

Original Adoption:	3/8/2016
Revised:	July 2019
Board Approved:	8/21/2019

Toms River Regional Schools PreCalculus Curriculum	
Content Area: Mathematics	
Course Title: PreCalculus	Grade Level: High School
Trigonometry	70 Days
Sequences, Series and Probability	20 Days
Exponential and Logarithmic Functions	25 Days
Polynomial and Rational Functions	30 Days
Analytic Geometry	20 Days

Introduction

Effective mathematics education provides students with a balanced instructional program. In such a program, students become proficient in basic computational skills and procedures, develop conceptual understandings, and become skilled at problem solving. Standards-based mathematics instruction starts with basic material and increases in scope and content as the years progress.

The curriculum is aligned to the NJSLS for Mathematics. Activities outlined in this curriculum infuse the Standards for Mathematical Practice. In alignment to the content and practice standards, PreCalculus students will extend their knowledge of mathematics as they learn to represent and compare Trigonometric functions, polynomials, periodic models and inference making.

Students use functions to model real world applications and their knowledge of their properties to explain the world around them. They will summarize, represent and interpret data to make inferences and justify conclusions. Students will use numerical, graphical, and algebraic models to solve problems.

Unit1: Trigonometry	Duration: 70 Days
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Standards/Learning Targets

Focus Standards (Major Standards)

G.SRT-6 Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles

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

F-TF-1 Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.

F-TF-2 Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.

F-TF-5 Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.

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

Supporting and Additional Standards

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

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

G-SRT-11 Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces)

F-TF-3 Use special triangles to determine geometrically the values of sine, cosine, tangent for $\pi/3$, $\pi/4$ and $\pi/6$, and use the unit circle to express the values of sine, cosines, and tangent for x , $\pi + x$, and $2\pi - x$ in terms of their values for x , where x is any real

number.

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

F-TF-6 Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.

F-TF-7 Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context.

F-TF-9 Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems

The following Standards for Mathematical Practice and select New Jersey Student Learning Standards should be covered throughout the various units of the curriculum.

Standards for Mathematical Practices

MP.1 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?”

MP.2 Reason abstractly and quantitatively.

- Make sense of quantities and their relationships in problems
- Learn to contextualize and de-contextualize
- Create coherent representations of problems

MP.3 Construct viable arguments and critique the reasoning of others.

- Understand and use information to construct arguments
- Make and explore the truth of conjectures

MP.4	Model with Mathematics.	<ul style="list-style-type: none"> ● Recognize and use counterexamples ● Justify conclusions and respond to arguments of others ● 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
MP.5	Use appropriate tools strategically.	<ul style="list-style-type: none"> ● 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
MP.6	Attend to precision.	<ul style="list-style-type: none"> ● 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
MP.7	Look for and make use of structure.	<ul style="list-style-type: none"> ● 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
MP.8	Look for and express regularity in repeated reasoning.	<ul style="list-style-type: none"> ● Notice if calculations are repeated and look both for general methods and shortcuts ● In solving problems, maintain oversight of the process while attending to detail ● Evaluate the reasonableness of their immediate results is

certain patterns and structures

Primary Interdisciplinary Connections: Infused within the unit are connections to the NJSLS for Mathematics, Language Arts Literacy

WHST.11-12.10. Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

● **TECHNOLOGY STANDARDS and APPLY explicit standards as appropriate.**

- 8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
 - A. Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations
 - B. Creativity and Innovation: Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.
 - E: Research and Information Fluency: Students apply digital tools to gather, evaluate, and use information.
 - F: Critical thinking, problem solving, and decision making: Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.

21st Century Themes/Careers: Through instruction in life and career skills, all students acquire the knowledge and skills needed to prepare for life as citizens and workers in the 21st century. For further clarification see NJ World Class Standards at www.NJ.gov/education/aps/cccs/career/

CRP2. Apply appropriate academic and technical skills.

CRP4. Communicate clearly and effectively and with reason.

CRP6. Demonstrate creativity and innovation.

CRP7. Employ valid and reliable research strategies.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

CRP11. Use technology to enhance productivity.

9.2.8.B.1 Research careers within the 16 Career Clusters and determine attributes of career success.

