
- Graphic organizers
- Highlight key words
- Sentence starters
- Prompting and cueing
- Activate schema
- Build background knowledge

Culturally Diverse:

- Create pictures, posters, art, books, maps, flags, etc to hang in the classroom.
- Create an emotionally positive classroom climate.
- Bring in guest speakers
- Create effective communication
- Model and teach cultural respect
- Build relationships with students by interviewing students to understand their background

Unit 2: Function operations, compositions and transformations	25 days
New Jersey Learning Standards-Mathematics	
F.BF.A.1	Write a function that describes a relationship between two quantities.
F.BF.A.1c	Compose functions.
F.BF.B.3	Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology.
F.IF.A.2	Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

Grade: High School	Content Area: Mathematics - Precalculus

F.IF.B.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.C.7	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

Standards of Mathematical Practices	
MP1. Make sense of problems and persevere in solving them	• Find meaning in problems • Look for entry points • Analyze, conjecture and plan solution pathways • Monitor and adjust • Verify answers • Ask themselves the question: "Does this make sense?"
MP2. Reason abstractly and quantitatively.	• Make sense of quantities and their relationships in problems • Learn to contextualized and decontextualized • Create coherent representations of problems
MP3. Construct viable arguments and critique the reasoning of others.	• Understand and use information to construct arguments • Make and explore the truth of conjectures • Recognize and use counterexamples • Justify conclusions and respond to arguments of others
MP4. Model with Mathematics.	• Apply mathematics to problems in everyday life • Make assumptions and approximations • Identify quantities in a practical situation • Interpret results in the context of the situation and reflect on whether the results make sense
MP5. Use appropriate tools strategically	• Consider the available tools when solving problems • Are familiar with tools appropriate for their grade or course (pencil and paper, concrete models, ruler, protractor, calculator, spreadsheet, computer programs, digital content located on a website, and other technological tools) • Make sound decisions of which of these tools might be helpful
MP6. Attend to precision.	• Communicate precisely to others • Use clear definitions, state the meaning of symbols and are careful about specifying units of measure and labeling axes • Calculate accurately and efficiently

Grade: High School	Content Area: Mathematics - Precalculus

MP7. Look for and make use of structure.	• Discern patterns and structures • Can step back for an overview and shift perspective • See complicated things as single objects or as being composed of several objects

Social and Emotional Learning Standards	
Self-Awareness	• Recognize one's personal traits, strengths, and limitations • Recognize the importance of self-confidence in handling daily tasks and challenges
Self-Management	• Recognize the skills needed to establish and achieve personal and educational goals • Identify and apply ways to persevere or overcome barriers through alternative methods to achieve one's goals
Social Awareness	• Demonstrate an understanding of the need for mutual respect when viewpoints differ
Responsible Decision-Making	• Develop, implement and model effective problem solving and critical thinking skills

Interdisciplinary Connections	
	ELA Standards
• **L.SS.11–12.1**	Demonstrate command of the system and structure of the English language when writing or speaking.
• **W.RW.11–12.7**	Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes.
	Science Standards
• **HS-ESS2-1**	Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features.
• **HS-LS2-2**	Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.

Computer Science & Design Thinking

8.1 Computer Science

- 8.1.5.DA.1: Collect, organize, and display data in order to highlight relationships or support a claim.

8.2 Design Thinking

- 8.2.5.ED.2: Collaborate with peers to collect information, brainstorm to solve a problem, and evaluate all possible solutions to provide the best results with supporting sketches or models.
- 8.2.5.ED.3: Follow step by step directions to assemble a product or solve a problem, using appropriate tools to accomplish the task.
- 8.2.8.ED.3: Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch).

Lakewood School DIstrict Curriculum Guide

Grade: High School	Content Area: Mathematics - Precalculus

Career Readiness, Life Literacies & Key Skills

9.1 Personal Financial Literacy

- 9.1.5.EG.1: Explain and give examples of what is meant by the term "tax."
- 9.1.8.FI.4: Analyze the interest rates and fees associated with financial products.
- 9.1.8.FP.7: Identify the techniques and effects of deceptive advertising.

9.4 Life Literacies & Key Skills

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

Evidence of Student Learning

Formative Tasks:

- Oral Questioning
- Student Conference
- Self-Assessment
- Hand Signals
- Communicators
- Graphic Organizers
- Teacher Observation
- DOL
- Quiz Classwork
- NJSLA Released questions
- Problem of the Day

Alternative Assessments:

- Teacher-Created Projects
- https://www.illustrativemathematics.org/
- https://www.khanacademy.org/
- https://www.engageny.org

Summative Assessments:

- Unit Tests
- Midterm Exam
- Final Exam

Benchmark Assessments:

- Quarterly Benchmarks
- Beginning/End of Year Assessment
- Unit Common Assessment

Knowledge & Skills

Enduring Understandings:

- Writing a function to describe a relationship allows students to translate real-world patterns into mathematical rules that can be analyzed, tested, and refined.
- Composing functions models situations where one output becomes another input, helping students understand multi-step processes and cumulative effects.
- Transformations such as shifts, reflections, and dilations reveal how parameter changes alter the

Essential Questions:

- How can we represent real-world relationships with functions, and what makes one type of function more suitable than another?
- In what situations is composing functions necessary to capture a multi-step or layered process?
- How do shifts, reflections, and stretches transform a function's graph, and what do these changes mean in context?

Grade: High School	**Content Area: Mathematics - Precalculus**

behavior of a model while preserving its structural identity. ● Function notation provides a precise language for expressing how quantities depend on each other and for evaluating relationships within a defined domain. ● Key features of graphs, including intercepts, extrema, intervals of change, and asymptotic behavior, give insight into the nature of the relationship being modeled. ● Sketching graphs from symbolic expressions or verbal descriptions strengthens students' ability to interpret patterns and predict system behavior. ● Technology supports exploration of complex models, allowing students to investigate functional changes dynamically and confirm analytical reasoning. ● Mathematical modeling requires selecting appropriate function types and understanding how changes in parameters reflect real-world constraints or shifts in conditions.	● How does function notation help us understand and communicate dependencies between variables? ● What can key features of a graph tell us about a relationship, and how do these features connect to real-world interpretations? ● How can we move between a verbal description, symbolic rule, and graphical representation of the same relationship? When does technology enhance our understanding of functions, models, and transformations? ● How can analyzing parameter changes help us refine a mathematical model to better reflect real phenomena?
Content *Students will know…* ● How algebraic structure determines the behavior of functions and how operations such as addition, subtraction, multiplication, division, and composition produce new functions. ● How to evaluate, interpret, and simplify expressions involving function operations. ● The meaning of even and odd functions and how symmetry relates to algebraic identities. ● How transformations affect the graph of a function, including vertical and horizontal shifts, reflections, and dilations. ● How the parameters in cf(x) and f(cx) impact amplitude, steepness, and horizontal shrink/stretch. ● That creating tables and plotting points provides a reliable procedural pathway for graphing unfamiliar functions. ● How to verify symmetry, periodicity, or transformation effects graphically and algebraically. ● How combinations and compositions of functions underlie more advanced modeling used later in Pre-Calculus.	**Skills** *Students will be able to …* ● Perform function operations (addition, subtraction, multiplication, division) and evaluate resulting expressions for specific inputs. ● Compose two functions, interpret the meaning of f(g(x)), and evaluate compositions numerically, algebraically, and graphically. ● Graph common parent functions by plotting points or creating tables, and use these graphs to analyze behavior. ● Apply vertical and horizontal shifts, reflections, and dilations to basic functions and describe the resulting transformations. ● Determine whether a function is even, odd, or neither using both graphical symmetry and algebraic evaluation (f(–x) tests). ● Explain the effect of cf(x) as a vertical stretch/compression and f(cx) as a horizontal stretch/compression, depending on the value of c. ● Interpret the relationship between a parent function and its transformed version using correct function notation. ● Construct transformed functions from descriptions

Grade: High School	Content Area: Mathematics - Precalculus

	and match equations to corresponding graphs.

Core Instructional & Supplemental Materials	
Suggested Activities/Resources: • HS-F.IF Activities • HS-F.BF Activities	**Supplemental resources:** • https://www.illustrativemathematics.org/ • https://www.khanacademy.org/ • http://www.coolmath.com/ • http://www.mobymax.com/ • https://www.tenmarks.com/ • https://www.ixl.com/math • https://nj.digitalitemlibrary.com/home • https://www.radicalmath.org/math-social-justice • African Americans in Math

Suggested Accommodations

English Language Learners:

- Multi-Sensory Instruction
- Flexible Grouping
- Small Group Instruction
- Peer Buddies
- Graphic Organizers
- Chunking Information
- Scaffolded Questioning
- Manipulatives/Concrete Models
- Build Background/Vocabulary
- Math Word Wall/Word Bank
- Gradual Release Model
- Visual Cues
- Visual Models
- Technology Integration
- Hands-On/Experiential Activities
- Native language support when possible
- Sheltered English Instructional Strategies
- Provide additional time

Special Education/Students with Disabilities:

- Extra help opportunities provided
- Credit Recovery
- Allow use of a calculator, when appropriate
- Modified length and time frame of assignments
- Alternate assessments with extended time
- Provide guided notes and study guides as needed
- Preferential Seating

- Extra Practice
- Directions repeated, clarified, and reworded
- Breakdown task into manageable units
- Differentiated instruction
- Use of manipulatives
- Math tool paper available
- Cooperative learning groups
- Supplemental books
- Repeat, reword or clarify directions
- Small group instruction as needed
- Instructional technology as needed/required
- Effective teacher questioning; ranging from fact recall to higher order critical thinking questions

504 Plans:

- Extra help opportunities provided
- Credit Recovery
- Allow use of a calculator, when appropriate
- Modified length and time frame of assignments
- Alternate assessments with extended time
- Provide guided notes and study guides as needed
- Preferential Seating
- Extra Practice
- Directions repeated, clarified, and reworded
- Breakdown task into manageable units
- Differentiated instruction
- Use of manipulatives
- Math tool paper available
- Cooperative learning groups
- Supplemental books
- Repeat, reword or clarify directions
- Small group instruction as needed
- Instructional technology as needed/required
- Effective teacher questioning; ranging from fact recall to higher order critical thinking questions

Gifted and Talented:

- Cooperative Learning Groups
- Enriched Assignments
- Tiered Assignments
- Word Problems
- NJSLA questions
- Model Curriculum Questions
- Inquiry Based Project
- Interest Based/Choice Activities

Students at Risk of Failure:

- Extended Time
- Multi-Sensory Instruction
- Flexible Grouping

Grade: High School	Content Area: Mathematics - Precalculus

- Small Group Instruction
- Peer Buddies
- Graphic Organizers
- Chunking Information
- Scaffolded Questioning
- Tiered Activities
- Manipulatives/Concrete Models
- Build Background/Vocabulary
- Math Word Wall/Word Bank
- Modified Assignments
- Gradual Release Model
- Preferential Seating
- Brain Breaks
- Visual Cues
- Visual Models
- Technology Integration
- Assistive Technology
- Credit Recovery

Economically Disadvantaged:

- Pre-teach vocabulary using visuals and gestures
- Chunk texts
- Summarize as you go
- Preview lessons
- Graphic organizers
- Highlight key words
- Sentence starters
- Prompting and cueing
- Activate schema
- Build background knowledge

Culturally Diverse:

- Create pictures, posters, art, books, maps, flags, etc to hang in the classroom.
- Create an emotionally positive classroom climate.
- Bring in guest speakers
- Create effective communication
- Model and teach cultural respect
- Build relationships with students by interviewing students to understand their background

Grade: High School	Content Area: Mathematics - Precalculus

Unit 3: Graphing Polynomials by analyzing Roots, end behavior and turning points.	18 days
New Jersey Learning Standards-Mathematics	
F.IF.B.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.C.7	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
A.APR.A.1	Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.
A.APR.B.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.B.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.REI.A.1	Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
N.CN.A.1	Know there is a complex number i such that $i^2 = -1$, and every complex number has the form a + bi with a and b real.
N.CN.A.2	Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.
N.CN.C.7	Solve quadratic equations with real coefficients that have complex solutions.

Standards of Mathematical Practices

Grade: High School	Content Area: Mathematics - Precalculus

MP1. Make sense of problems and persevere in solving them	• Find meaning in problems • Look for entry points • Analyze, conjecture and plan solution pathways • Monitor and adjust • Verify answers • Ask themselves the question: "Does this make sense?"
MP2. Reason abstractly and quantitatively.	• Make sense of quantities and their relationships in problems • Learn to contextualized and decontextualized • Create coherent representations of problems
MP3. Construct viable arguments and critique the reasoning of others.	• Understand and use information to construct arguments • Make and explore the truth of conjectures • Recognize and use counterexamples • Justify conclusions and respond to arguments of others
MP4. Model with Mathematics.	• Apply mathematics to problems in everyday life • Make assumptions and approximations • Identify quantities in a practical situation • Interpret results in the context of the situation and reflect on whether the results make sense
MP5. Use appropriate tools strategically	• Consider the available tools when solving problems • Are familiar with tools appropriate for their grade or course (pencil and paper, concrete models, ruler, protractor, calculator, spreadsheet, computer programs, digital content located on a website, and other technological tools) • Make sound decisions of which of these tools might be helpful
MP6. Attend to precision.	• Communicate precisely to others • Use clear definitions, state the meaning of symbols and are careful about specifying units of measure and labeling axes • Calculate accurately and efficiently
MP7. Look for and make use of structure.	• Discern patterns and structures • Can step back for an overview and shift perspective • See complicated things as single objects or as being composed of several objects

Social and Emotional Learning Standards	
Self-Awareness	• Recognize one's personal traits, strengths, and limitations • Recognize the importance of self-confidence in handling daily tasks and challenges

Grade: High School	Content Area: Mathematics - Precalculus

Self-Management	• Recognize the skills needed to establish and achieve personal and educational goals • Identify and apply ways to persevere or overcome barriers through alternative methods to achieve one's goals
Social Awareness	• Demonstrate an understanding of the need for mutual respect when viewpoints differ
Responsible Decision-Making	• Develop, implement and model effective problem solving and critical thinking skills

Interdisciplinary Connections	
	ELA Standards
• **L.SS.11–12.1**	Demonstrate command of the system and structure of the English language when writing or speaking.
• **W.RW.11–12.7**	Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes.
	Science Standards
• **HS-ESS1-4**	Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.
• **HS-PS4-1**	Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.

Computer Science & Design Thinking

8.1 Computer Science

- 8.1.5.DA.1: Collect, organize, and display data in order to highlight relationships or support a claim.

8.2 Design Thinking

- 8.2.5.ED.2: Collaborate with peers to collect information, brainstorm to solve a problem, and evaluate all possible solutions to provide the best results with supporting sketches or models.
- 8.2.5.ED.3: Follow step by step directions to assemble a product or solve a problem, using appropriate tools to accomplish the task.
- 8.2.8.ED.3: Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch).

Career Readiness, Life Literacies & Key Skills

9.1 Personal Financial Literacy

- 9.1.5.EG.1: Explain and give examples of what is meant by the term "tax."
- 9.1.8.FI.4: Analyze the interest rates and fees associated with financial products.
- 9.1.8.FP.7: Identify the techniques and effects of deceptive advertising.

9.4 Life Literacies & Key Skills

- 9.4.5.CT.3: Describe how digital tools and technology may be used to solve problems.

Grade: High School	**Content Area: Mathematics - Precalculus**

- 9.4.8.TL.3: Select appropriate tools to organize and present information digitally.

Evidence of Student Learning	
Formative Tasks: ● Oral Questioning ● Student Conference ● Self-Assessment ● Hand Signals ● Communicators ● Graphic Organizers ● Teacher Observation ● DOL ● Quiz Classwork ● NJSLA Released questions ● Problem of the Day	**Alternative Assessments:** ● Teacher-Created Projects ● https://www.illustrativemathematics.org/ ● https://www.khanacademy.org/ ● https://www.engageny.org
Summative Assessments: ● Unit Tests ● Midterm Exam ● Final Exam	**Benchmark Assessments:** ● Quarterly Benchmarks ● Beginning/End of Year Assessment ● Unit Common Assessment

Knowledge & Skills	
Enduring Understandings: ● Graphs and tables reveal essential features of relationships, and understanding these features allows students to interpret how quantities behave across different conditions. ● Symbolic expressions and their corresponding graphs provide complementary insights into the structure and behavior of functions. ● Polynomials form an algebraic system that behaves predictably under the operations of addition, subtraction, and multiplication, allowing students to build and manipulate complex expressions. ● The Remainder Theorem connects algebraic evaluation and polynomial division, offering a	**Essential Questions:** ● How do key features of graphs help us understand the relationships between two changing quantities? ● Why is it useful to represent functions both symbolically and graphically when analyzing real-world patterns? How do polynomial operations mirror the way integers behave, and why is closure important for building mathematical models? ● What does the Remainder Theorem reveal about the structure of a polynomial, and how can it be used to test factors efficiently? ● How do the zeros of a polynomial shape its graph, and how can we use this information to sketch a reasonable model?

Grade: High School	Content Area: Mathematics - Precalculus

powerful method for identifying factors and analyzing polynomial structure. ● The zeros of a polynomial determine important characteristics of its graph, including intercepts and overall shape, and support qualitative sketching. ● Solving equations requires a logical sequence of steps justified by mathematical properties, and students deepen their reasoning by explaining and defending solution paths. ● Complex numbers extend the real number system to allow solutions to equations that otherwise would have no real solution, expanding the scope of mathematical modeling. ● Operations with complex numbers rely on established algebraic properties, reinforcing students' understanding of structure, equivalence, and symbolic manipulation.	● What makes a solution method valid, and how can explaining each step strengthen mathematical reasoning? ● Why do we need complex numbers, and what problems become solvable only when we extend the number system? ● How do the algebraic properties of addition and multiplication ensure consistent operations with complex numbers?
Content *Students will know…* ● That polynomial functions exhibit predictable end behavior based on the degree and leading coefficient. ● How multiplicity affects the shape of the graph at each zero (crossing vs. touching the x-axis). ● That the Factor Theorem and Remainder Theorem connect polynomial division, factors, and roots. ● The structure of the complex number system, including the definition of i and powers of i. ● That polynomials with real coefficients have non-real roots in conjugate pairs. ● How to express complex numbers in standard form and interpret them as solutions to polynomial equations. ● How dividing a polynomial by $(x - k)$ reveals whether k is a zero, factor, or neither. ● How graphical features (intercepts, turning points, end behavior) connect to the algebraic form of the polynomial.	**Skills** *Students will be able to …* ● Predict the end behavior of a polynomial function using its degree and leading coefficient. ● Factor higher-degree polynomials to identify real and complex zeros. ● Use zeros, multiplicities, and end behavior to sketch accurate polynomial graphs. ● Perform long division and synthetic division to divide polynomials and evaluate remainders. Apply the Factor Theorem and Remainder Theorem to determine whether a value is a root or factor. ● Rewrite radicals with negative radicands in terms of i and simplify powers of i. ● Represent complex roots of polynomial equations and express them in a + bi form. ● Connect algebraic solutions to graphical representations by verifying roots and behavior on the graph

Core Instructional & Supplemental Materials	
Suggested Activities/Resources: ● HS-F.IF Activities ● HS-A.APR Activities	**Supplemental resources:** ● https://www.illustrativemathematics.org/ ● https://www.khanacademy.org/

Grade: High School	Content Area: Mathematics - Precalculus

• HS-A.REI Activities • HS-N.CN Activities	• http://www.coolmath.com/ • http://www.mobymax.com/ • https://www.tenmarks.com/ • https://www.ixl.com/math • https://nj.digitalitemlibrary.com/home • https://www.radicalmath.org/math-social-justice • African Americans in Math

Suggested Accommodations

English Language Learners:

- Multi-Sensory Instruction
- Flexible Grouping
- Small Group Instruction
- Peer Buddies
- Graphic Organizers
- Chunking Information
- Scaffolded Questioning
- Manipulatives/Concrete Models
- Build Background/Vocabulary
- Math Word Wall/Word Bank
- Gradual Release Model
- Visual Cues
- Visual Models
- Technology Integration
- Hands-On/Experiential Activities
- Native language support when possible
- Sheltered English Instructional Strategies
- Provide additional time

Special Education/Students with Disabilities:

- Extra help opportunities provided
- Credit Recovery
- Allow use of a calculator, when appropriate
- Modified length and time frame of assignments
- Alternate assessments with extended time
- Provide guided notes and study guides as needed
- Preferential Seating
- Extra Practice
- Directions repeated, clarified, and reworded
- Breakdown task into manageable units
- Differentiated instruction
- Use of manipulatives
- Math tool paper available
- Cooperative learning groups
- Supplemental books
- Repeat, reword or clarify directions

- Small group instruction as needed
- Instructional technology as needed/required
- Effective teacher questioning; ranging from fact recall to higher order critical thinking questions

504 Plans:

- Extra help opportunities provided
- Credit Recovery
- Allow use of a calculator, when appropriate
- Modified length and time frame of assignments
- Alternate assessments with extended time
- Provide guided notes and study guides as needed
- Preferential Seating
- Extra Practice
- Directions repeated, clarified, and reworded
- Breakdown task into manageable units
- Differentiated instruction
- Use of manipulatives
- Math tool paper available
- Cooperative learning groups
- Supplemental books
- Repeat, reword or clarify directions
- Small group instruction as needed
- Instructional technology as needed/required
- Effective teacher questioning; ranging from fact recall to higher order critical thinking questions

Gifted and Talented:

- Cooperative Learning Groups
- Enriched Assignments
- Tiered Assignments
- Word Problems
- NJSLA questions
- Model Curriculum Questions
- Inquiry Based Project
- Interest Based/Choice Activities

Students at Risk of Failure:

- Extended Time
- Multi-Sensory Instruction
- Flexible Grouping
- Small Group Instruction
- Peer Buddies
- Graphic Organizers
- Chunking Information
- Scaffolded Questioning
- Tiered Activities
- Manipulatives/Concrete Models
- Build Background/Vocabulary
- Math Word Wall/Word Bank

Grade: High School	Content Area: Mathematics - Precalculus

- Modified Assignments
- Gradual Release Model
- Preferential Seating
- Brain Breaks
- Visual Cues
- Visual Models
- Technology Integration
- Assistive Technology
- Credit Recovery

Economically Disadvantaged:

- Pre-teach vocabulary using visuals and gestures
- Chunk texts
- Summarize as you go
- Preview lessons
- Graphic organizers
- Highlight key words
- Sentence starters
- Prompting and cueing
- Activate schema
- Build background knowledge

Culturally Diverse:

- Create pictures, posters, art, books, maps, flags, etc to hang in the classroom.
- Create an emotionally positive classroom climate.
- Bring in guest speakers
- Create effective communication
- Model and teach cultural respect
- Build relationships with students by interviewing students to understand their background

Unit 4: Rational Function	22 days
New Jersey Learning Standards-Mathematics	
F.IF.B.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.C.7	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

Grade: High School	Content Area: Mathematics - Precalculus

F.IF.C.7d	Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.
F.BF.B.3	Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology.
A.APR.D.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.

Standards of Mathematical Practices	
MP1. Make sense of problems and persevere in solving them	• Find meaning in problems • Look for entry points • Analyze, conjecture and plan solution pathways • Monitor and adjust • Verify answers • Ask themselves the question: "Does this make sense?"
MP2. Reason abstractly and quantitatively.	• Make sense of quantities and their relationships in problems • Learn to contextualized and decontextualized • Create coherent representations of problems
MP3. Construct viable arguments and critique the reasoning of others.	• Understand and use information to construct arguments • Make and explore the truth of conjectures • Recognize and use counterexamples • Justify conclusions and respond to arguments of others
MP4. Model with Mathematics.	• Apply mathematics to problems in everyday life • Make assumptions and approximations • Identify quantities in a practical situation • Interpret results in the context of the situation and reflect on whether the results make sense
MP5. Use appropriate tools strategically	• Consider the available tools when solving problems • Are familiar with tools appropriate for their grade or course (pencil and paper, concrete models, ruler, protractor, calculator, spreadsheet, computer programs, digital content located on a website, and other technological tools)

Grade: High School	Content Area: Mathematics - Precalculus

	• Make sound decisions of which of these tools might be helpful
MP6. Attend to precision.	• Communicate precisely to others • Use clear definitions, state the meaning of symbols and are careful about specifying units of measure and labeling axes • Calculate accurately and efficiently
MP7. Look for and make use of structure.	• Discern patterns and structures • Can step back for an overview and shift perspective • See complicated things as single objects or as being composed of several objects

Social and Emotional Learning Standards	
Self-Awareness	• Recognize one's personal traits, strengths, and limitations • Recognize the importance of self-confidence in handling daily tasks and challenges
Self-Management	• Recognize the skills needed to establish and achieve personal and educational goals • Identify and apply ways to persevere or overcome barriers through alternative methods to achieve one's goals
Social Awareness	• Demonstrate an understanding of the need for mutual respect when viewpoints differ
Responsible Decision-Making	• Develop, implement and model effective problem solving and critical thinking skills

Interdisciplinary Connections	
	ELA Standards
• **L.SS.11–12.1**	Demonstrate command of the system and structure of the English language when writing or speaking.
• **W.RW.11–12.7**	Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes.
	Science Standards
• **HS-PS2-2**	Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.
• **HS-ESS2-4**	Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.

Computer Science & Design Thinking
8.1 Computer Science • 8.1.5.DA.1: Collect, organize, and display data in order to highlight relationships or support a claim. **8.2 Design Thinking**

Grade: High School	Content Area: Mathematics - Precalculus

- 8.2.5.ED.2: Collaborate with peers to collect information, brainstorm to solve a problem, and evaluate all possible solutions to provide the best results with supporting sketches or models.
- 8.2.5.ED.3: Follow step by step directions to assemble a product or solve a problem, using appropriate tools to accomplish the task.
- 8.2.8.ED.3: Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch).

Career Readiness, Life Literacies & Key Skills

9.1 Personal Financial Literacy

- 9.1.5.EG.1: Explain and give examples of what is meant by the term "tax."
- 9.1.8.FI.4: Analyze the interest rates and fees associated with financial products.
- 9.1.8.FP.7: Identify the techniques and effects of deceptive advertising.

9.4 Life Literacies & Key Skills

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

Evidence of Student Learning

Formative Tasks:	Alternative Assessments:
• Oral Questioning • Student Conference • Self-Assessment • Hand Signals • Communicators • Graphic Organizers • Teacher Observation • DOL • Quiz Classwork • NJSLA Released questions • Problem of the Day	• Teacher-Created Projects • https://www.illustrativemathematics.org/ • https://www.khanacademy.org/ • https://www.engageny.org
Summative Assessments:	**Benchmark Assessments:**
• Unit Tests • Midterm Exam • Final Exam	• Quarterly Benchmarks • Beginning/End of Year Assessment • Unit Common Assessment

Knowledge & Skills

Enduring Understandings:	Essential Questions:
• Key features of graphs and tables reveal how quantities interact, and interpreting these features	

Grade: High School	**Content Area: Mathematics - Precalculus**

helps students make sense of real-world patterns and constraints. ● Graphing functions symbolically supports a deeper understanding of how structure shapes behavior, especially when comparing different function types. ● Rational functions model relationships where quantities interact through ratios, and identifying zeros, asymptotes, and end behavior helps explain long-term or limiting behavior. ● Transformations of functions illustrate how parameter changes shift, stretch, or reflect graphs, allowing students to refine and analyze models more accurately. ● Function transformations support meaningful interpretation of contextual models by showing how changes in conditions affect system outputs. ● Rational expressions can be rewritten in various equivalent forms, each revealing different structural insights that support problem solving and interpretation. ● Dividing polynomials to rewrite rational expressions allows students to separate long-term trends from local behavior in complex models.	● How do the key features of graphs help us understand the underlying relationship between two changing quantities? ● Why is it valuable to represent functions symbolically and graphically when analyzing real-world behavior? ● What can rational functions tell us about long-term or limiting behavior in a system, and how do asymptotes support this interpretation? ● How do parameter changes transform a function's graph, and what can these transformations reveal about the context being modeled? ● When is it necessary to explore transformations such as shifts, reflections, or scalings to understand or refine a mathematical model? ● Why might we want to rewrite a rational expression in a different form, and how does this support deeper algebraic understanding? ● How does dividing polynomials help us analyze rational expressions and interpret their components? When and how does technology enhance our ability to analyze complex functions, including rational functions and their key features?
Content *Students will know…* ● That rational functions are defined as the quotient of two polynomials and may have vertical, horizontal, or slant asymptotes depending on the degrees of the numerator and denominator. ● How transformations such as vertical/horizontal shifts, reflections, and dilations modify the graph of the parent function f(x) = 1/x. ● That vertical asymptotes occur at values of x where the denominator is zero unless the zero produces a removable discontinuity (hole). ● How horizontal asymptotes reflect the long-term behavior of a rational function as x approaches positive or negative infinity. ● That slant (oblique) asymptotes occur when the degree of the numerator exceeds the degree of the denominator by one and can be identified using polynomial long division. ● How to distinguish holes from vertical asymptotes by determining whether a common factor cancels.	**Skills** *Students will be able to …* ● Graph the parent rational function f(x) = 1/x and explain its key features, including asymptotes and symmetry. Apply single or multiple transformations to graph rational functions of the form a/(x–h) + k and more complex rational expressions. Identify vertical and horizontal asymptotes algebraically based on denominator zeros and degree comparisons. ● Determine slant asymptotes by performing polynomial long division and analyzing end behavior as x approaches infinity. ● Decide whether a zero of the denominator creates a hole or a vertical asymptote by examining common factors. ● Graph rational functions with multiple asymptotes and rational functions containing holes using a structured approach: locate asymptotes, identify intercepts, note holes, and plot additional points. Explain how vertical, horizontal, and slant asymptotes

Grade: High School	Content Area: Mathematics - Precalculus

• How the graph of a rational function is shaped by asymptotes, intercepts, holes, and additional plotted points. • That limits provide a formal way to reason about rational function behavior near discontinuities and end behavior.	relate to limits and the long-run behavior of the function. • Analyze and compare rational function graphs using asymptotes, intercepts, end behavior, and discontinuities.