9.2.12.C.3 Identify transferable career skills and design alternate career plans

Evidence of Student Learning

Performance Tasks/Use of Technology:

- www.mathxforschool.com
- www.khanacademy.com
- www.desmos.com
- www.kahoot.com
- www.quizizz.com

Other Assessments

Formative

- Observation
- Homework
- Class Participation
- Whiteboards/communicators
- Think-Pair-Share
- Do-Now
- Notebook Checks
- Writing Prompts
- Exit Tickets
- Classroom Games
- Self-assessment

Summative

- Chapter/Unit Test
- Quizzes
- Presentations
- Unit Projects

Benchmark

	<ul style="list-style-type: none"> ● Quarterly Benchmark Assessment ● Midterm Assessment <p>Alternative</p> <ul style="list-style-type: none"> ● Portfolio Project ● Modified assignments
Knowledge and Skills	
Content	Skills
<p><i>Students will know...</i></p> <ul style="list-style-type: none"> ● Sine, cosine and tangent ratios for right triangles ● The laws of sine and cosine ● The area formula for oblique triangles is $\frac{1}{2}bc \sin A$ and Heron's formula ● How to convert between degrees and radians ● How to identify a unit circle and its relationship to real numbers ● How to evaluate trigonometric functions of any angle ● How to translate a graph ● The effects of period and amplitude ● The domain and range for all 6 trig functions ● How to graph the intercepts of trig functions with the x-axis ● How to find the quarters in a sine and cosine graph ● That cosecant and secant are reciprocal graphs of sine and cosine. ● How to verify trigonometric identities. ● How to solve trigonometric equations using algebraic techniques. 	<p><i>Students will be able to..</i></p> <ul style="list-style-type: none"> ● Apply sine, cosine and tangent ratios to find missing sides and angles in right triangles ● Utilize the law of sine and cosine to solve oblique triangles ● Employ area formulas derived from the laws of sine and cosine to find the area of oblique triangles. ● Evaluate trigonometric functions for any angle on the unit circle. ● Utilize radian measurement for all calculations in decimal and pi form. ● Graph trigonometric functions on a coordinate plane and use the rules for translations and stretching/shrinking the graph ● Employ trigonometric graphs to model real-life data ● Understand the importance of the fundamental identities in solving, simplifying, verifying and evaluating trig expressions and equations. ● Develop reasoning skills.

- How to use formulas to rewrite and evaluate trig functions.

Instructional Plan

Suggested Activities

Resources

- Graphing Calculator
- Microsoft Excel/PowerPoint
- Teacher-made tests, worksheets, warm-ups, and quizzes
- Computer software to support unit
- Smart board
- Document camera
- www.ixl.com
- www.purplemath.com
- www.brightstorm.com
- www.coolmath.com

MODIFICATIONS

English Language Learners

- Provide clear and specific directions
- Allow for alternate forms of responses- drawing or speaking instead of writing to demonstrate knowledge when you are not specifically assessing writing
- Provide class notes ahead of time to allow students to preview material and increase comprehension

- Provide extended time
- Model directions and provide gestures to increase understanding
- Simplify written and verbal instructions
- Allow the use of an online dictionary to look up the definition and hear the pronunciation of unknown words
- Create a nurturing environment with structured routines
- Teach study skills
- Gather materials such as visuals, models, manipulatives, videos and other tangible referents to contextualize the lesson.

Special Education

- Provide clear and specific directions
- Allow for alternate forms of responses- drawing or speaking instead of writing to demonstrate knowledge when you are not specifically assessing writing
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- Model directions and provide gestures to increase understanding
- Simplify written and verbal instructions
- Provide frequent breaks
- Provide written directions with models and diagrams when possible
- Utilize graphic organizers
- Assign peer tutor
- Provide manipulatives
- Frequently check for understanding
- Provide immediate praise and feedback
- Have student repeat directions to check for understanding
- Create a nurturing environment with structured routines

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Gifted and Talented

- Extension activities
- Opportunities for Critical Thinking
- Problem Solving/Design Challenges
- Technology Integration
- Student Choice Activities
- Student Driven Activities
- Group Projects
- Tiered Activities

Students at Risk of School Failure

- Extended Time
- Flexible Grouping
- Small Group Instruction
- Peer Buddies
- Graphic Organizers
- Chunking Information
- Scaffolded Questioning

- Tiered Activities
- Manipulatives
- Build Background/Vocabulary
- Math Word Wall/Word Bank
- Modified Assignments
- Gradual Release Model
- Preferential Seating
- Visual Cues/Models
- Technology Integration
- Assistive Technology

Core Instructional and Supplemental Materials

- PreCalculus Text
- www.kutasoftware.com
- Text Support Materials

Teacher Notes:

Unit 2: Sequences, Series and Probability

Duration: 20 Days

Standards/Learning Targets

Focus Standards (Major Standards)

S-CP-1 Describe events as subsets of a sample space using characteristics of the outcomes, or as unions, intersections, or complements of other events

S-CP-2 Understand that two events A and B are independent if the probability of A and B occurring together is the product of their probabilities and use this characterization to determine if they are independent.

S-CP-3 Understand the conditional probability of A given B as $P(A \text{ and } B)/P(B)$, and interpret independence of A and B as saying that the conditional probability of A given B is the same as the probability of A , and the conditional probability of B given A is the same as the probability of B .

S-CP-5 Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.

S-CP-6 Find the conditional probability of A given B as the fraction of B 's outcomes that also belong to A , and interpret the answer in terms of the model

S-CP-7 Apply the Addition Rule, $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$, and interpret the answer in terms of the model.

Supporting and Additional Standards

S-CP-8 Apply the general Multiplication Rule in a uniform probability model, $P(A \text{ and } B) = P(A)P(B|A) = P(B)P(A|B)$

S-CP-9 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of relationship, or two input-output pairs

F-LE-2 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship or two input

The following Standards for Mathematical Practice and select New Jersey Student Learning Standards should be covered throughout the various units of the curriculum.

Standards for Mathematical Practices

MP.1 Make sense of problems and persevere in solving them ● Find meaning in problems

		<ul style="list-style-type: none"> ● Look for entry points ● Analyze, conjecture and plan solution pathways ● Monitor and adjust ● Verify answers ● Ask themselves the question: “Does this make sense?”
MP.2	Reason abstractly and quantitatively.	<ul style="list-style-type: none"> ● Make sense of quantities and their relationships in problems ● Learn to contextualize and de-contextualize ● Create coherent representations of problems
MP.3	Construct viable arguments and critique the reasoning of others.	<ul style="list-style-type: none"> ● 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
MP.4	Model with Mathematics.	<ul style="list-style-type: none"> ● 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
MP.5	Use appropriate tools strategically.	<ul style="list-style-type: none"> ● 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
MP.6	Attend to precision.	<ul style="list-style-type: none"> ● Communicate precisely to others ● Use clear definitions, state the meaning of symbols and are

MP.7	Look for and make use of structure.	<p>careful about specifying units of measure and labeling axes</p> <ul style="list-style-type: none"> ● Calculate accurately and efficiently ● 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
MP.8	Look for and express regularity in repeated reasoning.	<ul style="list-style-type: none"> ● Notice if calculations are repeated and look both for general methods and shortcuts ● In solving problems, maintain oversight of the process while attending to detail ● Evaluate the reasonableness of their immediate results is certain patterns and structures



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CRP2. Apply appropriate academic and technical skills.

CRP4. Communicate clearly and effectively and with reason.

CRP6. Demonstrate creativity and innovation.

CRP7. Employ valid and reliable research strategies.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

CRP11. Use technology to enhance productivity.

9.2.8.B.6 Demonstrate understanding of the necessary preparation and legal requirements to enter the workforce.

9.2.12.C.3 Identify transferable career skills and design alternate career plans

Evidence of Student Learning

Performance Tasks/Use of Technology:

- www.mathx1forschool.com
- www.khanacademy.com
- www.desmos.com
- www.kahoot.com
- www.quizizz.com

Other Assessments

Formative

- Observation
- Homework
- Class Participation
- Whiteboards/communicators
- Think-Pair-Share
- Do-Now

	<ul style="list-style-type: none"> ● Notebook Checks ● Writing Prompts ● Exit Tickets ● Classroom Games ● Self-assessment <p>Summative</p> <ul style="list-style-type: none"> ● Chapter/Unit Test ● Quizzes ● Presentations ● Unit Projects <p>Benchmark</p> <ul style="list-style-type: none"> ● Quarterly Benchmark Assessment ● Midterm Assessment <p>Alternative</p> <ul style="list-style-type: none"> ● Portfolio Project ● Modified assignments
Knowledge and Skills	
Content	Skills
<p><i>Students will know...</i></p> <ul style="list-style-type: none"> ● How to calculate experimental probability given trial data. ● How to calculate theoretical probability. ● How to calculate probability of independent events using union and intersection. ● How to evaluate and use combinations and permutations. 	<p><i>Students will be able to..</i></p> <ul style="list-style-type: none"> ● Calculate the theoretical and experimental probability provided events are independent or dependent. Also, utilize complementary events. ● Determine the impact of order in an experiment and utilize calculations for permutations and combinations. ● Write the nth term of a sequence and evaluate multiple