Core Instructional & Supplemental Materials

Suggested Activities/Resources:

- HS-F.IF Activities
- HS-F.BF Activities
- HS-A.APR Activities

Supplemental resources:

- https://www.illustrativemathematics.org/
- https://www.khanacademy.org/
- http://www.coolmath.com/
- http://www.mobymax.com/
- https://www.tenmarks.com/
- https://www.ixl.com/math
- https://nj.digitalitemlibrary.com/home
- https://www.radicalmath.org/math-social-justice
- African Americans in Math

Suggested Accommodations

English Language Learners:

- Multi-Sensory Instruction
- Flexible Grouping
- Small Group Instruction
- Peer Buddies
- Graphic Organizers
- Chunking Information
- Scaffolded Questioning
- Manipulatives/Concrete Models
- Build Background/Vocabulary
- Math Word Wall/Word Bank
- Gradual Release Model
- Visual Cues
- Visual Models
- Technology Integration
- Hands-On/Experiential Activities
- Native language support when possible
- Sheltered English Instructional Strategies
- Provide additional time

Special Education/Students with Disabilities:

- Extra help opportunities provided
- Credit Recovery
- Allow use of a calculator, when appropriate

- Modified length and time frame of assignments
- Alternate assessments with extended time
- Provide guided notes and study guides as needed
- Preferential Seating
- Extra Practice
- Directions repeated, clarified, and reworded
- Breakdown task into manageable units
- Differentiated instruction
- Use of manipulatives
- Math tool paper available
- Cooperative learning groups
- Supplemental books
- Repeat, reword or clarify directions
- Small group instruction as needed
- Instructional technology as needed/required
- Effective teacher questioning; ranging from fact recall to higher order critical thinking questions

504 Plans:

- Extra help opportunities provided
- Credit Recovery
- Allow use of a calculator, when appropriate
- Modified length and time frame of assignments
- Alternate assessments with extended time
- Provide guided notes and study guides as needed
- Preferential Seating
- Extra Practice
- Directions repeated, clarified, and reworded
- Breakdown task into manageable units
- Differentiated instruction
- Use of manipulatives
- Math tool paper available
- Cooperative learning groups
- Supplemental books
- Repeat, reword or clarify directions
- Small group instruction as needed
- Instructional technology as needed/required
- Effective teacher questioning; ranging from fact recall to higher order critical thinking questions

Gifted and Talented:

- Cooperative Learning Groups
- Enriched Assignments
- Tiered Assignments
- Word Problems
- NJSLA questions
- Model Curriculum Questions
- Inquiry Based Project
- Interest Based/Choice Activities

Grade: High School	Content Area: Mathematics - Precalculus

Students at Risk of Failure:

- Extended Time
- Multi-Sensory Instruction
- Flexible Grouping
- Small Group Instruction
- Peer Buddies
- Graphic Organizers
- Chunking Information
- Scaffolded Questioning
- Tiered Activities
- Manipulatives/Concrete Models
- Build Background/Vocabulary
- Math Word Wall/Word Bank
- Modified Assignments
- Gradual Release Model
- Preferential Seating
- Brain Breaks
- Visual Cues
- Visual Models
- Technology Integration
- Assistive Technology
- Credit Recovery

Economically Disadvantaged:

- Pre-teach vocabulary using visuals and gestures
- Chunk texts
- Summarize as you go
- Preview lessons
- Graphic organizers
- Highlight key words
- Sentence starters
- Prompting and cueing
- Activate schema
- Build background knowledge

Culturally Diverse:

- Create pictures, posters, art, books, maps, flags, etc to hang in the classroom.
- Create an emotionally positive classroom climate.
- Bring in guest speakers
- Create effective communication
- Model and teach cultural respect
- Build relationships with students by interviewing students to understand their background

Grade: High School	Content Area: Mathematics - Precalculus

Unit 5: Exponential and Logarithmic Functions	27 days
New Jersey Learning Standards-Mathematics	
F.BF.B.3	Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology.
F.BF.B.4	Find inverse functions.
F.BF.B.4a	Solve an equation of the form f(x) = c for a simple function f that has an inverse and write an expression for the inverse.
F.BF.B.4b	Verify by composition that one function is the inverse of another.
F.IF.B.5	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
F.IF.C.7e	Graph exponential and logarithmic functions, showing intercepts and end behavior.
N.RN.A.1	Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents.
N.RN.A.2	Rewrite expressions involving radicals and rational exponents using the properties of exponents.
F.LE.A.2	Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
F.LE.A.4	Understand the inverse relationship between exponents and logarithms. For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.
A.REI.A.1	Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution.

Grade: High School	Content Area: Mathematics - Precalculus

	Construct a viable argument to justify a solution method.
A.REI.A.2	Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

Standards of Mathematical Practices	
MP1. Make sense of problems and persevere in solving them	• Find meaning in problems • Look for entry points • Analyze, conjecture and plan solution pathways • Monitor and adjust • Verify answers • Ask themselves the question: "Does this make sense?"
MP2. Reason abstractly and quantitatively.	• Make sense of quantities and their relationships in problems • Learn to contextualized and decontextualized • Create coherent representations of problems
MP3. Construct viable arguments and critique the reasoning of others.	• Understand and use information to construct arguments • Make and explore the truth of conjectures • Recognize and use counterexamples • Justify conclusions and respond to arguments of others
MP4. Model with Mathematics.	• Apply mathematics to problems in everyday life • Make assumptions and approximations • Identify quantities in a practical situation • Interpret results in the context of the situation and reflect on whether the results make sense
MP5. Use appropriate tools strategically	• Consider the available tools when solving problems • Are familiar with tools appropriate for their grade or course (pencil and paper, concrete models, ruler, protractor, calculator, spreadsheet, computer programs, digital content located on a website, and other technological tools) • Make sound decisions of which of these tools might be helpful
MP6. Attend to precision.	• Communicate precisely to others • Use clear definitions, state the meaning of symbols and are careful about specifying units of measure and labeling axes • Calculate accurately and efficiently
MP7. Look for and make use of structure.	• Discern patterns and structures • Can step back for an overview and shift perspective • See complicated things as single objects or as being composed of several objects

Grade: High School	Content Area: Mathematics - Precalculus

Social and Emotional Learning Standards	
Self-Awareness	● Recognize one's personal traits, strengths, and limitations ● Recognize the importance of self-confidence in handling daily tasks and challenges
Self-Management	● Recognize the skills needed to establish and achieve personal and educational goals ● Identify and apply ways to persevere or overcome barriers through alternative methods to achieve one's goals
Social Awareness	● Demonstrate an understanding of the need for mutual respect when viewpoints differ
Responsible Decision-Making	● Develop, implement and model effective problem solving and critical thinking skills

Interdisciplinary Connections	
	ELA Standards
● **L.SS.11–12.1**	Demonstrate command of the system and structure of the English language when writing or speaking.
● **W.RW.11–12.7**	Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes.
	Science Standards
● **HS-ESS2-1**	Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features.
● **HS-LS2-1**	Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.

Computer Science & Design Thinking

8.1 Computer Science

- 8.1.5.DA.1: Collect, organize, and display data in order to highlight relationships or support a claim.

8.2 Design Thinking

- 8.2.5.ED.2: Collaborate with peers to collect information, brainstorm to solve a problem, and evaluate all possible solutions to provide the best results with supporting sketches or models.
- 8.2.5.ED.3: Follow step by step directions to assemble a product or solve a problem, using appropriate tools to accomplish the task.
- 8.2.8.ED.3: Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch).

Grade: High School	Content Area: Mathematics - Precalculus

Career Readiness, Life Literacies & Key Skills

9.1 Personal Financial Literacy

- 9.1.5.EG.1: Explain and give examples of what is meant by the term "tax."
- 9.1.8.FI.4: Analyze the interest rates and fees associated with financial products.
- 9.1.8.FP.7: Identify the techniques and effects of deceptive advertising.

9.4 Life Literacies & Key Skills

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

Evidence of Student Learning

Formative Tasks:

- Oral Questioning
- Student Conference
- Self-Assessment
- Hand Signals
- Communicators
- Graphic Organizers
- Teacher Observation
- DOL
- Quiz Classwork
- NJSLA Released questions
- Problem of the Day

Alternative Assessments:

- Teacher-Created Projects
- https://www.illustrativemathematics.org/
- https://www.khanacademy.org/
- https://www.engageny.org

Summative Assessments:

- Unit Tests
- Midterm Exam
- Final Exam

Benchmark Assessments:

-
- Quarterly Benchmarks
- Beginning/End of Year Assessment
- Unit Common Assessment

Knowledge & Skills

Enduring Understandings:

- Transformations of functions illustrate how changes in parameters shift, stretch, compress, or reflect graphs, revealing how mathematical models respond to altered conditions.

Essential Questions:

- How do transformations help us understand how a mathematical model changes when conditions shift?
- What does it mean for two functions to be inverses, and why do inverse relationships appear so often in real contexts?