<ul style="list-style-type: none"> • How to write and evaluate sequences and series including summation notation and factorial notation. 	<p>forms of a sequence and series.</p>
Instructional Plan	
Suggested Activities	Resources
	<ul style="list-style-type: none"> • Graphing Calculator • Microsoft Excel/PowerPoint • Teacher-made tests, worksheets, warm-ups, and quizzes • Computer software to support unit • Smart board • Document camera • www.ixl.com • www.purplemath.com • www.brightstorm.com • www.coolmath.com
MODIFICATIONS	
<p><i>English Language Learners</i></p> <ul style="list-style-type: none"> • Provide clear and specific directions • Allow for alternate forms of responses- drawing or speaking instead of writing to demonstrate knowledge when you are not specifically assessing writing • Provide class notes ahead of time to allow students to preview material and increase comprehension • Provide extended time 	

- Model directions and provide gestures to increase understanding
- Simplify written and verbal instructions
- Allow the use of an online dictionary to look up the definition and hear the pronunciation of unknown words
- Create a nurturing environment with structured routines
- Teach study skills
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Core Instructional and Supplemental Materials

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Teacher Notes:

Unit 3: Exponential and Logarithmic Functions

Duration: 25 Days

Standards/Learning Targets

Focus Standards (Major Standards)

F-LE-1 Distinguish between situations that can be modeled with linear functions and with exponential functions.

a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.

b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.

c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

F-LE-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-3 Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.

F-LE-4 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.

F-LE-5 Interpret the parameters in a linear or exponential function in terms of a context.

F-IF-7e Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude

Supporting and Additional Standards

The following Standards for Mathematical Practice and select New Jersey Student Learning Standards should be covered throughout the various units of the curriculum.

Standards for Mathematical Practices

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MP.4	Model with Mathematics.	<ul style="list-style-type: none"> ● 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
MP.5	Use appropriate tools strategically.	<ul style="list-style-type: none"> ● 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
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		<ul style="list-style-type: none"> ● Use clear definitions, state the meaning of symbols and are careful about specifying units of measure and labeling axes ● Calculate accurately and efficiently
MP.7	Look for and make use of structure.	<ul style="list-style-type: none"> ● 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
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9.2.8.B.1 Research careers within the 16 Career Clusters and determine attributes of career success.

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Evidence of Student Learning

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Knowledge and Skills	
Content	Skills
<p><i>Students will know...</i></p> <ul style="list-style-type: none"> ● How to graph exponential and logarithmic functions and e ● How to simplify and evaluate logarithms using the properties. ● How to solve exponential and logarithmic equations. 	<p><i>Students will be able to..</i></p> <ul style="list-style-type: none"> ● Explain why the graphs of exponentials and logarithms do not cross an axis or asymptote. ● Examine a real-life situation and determine if an exponential or logarithmic model can be used. ● Solve exponential and logarithmic equations to evaluate a

<ul style="list-style-type: none"> ● How to model real-life problems in a variety of content areas with exponential and logarithmic functions. 	<p>moment real-life situation.</p>
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Instructional Plan

Suggested Activities	Resources
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<p> www.ixl.com www.purplemath.com www.khanacademy.com www.brightstorm.com www.coolmath.com </p>	<ul style="list-style-type: none"> ● Graphing Calculator ● Microsoft Excel/PowerPoint ● Teacher-made tests, worksheets, warm-ups, and quizzes ● Computer software to support unit ● Smart board ● Document camera ● www.ixl.com ● www.purplemath.com ● www.brightstorm.com ● www.coolmath.com
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MODIFICATIONS

<p><i>English Language Learners</i></p> <ul style="list-style-type: none"> ● Provide clear and specific directions ● Allow for alternate forms of responses- drawing or speaking instead of writing to demonstrate knowledge when you are not specifically assessing writing ● Provide class notes ahead of time to allow students to preview material and increase comprehension ● Provide extended time

- Model directions and provide gestures to increase understanding
- Simplify written and verbal instructions
- Allow the use of an online dictionary to look up the definition and hear the pronunciation of unknown words
- Create a nurturing environment with structured routines
- Teach study skills
- Gather materials such as visuals, models, manipulatives, videos and other tangible referents to contextualize the lesson.