Grade: High School	**Content Area: Mathematics - Precalculus**

• Inverse functions reverse the roles of inputs and outputs, helping students understand how processes can be undone or traced backward in real-world contexts. • Solving equations of the form f(x) = c is essential for identifying input values that produce specific outputs, and this skill extends naturally to finding inverse relationships. • Verifying inverses by composition strengthens students' understanding of how functions behave structurally and reinforces the idea of functions as reversible processes. • The domain of a function must be interpreted through the lens of context, recognizing that real situations impose meaningful constraints on allowable inputs. • Exponential and logarithmic functions model a wide variety of growth and decay phenomena, and analyzing their intercepts and end behavior helps interpret long-term trends. • Rational exponents extend the properties of integer exponents, allowing for a unified treatment of radicals and exponent rules within a coherent number system. • Linear and exponential models provide powerful tools for representing real-world relationships, and understanding their differences is essential for accurate modeling and prediction.	• When solving f(x) = c, what does the solution tell us about the relationship between input and output? • How can function composition be used to verify that one function truly reverses the action of another? • How does context determine the domain of a function, and why are these constraints important for modeling? • What do exponential and logarithmic functions reveal about long-term growth or decay, and how can we interpret their key features? • How do rational exponents extend exponent rules, and why does this extension provide a more complete number system? • What distinguishes linear from exponential behavior, and how can we determine which type of function best fits a given set of data or conditions?
Content *Students will know…* • That inverse functions reverse the input–output relationship and reflect across the line $y = x$. • How to determine whether a relation and its inverse both satisfy the definition of a function. • That restricting a domain may be necessary to create an invertible function. • How exponential functions model growth and decay using the structure $f(x) = a \cdot b^x$. • How the parameters a and b affect exponential behavior, including growth rate, asymptotes, and intercepts. • That logarithmic functions are the inverses of exponential functions and that logs represent *exponents*. • The key features of exponential and logarithmic	**Skills** *Students will be able to …* • Find the inverse of a function algebraically and graphically. • Verify inverses by composing a function with its inverse to show they return the input. • Determine whether a function's inverse is also a function and restrict the domain if needed. • Apply exponent rules to simplify and evaluate numerical expressions. • Create tables of values for exponential functions and graph them accurately. • Write the equation of an exponential function from a table or graph. • Graph exponential growth and decay functions and describe their key features. • Apply vertical/horizontal shifts, reflections, and

Grade: High School	Content Area: Mathematics - Precalculus

graphs, including domain, range, asymptotes, and intercepts. ● The algebraic rules for simplifying log expressions (product, quotient, and power rules). ● That exponential and logarithmic equations require different solution pathways (common base vs. logarithms). ● How transformations affect the shape and position of exponential and logarithmic graphs.	stretches/compressions to exponential graphs. ● Convert exponential equations to a common base to solve for the variable. ● Use the definition of a logarithm to evaluate log expressions and generate log function tables. ● Sketch graphs of $y = log(x)$ and $y = ln(x)$, identifying asymptotes and intercepts. ● Graph transformed logarithmic functions and describe the effect of each parameter. ● Simplify logarithmic expressions using log rules. ● Solve logarithmic equations of varying difficulty (Level 1 and Level 2). ● Solve exponential equations by applying logarithms to both sides.

Core Instructional & Supplemental Materials

Suggested Activities/Resources:	Supplemental resources:
● HS-F.IF Activities ● HS-F.BF Activities ● HS-A.REI Activities ● HS-N.RN Activities ● HS-F.LE Activities	● https://www.illustrativemathematics.org/ ● https://www.khanacademy.org/ ● http://www.coolmath.com/ ● http://www.mobymax.com/ ● https://www.tenmarks.com/ ● https://www.ixl.com/math ● https://nj.digitalitemlibrary.com/home ● Mathematicians ● https://www.radicalmath.org/math-social-justice ● African Americans in Math ● History of Emmy Noether

Suggested Accommodations

English Language Learners:

- Multi-Sensory Instruction
- Flexible Grouping
- Small Group Instruction
- Peer Buddies
- Graphic Organizers
- Chunking Information
- Scaffolded Questioning
- Manipulatives/Concrete Models
- Build Background/Vocabulary
- Math Word Wall/Word Bank
- Gradual Release Model
- Visual Cues
- Visual Models

- Technology Integration
- Hands-On/Experiential Activities
- Native language support when possible
- Sheltered English Instructional Strategies
- Provide additional time

Special Education/Students with Disabilities:

- Extra help opportunities provided
- Credit Recovery
- Allow use of a calculator, when appropriate
- Modified length and time frame of assignments
- Alternate assessments with extended time
- Provide guided notes and study guides as needed
- Preferential Seating
- Extra Practice
- Directions repeated, clarified, and reworded
- Breakdown task into manageable units
- Differentiated instruction
- Use of manipulatives
- Math tool paper available
- Cooperative learning groups
- Supplemental books
- Repeat, reword or clarify directions
- Small group instruction as needed
- Instructional technology as needed/required
- Effective teacher questioning; ranging from fact recall to higher order critical thinking questions.

504 Plans:

- Extra help opportunities provided
- Credit Recovery
- Allow use of a calculator, when appropriate
- Modified length and time frame of assignments
- Alternate assessments with extended time
- Provide guided notes and study guides as needed
- Preferential Seating
- Extra Practice
- Directions repeated, clarified, and reworded
- Breakdown task into manageable units
- Differentiated instruction
- Use of manipulatives
- Math tool paper available
- Cooperative learning groups
- Supplemental books
- Repeat, reword or clarify directions
- Small group instruction as needed
- Instructional technology as needed/required
- Effective teacher questioning; ranging from fact recall to higher order critical thinking questions

Gifted and Talented:

- Cooperative Learning Groups
- Enriched Assignments
- Tiered Assignments
- Word Problems
- NJSLA questions
- Model Curriculum Questions
- Inquiry Based Project
- Interest Based/Choice Activities

Students at Risk of Failure:

- Extended Time
- Multi-Sensory Instruction
- Flexible Grouping
- Small Group Instruction
- Peer Buddies
- Graphic Organizers
- Chunking Information
- Scaffolded Questioning
- Tiered Activities
- Manipulatives/Concrete Models
- Build Background/Vocabulary
- Math Word Wall/Word Bank
- Modified Assignments
- Gradual Release Model
- Preferential Seating
- Brain Breaks
- Visual Cues
- Visual Models
- Technology Integration
- Assistive Technology
- Credit Recovery

Economically Disadvantaged:

- Pre-teach vocabulary using visuals and gestures
- Chunk texts
- Summarize as you go
- Preview lessons
- Graphic organizers
- Highlight key words
- Sentence starters
- Prompting and cueing
- Activate schema
- Build background knowledge

Culturally Diverse:

- Create pictures, posters, art, books, maps, flags, etc to hang in the classroom.
- Create an emotionally positive classroom climate.
- Bring in guest speakers

Grade: High School	Content Area: Mathematics - Precalculus

- Create effective communication
- Model and teach cultural respect
- Build relationships with students by interviewing students to understand their background

Unit 6: Introduction to Trigonometry	16 days
New Jersey Learning Standards-Mathematics	
F.TF.A.1 (+)	Understand the radian measure of an angle as the length of the arc on the unit circle subtended by the angle.
F.TF.A.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 traversed counterclockwise around the unit circle.
F.TF.A.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, cosines, and tangent for $\pi-x$, $\pi+x$, and $2\pi-x$ in terms of their values for x, where x is any real number.
F.TF.B.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.

Standards of Mathematical Practices	
MP1. Make sense of problems and persevere in solving them	• Find meaning in problems • Look for entry points • Analyze, conjecture and plan solution pathways • Monitor and adjust • Verify answers • Ask themselves the question: "Does this make sense?"
MP2. Reason abstractly and quantitatively.	• Make sense of quantities and their relationships in problems • Learn to contextualized and decontextualized • Create coherent representations of problems
MP3. Construct viable arguments and critique the reasoning of others.	• Understand and use information to construct arguments • Make and explore the truth of conjectures • Recognize and use counterexamples • Justify conclusions and respond to arguments of others
MP4. Model with Mathematics.	• Apply mathematics to problems in everyday life • Make assumptions and approximations

Grade: High School	Content Area: Mathematics - Precalculus

	• Identify quantities in a practical situation • Interpret results in the context of the situation and reflect on whether the results make sense
MP5. Use appropriate tools strategically	• Consider the available tools when solving problems • Are familiar with tools appropriate for their grade or course (pencil and paper, concrete models, ruler, protractor, calculator, spreadsheet, computer programs, digital content located on a website, and other technological tools) • Make sound decisions of which of these tools might be helpful
MP6. Attend to precision.	• Communicate precisely to others • Use clear definitions, state the meaning of symbols and are careful about specifying units of measure and labeling axes • Calculate accurately and efficiently
MP7. Look for and make use of structure.	• Discern patterns and structures • Can step back for an overview and shift perspective • See complicated things as single objects or as being composed of several objects

Social and Emotional Learning Standards	
Self-Awareness	• Recognize one's personal traits, strengths, and limitations • Recognize the importance of self-confidence in handling daily tasks and challenges
Self-Management	• Recognize the skills needed to establish and achieve personal and educational goals • Identify and apply ways to persevere or overcome barriers through alternative methods to achieve one's goals
Social Awareness	• Demonstrate an understanding of the need for mutual respect when viewpoints differ
Responsible Decision-Making	• Develop, implement and model effective problem solving and critical thinking skills

Interdisciplinary Connections	
	ELA Standards
• **L.SS.11–12.1**	Demonstrate command of the system and structure of the English language when writing or speaking.
• **W.RW.11–12.7**	Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes.
	Science Standards
• **HS-ESS1-4**	Use mathematical or computational representations to predict the motion of orbiting objects

Grade: High School	Content Area: Mathematics - Precalculus

	in the solar system.
• **HS-PS4-1**	Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.

Computer Science & Design Thinking

8.1 Computer Science

- 8.1.5.DA.1: Collect, organize, and display data in order to highlight relationships or support a claim.

8.2 Design Thinking

- 8.2.5.ED.2: Collaborate with peers to collect information, brainstorm to solve a problem, and evaluate all possible solutions to provide the best results with supporting sketches or models.
- 8.2.5.ED.3: Follow step by step directions to assemble a product or solve a problem, using appropriate tools to accomplish the task.
- 8.2.8.ED.3: Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch).

Career Readiness, Life Literacies & Key Skills

9.1 Personal Financial Literacy

- 9.1.5.EG.1: Explain and give examples of what is meant by the term “tax.”
- 9.1.8.FI.4: Analyze the interest rates and fees associated with financial products.
- 9.1.8.FP.7: Identify the techniques and effects of deceptive advertising.

9.4 Life Literacies & Key Skills

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

Evidence of Student Learning

Formative Tasks:	Alternative Assessments:
• Oral Questioning • Student Conference • Self-Assessment • Hand Signals • Communicators • Graphic Organizers • Teacher Observation • DOL • Quiz Classwork • NJSLA Released questions • Problem of the Day	• Teacher-Created Projects • https://www.illustrativemathematics.org/ • https://www.khanacademy.org/ • https://www.engageny.org
Summative Assessments:	**Benchmark Assessments:**

Grade: High School	**Content Area: Mathematics - Precalculus**

• Unit Tests • Midterm Exam • Final Exam	• • Quarterly Benchmarks • Beginning/End of Year Assessment • Unit Common Assessment

Knowledge & Skills	
Enduring Understandings: • Radian measure provides a natural way to quantify angles by relating them directly to arc length, which deepens understanding of circular motion and periodic behavior. • The unit circle extends trigonometric functions beyond acute angles, allowing sine, cosine, and tangent to be defined for all real numbers. The geometric structure of the unit circle reveals fundamental symmetries in trigonometric functions, including reflections, periodicity, and sign changes across quadrants. • Special triangles offer exact trigonometric values that serve as benchmarks for estimating and verifying solutions. • Expressing trigonometric values at angles such as $\pi - x$ or $2\pi - x$ highlights predictable patterns that arise from rotation on the unit circle. • Inverse trigonometric functions allow angles to be recovered from known ratios, supporting real-world applications involving periodic or rotational relationships. • Solving trigonometric equations requires interpreting multiple solutions, understanding periodicity, and selecting those that fit contextual constraints. • Technology enhances the ability to analyze trigonometric models, especially when interpreting complex equations or verifying solutions with greater accuracy.	**Essential Questions:** • Why is radian measure often more meaningful and mathematically natural than degrees when studying circular motion? • How does the unit circle allow trigonometric functions to be defined for any real number? • What do the symmetries of the unit circle reveal about the behavior of sine, cosine, and tangent across different quadrants? • How do special triangles help us determine exact trigonometric values and deepen our geometric understanding? • Why do angles like $\pi - x$ or $2\pi - x$ produce predictable transformations of trigonometric values? • How do inverse trigonometric functions allow us to determine unknown angles from real-world relationships? • How do we interpret trigonometric equations in context, especially when multiple solutions are possible? • When is technology necessary to support solving or interpreting trigonometric equations?
Content *Students will know…* • The definitions of the six trigonometric functions and how they relate to ratios in right triangles and points on the unit circle. • How special right-triangle values (30°, 45°, 60°, $\pi/6$, $\pi/4$, $\pi/3$) generate exact trigonometric ratios.	**Skills** *Students will be able to …* • Apply right-triangle trigonometry to solve for missing sides and angles, using all six trigonometric functions. • Evaluate exact trigonometric ratios for special angles and extend these values to any angle using

Grade: High School	Content Area: Mathematics - Precalculus

• That angle can be measured in degrees or radians and how the two measurement systems correspond. • How coterminal angles and periodicity allow trig values to repeat across revolutions. • The relationship between reference angles, quadrants, and the signs of trig values. • How inverse trigonometric functions recover angle measures from given ratios. • Trigonometric equations often have multiple solutions within an interval and infinitely many solutions overall. • How radian measure connects angle, arc length, and the geometry of the unit circle.	reference-angle reasoning. • Identify coterminal angles and use them to compute trig values for angles greater than 360° or less than 0°. • Solve trigonometric equations in degrees on the interval 0°–360° and for all possible solutions. • Convert between degree and radian measure and explain the geometric meaning of a radian. • Evaluate trig functions in radian measure using special angles and the unit circle. • Solve trigonometric equations in radians on the interval 0–2π and for all possible solutions. • Use inverse trigonometric functions to find angle measures that satisfy equations involving sine, cosine, tangent, and their reciprocals.

Core Instructional & Supplemental Materials

Suggested Activities/Resources:	Supplemental resources:
• HS-F.TF Activities	• https://www.illustrativemathematics.org/ • https://www.khanacademy.org/ • http://www.coolmath.com/ • http://www.mobymax.com/ • https://www.tenmarks.com/ • https://www.ixl.com/math • https://nj.digitalitemlibrary.com/home • https://www.radicalmath.org/math-social-justice • African Americans in Math • History of Alan Turing in Math

Suggested Accommodations

English Language Learners:

- Multi-Sensory Instruction
- Flexible Grouping
- Small Group Instruction
- Peer Buddies
- Graphic Organizers
- Chunking Information
- Scaffolded Questioning
- Manipulatives/Concrete Models
- Build Background/Vocabulary
- Math Word Wall/Word Bank
- Gradual Release Model
- Visual Cues

- Visual Models
- Technology Integration
- Hands-On/Experiential Activities
- Native language support when possible
- Sheltered English Instructional Strategies
- Provide additional time

Special Education/Students with Disabilities:

- Extra help opportunities provided
- Credit Recovery
- Allow use of a calculator, when appropriate
- Modified length and time frame of assignments
- Alternate assessments with extended time
- Provide guided notes and study guides as needed
- Preferential Seating
- Extra Practice
- Directions repeated, clarified, and reworded
- Breakdown task into manageable units
- Differentiated instruction
- Use of manipulatives
- Math tool paper available
- Cooperative learning groups
- Supplemental books
- Repeat, reword or clarify directions
- Small group instruction as needed
- Instructional technology as needed/required
- Effective teacher questioning; ranging from fact recall to higher order critical thinking questions

504 Plans:

- Extra help opportunities provided
- Credit Recovery
- Allow use of a calculator, when appropriate
- Modified length and time frame of assignments
- Alternate assessments with extended time
- Provide guided notes and study guides as needed
- Preferential Seating
- Extra Practice
- Directions repeated, clarified, and reworded
- Breakdown task into manageable units
- Differentiated instruction
- Use of manipulatives
- Math tool paper available
- Cooperative learning groups
- Supplemental books
- Repeat, reword or clarify directions
- Small group instruction as needed
- Instructional technology as needed/required

- Effective teacher questioning; ranging from fact recall to higher order critical thinking questions

Gifted and Talented:

- Cooperative Learning Groups
- Enriched Assignments
- Tiered Assignments
- Word Problems
- NJSLA questions
- Model Curriculum Questions
- Inquiry Based Project
- Interest Based/Choice Activities

Students at Risk of Failure:

- Extended Time
- Multi-Sensory Instruction
- Flexible Grouping
- Small Group Instruction
- Peer Buddies
- Graphic Organizers
- Chunking Information
- Scaffolded Questioning
- Tiered Activities
- Manipulatives/Concrete Models
- Build Background/Vocabulary
- Math Word Wall/Word Bank
- Modified Assignments
- Gradual Release Model
- Preferential Seating
- Brain Breaks
- Visual Cues
- Visual Models
- Technology Integration
- Assistive Technology
- Credit Recovery

Economically Disadvantaged:

- Pre-teach vocabulary using visuals and gestures
- Chunk texts
- Summarize as you go
- Preview lessons
- Graphic organizers
- Highlight key words
- Sentence starters
- Prompting and cueing
- Activate schema
- Build background knowledge

Lakewood School DIstrict Curriculum Guide

Grade: High School	Content Area: Mathematics - Precalculus

Culturally Diverse:

- Create pictures, posters, art, books, maps, flags, etc to hang in the classroom.
- Create an emotionally positive classroom climate.
- Bring in guest speakers
- Create effective communication
- Model and teach cultural respect
- Build relationships with students by interviewing students to understand their background

Unit 7: Trigonometric Identities and Equations	14 days
New Jersey Learning Standards-Mathematics	
F.TF.A.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 traversed counterclockwise around the unit circle.
F.TF.A.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, cosines, and tangent for $\pi-x$, $\pi+x$, and $2\pi-x$ in terms of their values for x, where x is any real number.
F.TF.B.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.C.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 $\sin(\theta)$, $\cos(\theta)$ or $\tan(\theta)$ and the quadrant of the angle.

Standards of Mathematical Practices	
MP1. Make sense of problems and persevere in solving them	• Find meaning in problems • Look for entry points • Analyze, conjecture and plan solution pathways • Monitor and adjust • Verify answers • Ask themselves the question: "Does this make sense?"
MP2. Reason abstractly and quantitatively.	• Make sense of quantities and their relationships in problems • Learn to contextualized and decontextualized • Create coherent representations of problems
MP3. Construct viable arguments and critique the reasoning of others.	• Understand and use information to construct arguments • Make and explore the truth of conjectures • Recognize and use counterexamples

Grade: High School	Content Area: Mathematics - Precalculus

	• Justify conclusions and respond to arguments of others
MP4. Model with Mathematics.	• Apply mathematics to problems in everyday life • Make assumptions and approximations • Identify quantities in a practical situation • Interpret results in the context of the situation and reflect on whether the results make sense
MP5. Use appropriate tools strategically	• Consider the available tools when solving problems • Are familiar with tools appropriate for their grade or course (pencil and paper, concrete models, ruler, protractor, calculator, spreadsheet, computer programs, digital content located on a website, and other technological tools) • Make sound decisions of which of these tools might be helpful
MP6. Attend to precision.	• Communicate precisely to others • Use clear definitions, state the meaning of symbols and are careful about specifying units of measure and labeling axes • Calculate accurately and efficiently
MP7. Look for and make use of structure.	• Discern patterns and structures • Can step back for an overview and shift perspective • See complicated things as single objects or as being composed of several objects

Social and Emotional Learning Standards	
Self-Awareness	• Recognize one's personal traits, strengths, and limitations • Recognize the importance of self-confidence in handling daily tasks and challenges
Self-Management	• Recognize the skills needed to establish and achieve personal and educational goals • Identify and apply ways to persevere or overcome barriers through alternative methods to achieve one's goals
Social Awareness	• Demonstrate an understanding of the need for mutual respect when viewpoints differ
Responsible Decision-Making	• Develop, implement and model effective problem solving and critical thinking skills

Interdisciplinary Connections	
	ELA Standards
• **L.SS.11–12.1**	Demonstrate command of the system and structure of the English language when writing or speaking.
• **W.RW.11–12.7**	Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes.

Grade: High School	Content Area: Mathematics - Precalculus

	Science Standards
● **HS-PS4-3**	Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other.
● **HS-ESS1-2**	Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.