Special Education

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- Provide written directions with models and diagrams when possible
- Utilize graphic organizers
- Assign peer tutor
- Provide manipulatives
- Frequently check for understanding
- Provide immediate praise and feedback
- Have student repeat directions to check for understanding
- Create a nurturing environment with structured routines

504

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Gifted and Talented

- Extension activities
- Opportunities for Critical Thinking
- Problem Solving/Design Challenges
- Technology Integration
- Student Choice Activities
- Student Driven Activities
- Group Projects
- Tiered Activities

Students at Risk of School Failure

- Extended Time
- Flexible Grouping
- Small Group Instruction
- Peer Buddies
- Graphic Organizers
- Chunking Information
- Scaffolded Questioning
- Tiered Activities
- Manipulatives

- Build Background/Vocabulary
- Math Word Wall/Word Bank
- Modified Assignments
- Gradual Release Model
- Preferential Seating
- Visual Cues/Models
- Technology Integration
- Assistive Technology

Core Instructional and Supplemental Materials

- PreCalculus Text
- www.kutasoftware.com
- Text Support Materials

Teacher Notes:

Unit 4: Polynomial and Rational Functions

Duration: 30 Days

Standards/Learning Targets

Focus Standards (Major Standards)

A-APR-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-SSE-1 Interpret expressions that represent a quantity in terms of its context.

a. Interpret parts of an expression, such as terms, factors, and coefficients.

b. Interpret complicated expressions by viewing one or more of their parts as a single entity. *For example, interpret $P(1+r)^n$ as the product of P and a factor not depending on P .*

A-SSE-2 Use the structure of an expression to identify ways to rewrite it. *For example, see $x^4 - y^4$ as $(x^2)^2 - (y^2)^2$, thus recognizing it as a difference of squares that can be factored as $(x^2 - y^2)(x^2 + y^2)$.*

A-SSE-3 Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

a. Factor a quadratic expression to reveal the zeros of the function it defines.

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

F-IF-8 a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.

Supporting and Additional Standards

F-IF-7 d. Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior

The following Standards for Mathematical Practice and select New Jersey Student Learning Standards should be covered throughout the various units of the curriculum.

Standards for Mathematical Practices

MP.1	Make sense of problems and persevere in solving them	<ul style="list-style-type: none">● 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?”
MP.2	Reason abstractly and quantitatively.	<ul style="list-style-type: none">● Make sense of quantities and their relationships in problems● Learn to contextualize and de-contextualize● Create coherent representations of problems
MP.3	Construct viable arguments and critique the reasoning of others.	<ul style="list-style-type: none">● 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
MP.4	Model with Mathematics.	<ul style="list-style-type: none">● 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
MP.5	Use appropriate tools strategically.	<ul style="list-style-type: none">● 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

MP.6	Attend to precision.	<ul style="list-style-type: none"> ● 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
MP.7	Look for and make use of structure.	<ul style="list-style-type: none"> ● 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
MP.8	Look for and express regularity in repeated reasoning.	<ul style="list-style-type: none"> ● Notice if calculations are repeated and look both for general methods and shortcuts ● In solving problems, maintain oversight of the process while attending to detail ● Evaluate the reasonableness of their immediate results is certain patterns and structures

Primary Interdisciplinary Connections: Infused within the unit are connections to the NJSLS for Mathematics, Language Arts Literacy

WHST.11-12.10. Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences.

● **TECHNOLOGY STANDARDS and APPLY explicit standards as appropriate.**

- 8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
 - A. Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts,

systems and operations

- B. Creativity and Innovation: Students demonstrate creative thinking, construct knowledge and develop innovative products and process using technology.
- E: Research and Information Fluency: Students apply digital tools to gather, evaluate, and use information.
- F: Critical thinking, problem solving, and decision making: Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.

21st Century Themes/Careers: Through instruction in life and career skills, all students acquire the knowledge and skills needed to prepare for life as citizens and workers in the 21st century. For further clarification see NJ World Class Standards at www.NJ.gov/education/aps/cccs/career/

CRP2. Apply appropriate academic and technical skills.

CRP4. Communicate clearly and effectively and with reason.

CRP6. Demonstrate creativity and innovation.

CRP7. Employ valid and reliable research strategies.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

CRP11. Use technology to enhance productivity.

9.2.8.B.1 Research careers within the 16 Career Clusters and determine attributes of career success.