Computer Science & Design Thinking

8.1 Computer Science

- 8.1.5.DA.1: Collect, organize, and display data in order to highlight relationships or support a claim.

8.2 Design Thinking

- 8.2.5.ED.2: Collaborate with peers to collect information, brainstorm to solve a problem, and evaluate all possible solutions to provide the best results with supporting sketches or models.
- 8.2.5.ED.3: Follow step by step directions to assemble a product or solve a problem, using appropriate tools to accomplish the task.
- 8.2.8.ED.3: Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch).

Career Readiness, Life Literacies & Key Skills

9.1 Personal Financial Literacy

- 9.1.5.EG.1: Explain and give examples of what is meant by the term “tax.”
- 9.1.8.FI.4: Analyze the interest rates and fees associated with financial products.
- 9.1.8.FP.7: Identify the techniques and effects of deceptive advertising.

9.4 Life Literacies & Key Skills

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

Evidence of Student Learning

Formative Tasks:

- Oral Questioning
- Student Conference
- Self-Assessment
- Hand Signals
- Communicators
- Graphic Organizers
- Teacher Observation
- DOL
- Quiz Classwork

Alternative Assessments:

- Teacher-Created Projects
- https://www.illustrativemathematics.org/
- https://www.khanacademy.org/
- https://www.engageny.org

Grade: High School	**Content Area: Mathematics - Precalculus**

• NJSLA Released questions • Problem of the Day	
Summative Assessments: • Unit Tests • Midterm Exam • Final Exam	**Benchmark Assessments:** • Quarterly Benchmarks • Beginning/End of Year Assessment • Unit Common Assessment

Knowledge & Skills	
Enduring Understandings: • The unit circle provides a unified framework for defining trigonometric functions for all real numbers, connecting angle measure to circular motion. • Special triangles reveal exact trigonometric values that serve as foundational benchmarks for understanding periodic behavior. • Symmetry on the unit circle explains how trigonometric values transform when angles are shifted, reflected, or rotated by π or 2π. • Trigonometric functions exhibit predictable periodic behavior that allows them to model oscillations, waves, and repeating patterns. • Inverse trigonometric functions allow us to recover angle measures from known trigonometric ratios, supporting real-world modeling. • Solving trigonometric equations requires accounting for periodicity and selecting solutions that fit contextual constraints. • The Pythagorean identity formalizes the fundamental relationship among sine, cosine, and the unit circle, grounding all trigonometric reasoning. • Knowing how to use the Pythagorean identity and quadrant information strengthens students' ability to determine missing trigonometric values and interpret geometric or physical situations.	**Essential Questions:** • How does the unit circle allow trigonometric functions to extend naturally to all real numbers? • Why are special triangles so important for determining exact trigonometric values? • What do transformations such as π–x or 2π–x reveal about the symmetries of trigonometric functions? • How does the periodic nature of trigonometric functions help us model repeating phenomena? • Why do we use inverse trigonometric functions to solve real-world problems involving angles or rotations? • How do we decide which trigonometric equation solutions make sense in a contextual situation? • What does the Pythagorean identity tell us about the relationship between sine and cosine, and why is this relationship fundamental? • How does quadrant information help us determine the correct signs and values of trigonometric expressions?
Content *Students will know…* • That all six trigonometric functions can be rewritten in terms of sine and cosine, creating a unified framework for simplifying expressions. • The Pythagorean identities and how they relate the	**Skills** *Students will be able to …* • Rewrite tan(x), cot(x), sec(x), and csc(x) in terms of sine and cosine to simplify and analyze expressions. • Use the Pythagorean identities to find missing trigonometric values given one trig function and information about the quadrant.

Grade: High School	Content Area: Mathematics - Precalculus

squares of trig functions to one another. ● How factoring, combining rational expressions, and rewriting functions in sin/cos form make complex identities simpler to analyze. ● The structure and purpose of double-angle identities and how they arise from angle-sum formulas. ● That simplifying trigonometric expressions often requires layered strategies, including algebraic manipulation and identity substitution. ● How trigonometric identities describe equivalences, not evaluations, and must be proven for all real numbers for which the functions are defined. ● Solving trigonometric equations may involve identity use, factoring, isolating trig ratios, and applying unit-circle reasoning. ● How periodicity and symmetry influence the number of solutions to trigonometric equations.	● Simplify trigonometric expressions using identity substitution, factoring, and rational expression techniques. ● Prove trigonometric identities by transforming one expression into another using algebraic and trigonometric properties. ● Apply double-angle identities to rewrite expressions and manipulate equations. ● Solve trigonometric equations by isolating a trig expression, using identities, and determining all solutions on a given interval or over all real numbers. ● Use symmetry and periodicity on the unit circle to determine the sign and value of trig ratios. ● Justify reasoning clearly when simplifying identities or solving equations, showing each necessary algebraic step.

Core Instructional & Supplemental Materials

Suggested Activities/Resources:	Supplemental resources:
● HS-F.TF Activities	● https://www.illustrativemathematics.org/ ● https://www.khanacademy.org/ ● http://www.coolmath.com/ ● http://www.mobymax.com/ ● https://www.tenmarks.com/ ● https://www.ixl.com/math ● https://nj.digitalitemlibrary.com/home ● https://www.radicalmath.org/math-social-justice ● African Americans in Math

Suggested Accommodations

English Language Learners:

- Multi-Sensory Instruction
- Flexible Grouping
- Small Group Instruction
- Peer Buddies
- Graphic Organizers
- Chunking Information
- Scaffolded Questioning
- Manipulatives/Concrete Models
- Build Background/Vocabulary

- Math Word Wall/Word Bank
- Gradual Release Model
- Visual Cues
- Visual Models
- Technology Integration
- Hands-On/Experiential Activities
- Native language support when possible
- Sheltered English Instructional Strategies
- Provide additional time

Special Education/Students with Disabilities:

- Extra help opportunities provided
- Credit Recovery
- Allow use of a calculator, when appropriate
- Modified length and time frame of assignments
- Alternate assessments with extended time
- Provide guided notes and study guides as needed
- Preferential Seating
- Extra Practice
- Directions repeated, clarified, and reworded
- Breakdown task into manageable units
- Differentiated instruction
- Use of manipulatives
- Math tool paper available
- Cooperative learning groups
- Supplemental books
- Repeat, reword or clarify directions
- Small group instruction as needed
- Instructional technology as needed/required
- Effective teacher questioning; ranging from fact recall to higher order critical thinking questions

504 Plans:

- Extra help opportunities provided
- Credit Recovery
- Allow use of a calculator, when appropriate
- Modified length and time frame of assignments
- Alternate assessments with extended time
- Provide guided notes and study guides as needed
- Preferential Seating
- Extra Practice
- Directions repeated, clarified, and reworded
- Breakdown task into manageable units
- Differentiated instruction
- Use of manipulatives
- Math tool paper available
- Cooperative learning groups
- Supplemental books
- Repeat, reword or clarify directions

- Small group instruction as needed
- Instructional technology as needed/required
- Effective teacher questioning; ranging from fact recall to higher order critical thinking questions

Gifted and Talented:

- Cooperative Learning Groups
- Enriched Assignments
- Tiered Assignments
- Word Problems
- NJSLA questions
- Model Curriculum Questions
- Inquiry Based Project
- Interest Based/Choice Activities

Students at Risk of Failure:

- Extended Time
- Multi-Sensory Instruction
- Flexible Grouping
- Small Group Instruction
- Peer Buddies
- Graphic Organizers
- Chunking Information
- Scaffolded Questioning
- Tiered Activities
- Manipulatives/Concrete Models
- Build Background/Vocabulary
- Math Word Wall/Word Bank
- Modified Assignments
- Gradual Release Model
- Preferential Seating
- Brain Breaks
- Visual Cues
- Visual Models
- Technology Integration
- Assistive Technology
- Credit Recovery

Economically Disadvantaged:

- Pre-teach vocabulary using visuals and gestures
- Chunk texts
- Summarize as you go
- Preview lessons
- Graphic organizers
- Highlight key words
- Sentence starters
- Prompting and cueing
- Activate schema

Grade: High School	Content Area: Mathematics - Precalculus

- Build background knowledge

Culturally Diverse:

- Create pictures, posters, art, books, maps, flags, etc to hang in the classroom.
- Create an emotionally positive classroom climate.
- Bring in guest speakers
- Create effective communication
- Model and teach cultural respect
- Build relationships with students by interviewing students to understand their background

Unit 8: Graphing Trig Functions & Inverse Trig Functions	17 days
New Jersey Learning Standards-Mathematics	
F.TF.B.5 (+)	Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.
F.IF.C.7	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
F.IF.C.7f (+)	Graph trigonometric functions, showing period, midline, and amplitude.
F.BF.B.3	Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology.

Standards of Mathematical Practices	
MP1. Make sense of problems and persevere in solving them	• Find meaning in problems • Look for entry points • Analyze, conjecture and plan solution pathways • Monitor and adjust • Verify answers • Ask themselves the question: “Does this make sense?”
MP2. Reason abstractly and quantitatively.	• Make sense of quantities and their relationships in problems • Learn to contextualized and decontextualized • Create coherent representations of problems
MP3. Construct viable arguments and critique the reasoning of others.	• Understand and use information to construct arguments

Grade: High School	Content Area: Mathematics - Precalculus

	• Make and explore the truth of conjectures • Recognize and use counterexamples • Justify conclusions and respond to arguments of others
MP4. Model with Mathematics.	• Apply mathematics to problems in everyday life • Make assumptions and approximations • Identify quantities in a practical situation • Interpret results in the context of the situation and reflect on whether the results make sense
MP5. Use appropriate tools strategically	• Consider the available tools when solving problems • Are familiar with tools appropriate for their grade or course (pencil and paper, concrete models, ruler, protractor, calculator, spreadsheet, computer programs, digital content located on a website, and other technological tools) • Make sound decisions of which of these tools might be helpful
MP6. Attend to precision.	• Communicate precisely to others • Use clear definitions, state the meaning of symbols and are careful about specifying units of measure and labeling axes • Calculate accurately and efficiently
MP7. Look for and make use of structure.	• Discern patterns and structures • Can step back for an overview and shift perspective • See complicated things as single objects or as being composed of several objects

Social and Emotional Learning Standards	
Self-Awareness	• Recognize one's personal traits, strengths, and limitations • Recognize the importance of self-confidence in handling daily tasks and challenges
Self-Management	• Recognize the skills needed to establish and achieve personal and educational goals • Identify and apply ways to persevere or overcome barriers through alternative methods to achieve one's goals
Social Awareness	• Demonstrate an understanding of the need for mutual respect when viewpoints differ
Responsible Decision-Making	• Develop, implement and model effective problem solving and critical thinking skills

Interdisciplinary Connections	
	ELA Standards
• **L.SS.11–12.1**	Demonstrate command of the system and structure of the English language when writing or

Grade: High School	Content Area: Mathematics - Precalculus

	speaking.
• **W.RW.11–12.7**	Write routinely over extended time frames (time for research, reflection, and revision) and shorter time frames (a single sitting or a day or two) for a range of tasks, purposes.
	Science Standards
• **HS-ESS2-3**	Analyze geoscience data to make the claim that one change to Earth's surface can create feedback that causes changes to other Earth systems.
• **HS-LS2-4**	Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem

Computer Science & Design Thinking

8.1 Computer Science

- 8.1.5.DA.1: Collect, organize, and display data in order to highlight relationships or support a claim.

8.2 Design Thinking

- 8.2.5.ED.2: Collaborate with peers to collect information, brainstorm to solve a problem, and evaluate all possible solutions to provide the best results with supporting sketches or models.
- 8.2.5.ED.3: Follow step by step directions to assemble a product or solve a problem, using appropriate tools to accomplish the task.
- 8.2.8.ED.3: Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch).

Career Readiness, Life Literacies & Key Skills

9.1 Personal Financial Literacy

- 9.1.5.EG.1: Explain and give examples of what is meant by the term "tax."
- 9.1.8.FI.4: Analyze the interest rates and fees associated with financial products.
- 9.1.8.FP.7: Identify the techniques and effects of deceptive advertising.

9.4 Life Literacies & Key Skills

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

Evidence of Student Learning

Formative Tasks:

- Oral Questioning
- Student Conference
- Self-Assessment
- Hand Signals
- Communicators
- Graphic Organizers

Alternative Assessments:

- Teacher-Created Projects
- https://www.illustrativemathematics.org/
- https://www.khanacademy.org/
- https://www.engageny.org

Grade: High School	**Content Area: Mathematics - Precalculus**

• Teacher Observation • DOL • Quiz Classwork • NJSLA Released questions • Problem of the Day	
Summative Assessments: • Unit Tests • Midterm Exam • Final Exam	**Benchmark Assessments:** • • Quarterly Benchmarks • Beginning/End of Year Assessment • Unit Common Assessment

Knowledge & Skills	
Enduring Understandings: • Many real-world phenomena exhibit periodic behavior, and trigonometric functions provide powerful tools for modeling these repeating patterns. • Amplitude, frequency, midline, and phase shifts determine the shape and behavior of a trigonometric model, allowing precise representation of cyclical systems. • Graphing trigonometric functions clarifies how changes in parameters affect period, vertical shifts, horizontal shifts, and overall oscillation pattern. • Visualizing periodic functions supports interpretation of real-world data involving cycles such as seasonal changes, electrical signals, or wave motion. • Transformations such as vertical shifts, horizontal shifts, and scalings help refine mathematical models to match observed behavior. • Graphs expressed symbolically highlight key features that reveal underlying structures, constraints, and long-term behavior in the modeled system. • Technology enhances the ability to analyze and refine trigonometric models, especially when working with complex or noisy periodic datasets.	**Essential Questions:** • How do we determine which trigonometric function best models a periodic phenomenon? • What do amplitude, frequency, and midline tell us about the behavior of a real-world cycle? • How does graphing a trigonometric function reveal important features such as period, midline, and amplitude? • Why do we use transformations to adjust or refine trigonometric models? • How do symbolic expressions help us understand and interpret periodic behavior? • How can analyzing graphs support our understanding of real-world repeating patterns? • When is technology necessary for exploring or refining periodic models? • How do we decide whether a sine, cosine, or other trigonometric function provides the most accurate representation of observed data?
Content *Students will know…* • How amplitude, period, phase shift, and vertical shift affect the graphs of sine, cosine, tangent, secant, and	**Skills** *Students will be able to …* • Graph sin(x)\sin(x)sin(x) and cos(x)\cos(x)cos(x) using amplitude changes, reflections, vertical shifts, and

Grade: High School	Content Area: Mathematics - Precalculus

cosecant functions. ● That sine and cosine graphs are periodic with a base period of 2π2\pi2π, while tangent, secant, and cosecant have different periodicities and asymptotic behavior. ● The geometric meaning of reflections over the x-axis and y-axis for trigonometric functions. ● How to determine vertical asymptotes by identifying when sin(x)=0\sin(x) = 0sin(x)=0 or cos(x)=0\cos(x) = 0cos(x)=0, depending on the function. ● The parent graphs of sin(x),cos(x),tan(x),csc(x),sec(x), and how transformations modify their shape and key features. ● That amplitude affects vertical stretch and compression for trigonometric functions, while frequency affects the number of cycles in a given interval. ● How shifts and stretches are represented algebraically in expressions such as asin(bx+c)+ka\sin(bx + c) + kasin(bx+c)+k. ● How to interpret and model real-world periodic behavior using trigonometric graphs.	horizontal shifts. ● Graph sine and cosine functions with altered periods by using the formula Period=2π∣b∣\text{Period} = \frac{2\pi}{|b|}Period=∣b∣2π. ● Produce complete, accurate graphs of y=csc(x)y = \csc(x)y=csc(x) and y=sec(x)y = \sec(x)y=sec(x), including identifying domains, asymptotes, maxima/minima, and intervals of increase/decrease. ● Graph y=tan(x)y = \tan(x)y=tan(x) with any amplitude or frequency and accurately place asymptotes and key reference points. ● Determine vertical asymptotes of tangent, secant, and cosecant functions by solving cos(x)=0\cos(x) = 0cos(x)=0 or sin(x)=0\sin(x) = 0sin(x)=0 and use these to guide graph construction. ● Describe how transformations affect the behavior, symmetry, and periodicity of trigonometric functions. ● Compare graphs before and after transformations to interpret parameter changes. ● Construct complete graphs for trigonometric expressions from equations and descriptions, and verify correctness using tables or unit-circle reasoning.

Core Instructional & Supplemental Materials

Suggested Activities/Resources:	Supplemental resources:
● HS-F.IF Activities ● HS-F.BF Activities ● HS-F.TF Activities	● https://www.illustrativemathematics.org/ ● https://www.khanacademy.org/ ● http://www.coolmath.com/ ● http://www.mobymax.com/ ● https://www.tenmarks.com/ ● https://www.ixl.com/math ● https://nj.digitalitemlibrary.com/home ● https://www.radicalmath.org/math-social-justice ● African Americans in Math

Suggested Accommodations

English Language Learners:

- Multi-Sensory Instruction
- Flexible Grouping
- Small Group Instruction
- Peer Buddies
- Graphic Organizers
- Chunking Information

- Scaffolded Questioning
- Manipulatives/Concrete Models
- Build Background/Vocabulary
- Math Word Wall/Word Bank
- Gradual Release Model
- Visual Cues
- Visual Models
- Technology Integration
- Hands-On/Experiential Activities
- Native language support when possible
- Sheltered English Instructional Strategies
- Provide additional time

Special Education/Students with Disabilities:

- Extra help opportunities provided
- Credit Recovery
- Allow use of a calculator, when appropriate
- Modified length and time frame of assignments
- Alternate assessments with extended time
- Provide guided notes and study guides as needed
- Preferential Seating
- Extra Practice
- Directions repeated, clarified, and reworded
- Breakdown task into manageable units
- Differentiated instruction
- Use of manipulatives
- Math tool paper available
- Cooperative learning groups
- Supplemental books
- Repeat, reword or clarify directions
- Small group instruction as needed
- Instructional technology as needed/required
- Effective teacher questioning; ranging from fact recall to higher order critical thinking questions

504 Plans:

- Extra help opportunities provided
- Credit Recovery
- Allow use of a calculator, when appropriate
- Modified length and time frame of assignments
- Alternate assessments with extended time
- Provide guided notes and study guides as needed
- Preferential Seating
- Extra Practice
- Directions repeated, clarified, and reworded
- Breakdown task into manageable units
- Differentiated instruction
- Use of manipulatives
- Math tool paper available

- Cooperative learning groups
- Supplemental books
- Repeat, reword or clarify directions
- Small group instruction as needed
- Instructional technology as needed/required
- Effective teacher questioning; ranging from fact recall to higher order critical thinking questions

Gifted and Talented:

- Cooperative Learning Groups
- Enriched Assignments
- Tiered Assignments
- Word Problems
- NJSLA questions
- Model Curriculum Questions
- Inquiry Based Project
- Interest Based/Choice Activities

Students at Risk of Failure:

- Extended Time
- Multi-Sensory Instruction
- Flexible Grouping
- Small Group Instruction
- Peer Buddies
- Graphic Organizers
- Chunking Information
- Scaffolded Questioning
- Tiered Activities
- Manipulatives/Concrete Models
- Build Background/Vocabulary
- Math Word Wall/Word Bank
- Modified Assignments
- Gradual Release Model
- Preferential Seating
- Brain Breaks
- Visual Cues
- Visual Models
- Technology Integration
- Assistive Technology
- Credit Recovery

Economically Disadvantaged:

- Pre-teach vocabulary using visuals and gestures
- Chunk texts
- Summarize as you go
- Preview lessons
- Graphic organizers
- Highlight key words
- Sentence starters

- Prompting and cueing
- Activate schema
- Build background knowledge

Culturally Diverse:

- Create pictures, posters, art, books, maps, flags, etc to hang in the classroom.
- Create an emotionally positive classroom climate.
- Bring in guest speakers
- Create effective communication
- Model and teach cultural respect
- Build relationships with students by interviewing students to understand their background