9.2.12.C.3 Identify transferable career skills and design alternate career plans

Evidence of Student Learning

Performance Tasks/Use of Technology:

- www.mathxforschool.com
- www.khanacademy.com
- www.desmos.com
- www.kahoot.com
- www.quizizz.com

Other Assessments

Formative

- Observation
- Homework
- Class Participation
- Whiteboards/communicators
- Think-Pair-Share

	<ul style="list-style-type: none"> ● Do-Now ● Notebook Checks ● Writing Prompts ● Exit Tickets ● Classroom Games ● Self-assessment <p>Summative</p> <ul style="list-style-type: none"> ● Chapter/Unit Test ● Quizzes ● Presentations ● Unit Projects <p>Benchmark</p> <ul style="list-style-type: none"> ● Quarterly Benchmark Assessment ● Midterm Assessment <p>Alternative</p> <ul style="list-style-type: none"> ● Portfolio Project ● Modified assignments
Knowledge and Skills	
Content	Skills
<p><i>Students will know...</i></p> <ul style="list-style-type: none"> ● How to graph quadratic and polynomial functions. ● How to divide polynomials. ● How to factor polynomials. ● How to find all the zeros of a polynomial. ● How to model real-life problems in a variety of content 	<p><i>Students will be able to..</i></p> <ul style="list-style-type: none"> ● Explain the relevance of the maximum and minimum values of quadratic and polynomial graphs ● Analyze real-life situation and determine if a quadratic or polynomial model can be used. ● Calculate the zeros of a polynomial utilizing a variety of

areas with quadratic and polynomial functions.

different methods.

Instructional Plan

Suggested Activities

Resources

www.ixl.com
www.purplemath.com
www.khanacademy.com
www.brightstorm.com
www.coolmath.com

- Graphing Calculator
- Microsoft Excel/PowerPoint
- Teacher-made tests, worksheets, warm-ups, and quizzes
- Computer software to support unit
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MODIFICATIONS

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- Create a nurturing environment with structured routines

- Teach study skills
- Gather materials such as visuals, models, manipulatives, videos and other tangible referents to contextualize the lesson.

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504

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Gifted and Talented

- Extension activities
- Opportunities for Critical Thinking
- Problem Solving/Design Challenges
- Technology Integration
- Student Choice Activities
- Student Driven Activities
- Group Projects
- Tiered Activities

Students at Risk of School Failure

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- Scaffolded Questioning
- Tiered Activities
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- Build Background/Vocabulary
- Math Word Wall/Word Bank
- Modified Assignments

- Gradual Release Model
- Preferential Seating
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- Technology Integration
- Assistive Technology

Core Instructional and Supplemental Materials

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- Text Support Materials

Teacher Notes:

Unit 5: Analytic Geometry	Duration: 20 Days
Standards/Learning Targets	
Focus Standards (Major Standards)	
G-GPE-1 Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation	
G-GPE-2 Derive the equation of a parabola given a focus and directrix	

Supporting and Additional Standards

G-GPE-3 Derive the equations of ellipses and hyperolas given the foci, using the fact that the sum or difference of distances from the foci is constant

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MP.4	Model with Mathematics.	<ul style="list-style-type: none">● 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
MP.5	Use appropriate tools strategically.	<ul style="list-style-type: none"> ● 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
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Evidence of Student Learning

Performance Tasks/Use of Technology:

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- www.khanacademy.com
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Other Assessments

Formative

- Observation
- Homework
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Summative

- Chapter/Unit Test
- Quizzes
- Presentations
- Unit Projects

Benchmark

- Quarterly Benchmark Assessment
- Midterm Assessment

Alternative

- Portfolio Project
- Modified assignments

Knowledge and Skills

Content	Skills
<p><i>Students will know...</i></p> <ul style="list-style-type: none"> ● How to graph parabola with the vertex, axis of symmetry, directrix and focus. ● How to graph an ellipse including the foci, center, major axis and minor axis. ● How to graph a circle with center and radius. ● How to graph a hyperbola including the foci, vertex and asymptotes. ● How to model real-life problems in a variety of content areas with conics. 	<p><i>Students will be able to..</i></p> <ul style="list-style-type: none"> ● Explain the purpose of the key characteristics of each graph of a conic. ● Analyze a real-life situation and determine if a conic can be used to model that situation. ● Give many areas in science and construction where conics are used.
Instructional Plan	
Suggested Activities	Resources
<p> www.ixl.com www.purplemath.com www.khanacademy.com www.brightstorm.com www.coolmath.com </p>	<ul style="list-style-type: none"> ● Graphing Calculator ● Microsoft Excel/PowerPoint ● Teacher-made tests, worksheets, warm-ups, and quizzes ● Computer software to support unit ● Smart board ● Document camera ● www.ixl.com ● www.purplemath.com ● www.brightstorm.com ● www.coolmath.com

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Teacher Notes:

