ROBBINSVILLE PUBLIC SCHOOLS

OFFICE OF CURRICULUM AND INSTRUCTION

HIGH SCHOOL MATHEMATICS

PRE-CALCULUS

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Course Philosophy

The New Jersey Core Curriculum Content Standards for Mathematics set a lofty goal for the mathematics curriculum when they state "all of our children, as well as our state and our nation, will be better served by higher expectations, by curricula that go far beyond basic skills and include a variety of mathematical models, and by programs which devote a greater percentage of instructional time to problem-solving learning." The *Common Core Standards* seek to narrow the focus and foster a coherent progression of skills and concepts across grade levels. In addition, the *Common Core Standards* require both mastery of conceptual understanding and procedural fluency. We seek to adopt these practices and share the nation's goal to enrich mathematics education.

It is our belief that the content of a mathematics course is brought to life for the student when it involves the student in investigating real-world applications using inductive and deductive reasoning while working cooperatively with others and communicating mathematically. This is reinforced by the use of technology and the use of real world data. In order to be competitive in today's global, information-based economy, students' mathematics experience must go beyond computation so that they are able to solve real problems, reason effectively, make logical connections, and think mathematically.

The Principles and Standards for School Mathematics published by the National Council of Teachers of Mathematics is a guiding document in the development and articulation of mathematics programs in Robbinsville. A central theme of this document is connections. According to *Principles and Standards*, "Students develop a much richer understanding of mathematics and its applications when they can view the same phenomena from multiple mathematical perspectives. One way to have students see mathematics in this way is to use instructional materials that are intentionally designed to weave together different content strands. Another means of achieving content integration is to make sure that courses oriented toward any particular content area (such as algebra or geometry) contain many integrative problems—problems that draw on a variety of aspects of mathematics, that are solvable using a variety of methods, and that students can access in different ways." (NCTM)

Through engagement in mathematics learning outlined in this curriculum, the students of Robbinsville Public Schools will acquire the mathematical skills, understandings and reasoning to be successful citizens of the world.

Course Description

Pre-Calculus
Grade: 11-12
5 Credits Year
Prerequisite(s): *Grade of A or B in Algebra II*
This college preparatory course covers all the fundamental topics that prepare students for calculus. Emphasis is on problem solving and the study of relations, functions, equation solving and graphing. The functions studied include polynomial, conics, rational, exponential, logarithmic, trigonometric, and inverse functions.

Core and Supplemental Instructional Materials

Core Materials	Supplemental Materials
• Textbook	• Graphing websites (geogebra.com, desmos.com, etc.) • Graphing calculator • Online Resources • Guided Notes • Mimeo

Social Emotional Learning Connections
Below are the five core SEL Competencies as outlined by CASEL, and examples of how each may be addressed within this curriculum
Self-awareness: The ability to accurately recognize one's emotions and thoughts and their influence on behavior. This includes accurately assessing one's strengths and limitations and possessing a well-grounded sense of confidence and optimism. **Example 1:** Students will discuss "what went well" at the end of class to assess their own understanding. **Example 2:** Students will analyze their own errors and determine *why* they made a mistake so they can determine their level of understanding, strengths, and areas that need improvement in the unit.
Self-management: The ability to regulate one's emotions, thoughts, and behaviors effectively in different situations. This includes managing stress, controlling impulses, motivating oneself, and setting and working toward achieving personal and academic goals. **Example 1:** Students will have projects that will require steps and checkpoints. Completing the steps on time and remaining on task will require both self-motivation and regulation.

Example 2: Students will be given ample time in class to complete independent and group work. They must manage their time appropriately in order to keep up with the pace of the class.

Social awareness: The ability to take the perspective of and empathize with others from diverse backgrounds and cultures, to understand social and ethical norms for behavior, and to recognize family, school, and community resources and supports.

Example 1: Students will research other cultures and how different traditions and ways of life contribute to disease spread or population growth
Example 2: Students will learn about each other's diverse backgrounds and where to go at school and in the community if they need support.

Relationship skills: The ability to establish and maintain healthy and rewarding relationships with diverse individuals and groups. This includes communicating clearly, listening actively, cooperating, resisting inappropriate social pressure, negotiating conflict constructively, and seeking and offering help when needed.

Example 1: Instruct students how to effectively communicate with the teacher when conflicts arise. For example, if there is a conflict with academics and extracurricular activities, they will learn to be proactive and discuss how to resolve the conflict with the teacher.
Example 2: Students will work side by side with one another in order to discover theorems and solve problems

Responsible decision-making: The ability to make constructive and respectful choices about personal behavior and social interactions based on consideration of ethical standards, safety concerns, social norms, the realistic evaluation of consequences of various actions, and the well-being of self and others.

Example 1: Instruct students to embrace mistakes and not to criticize others when taking risks with new material
Example 2: Teach students that every action, whether intentional or not, has consequences, and that they should be mindful of what they say and how they act around others

Educational Technology

Standards:(8.1.12.A.2, 8.1.12.A.5, 8.1.12.C.1, 8.1.12.F.1)

- **8.1.12.A.2 Select and use applications effectively and productively.** Produce and edit a multi-page digital document for a commercial or professional audience and present it to peers and/or professionals in that related area for review.
- **8.1.12.A.5 Select and use applications effectively and productively.** Create a report from a relational database consisting of at least two tables, describe the process, and explain the report results.
    - Example: Students can electronically submit a slide presentation on a research topic of their choosing and present it to their peers and teachers. They must include at least two tables and three graphs in their presentation and use them to help explain their results.

- **8.1.12.C.1 Contribute to project teams to produce original works or solve problems** Develop an innovative solution to a real world problem or issue in collaboration with peers and experts, and present ideas for feedback through social media or in an online community
    - Example: Students discuss how disease can spread and how exponential growth is found in a real world setting. Students will research ways to reduce rates of infection and present ideas to the class.

- **8.1.12.F.1 Plan and manage activities to develop a solution or complete a project.** Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and/or social needs.
    - Example: Students can use online graphing tools to explore trigonometric, exponential, and logarithmic graphs. They can use these resources to transform parent functions and draw conclusions about the graphs and trends.

Career Ready Practices

Standards: (CRP1, CRP2, CRP4, CRP8, CRP11)

CRP1. Act as a responsible and contributing citizen and employee Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.

Example: Students will demonstrate the responsibilities associated with being a member of a community when engaging collaboratively during sharing in pairs/trios, and participating in whole group discussions. Examples may include jigsaw and fishbowl activities.

CRP2. Apply appropriate academic and technical skills.

Example: Students will demonstrate the skills learned in PreCalculus when engaging collaboratively during sharing in pairs/trios and participating in whole group discussions. Examples may include jigsaw and fishbowl activities, as well as projects and formal assessments.

CRP4. Communicate clearly and effectively and with reason. Communication is a key factor in PreCalculus. Students are aware that their words and techniques they use to convey their thoughts are crucial to audience understanding.

Example: Students will demonstrate clear and effective communication through written and oral assignments and assessments.

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

Example: Students will demonstrate critical thinking as they determine the best methods to solve free response and multiple choice problems.

CRP11. Use technology to enhance productivity.

Example: Students will use technology to enhance productivity on a regular basis as they use graphing calculators and other graphing software to complete calculus problems.

Robbinsville Ready 21st Century Skill Integration

The following skills will be embedded throughout the curriculum and instruction of this course.

Collaborative Team Member: Robbinsville students will learn more by working together than in isolation. As educational theorist Lev Vygotsky advocated, learning is a social process. Many workplaces today encourage employees to work in teams to solicit diverse perspectives, brainstorm new ideas and/or products, and solve problems. Further, collaboration fosters interpersonal relationships, self-management skills, cooperation, and a sense of collective responsibility. Collaborative team members are able to work with diverse groups of people who hold a variety of perspectives.

Effective Communicator: Robbinsville students must be able to clearly articulate their ideas orally, in writing, and across various media in order to successfully connect to the world around them. As the world becomes increasingly globalized, communication is more than just sharing one's ideas. Effective communicators are able to communicate their convictions, actively listen and analyze others' work to identify perspective and/or potential bias.

Emotionally Intelligent Learner: Robbinsville students who are emotionally intelligent learn to be empathetic, demonstrate integrity and ethical behavior, are kind, are self-aware, willing to change, and practice self-care. They are better able to cope with the demands of the 21st century digital society and workplace because they are reliable, responsible, form stable and healthy relationships, and seek to grow personally and professionally. Emotionally intelligent people are able to manage their emotions, work effectively on teams and are leaders who can grow and help to develop others.

Informed and Involved Citizen: Robbinsville students need to be digital citizens who are civically and globally aware. The concept of what it means to be "literate" has evolved along with 21st century technological and cultural shifts. Our progressive vision of literacy entails having our students explore real world problems in the classroom. Informed and involved citizens are able to safely and accurately communicate with people all around the world and are financially, environmentally and informationally literate.

Innovative Thinker: Robbinsville students must encompass innovative thinking skills in order to be successful lifelong learners in the 21st century world. As stated by Karl Fisch and Scott McLeod in the short film Shift Happens, "We are currently preparing students for jobs that don't yet exist . . . using technologies that haven't been invented . . . in order to solve problems we don't even know are problems yet." Innovative thinkers are able to think analytically, solve problems critically, creatively engage in curiosity and tinkering, and demonstrate originality.

Resilient and Self-Directed Learner: Robbinsville students need to take risks and ultimately make independent and informed decisions in an ever-changing world. Author of Life, the Truth, and Being Free, Steve Maraboli stated, "Life doesn't get easier or more forgiving, we get stronger and more resilient." Self-directed scholars of the 21st century are able to set goals, initiate resolutions by seeking creative approaches, and adjust their thinking in light of difficult situations. Resilient students are able to take risks without fear of failure and overcome setbacks by utilizing experiences to confront new challenges. Resilient and self directed scholars will consistently embrace opportunities to initiate solutions and overcome obstacles.

Robbinsville Public Schools
Scope, Sequence, Pacing and Assessment

PreCalculus

Unit Title	Unit Understandings and Goals	Recommended Duration/ Pacing	Assessments			
			Formative	**Summative**	**Common Benchmark Assessments** (mid-course and end of course **only**)	**Alternative Assessments** (projects, etc. **when appropriate**)
Unit 1: Functions and Their Graphs	• Relations and functions can be represented algebraically, numerically, and graphically. • The domain of a function changes when two or more functions are graphically or algebraically combined or composed. • A function and its inverse undo each other using the property that the input and output of function respectively become the output and input of an inverse function. • The properties of functions and function operations are used to model and analyze real-world applications and quantitative relationships.	9 blocks	Unit Quizzes Open-Ended Questions Class Discussion In-class Assignments: (Group-work, Mini-Projects, Practice Material) Observations Exit Slips Quizzes Chapter Test	Unit Test with Varying Types of Questions Projects Authentic Assessments Core Assessments	Cumulative Exam Final Exam	Application Projects Graphing explorations Anticipatory Set/Warm Up Homework Quizzes Open-Ended Leading Questions Highlighting Prior Knowledge

Unit 2: Polynomials, Quadratics, and Rational Functions	• There is a direct relationship between the graphs of polynomial and rational functions in terms of algebraically solving their equations when equal to zero. • Technology allows us to approximate solutions easily, whereas solving for solutions algebraic gives us exact answers. We need to know when the difference between the two is relevant in a problem.	9 blocks	Unit Quizzes Open-Ended Questions Class Discussion In-class Assignments: (Group-work, Mini-Projects, Practice Material) Observations Exit Slips Quizzes Chapter Test	Unit Test with Varying Types of Questions Projects Authentic Assessments Core Assessments	Cumulative Exam Final Exam	Application Projects Graphing explorations Anticipatory Set/Warm Up Homework Quizzes Open-Ended Leading Questions Highlighting Prior Knowledge
Unit 3: Exponential and Logarithmic Functions	• Data that multiplies by a constant factor increases and decreases rapidly over time is represented by an exponential equation • All exponential and logarithmic functions can be written in either exponential or logarithmic form • Predictions for population, carbon dating, compound interest, and cooling are all examples of how exponential and logarithmic models are used to interpret real world data	10 blocks	Unit Quizzes Open-Ended Questions Class Discussion In-class Assignments: (Group-work, Mini-Projects, Practice Material) Observations Exit Slips Quizzes	Unit Test with Varying Types of Questions Projects Authentic Assessments Core Assessments	Cumulative Exam Final Exam	Application Projects Graphing explorations Anticipatory Set/Warm Up Homework Quizzes Open-Ended Leading Questions Highlighting Prior Knowledge

			Chapter Test			
Unit 4: Trigonometric Functions	• Periodic behavior is behavior that repeats over intervals of equal length. • The measure of an angle is the input for two important functions called sine and cosine. • You can translate periodic functions in the same way that you translate other functions. • Sine, cosine, and tangent have reciprocals.	12 blocks	Unit Quizzes Open-Ended Questions Class Discussion In-class Assignments: (Group-work, Mini-Projects, Practice Material) Observations Exit Slips Quizzes Chapter Test	Unit Test with Varying Types of Questions Projects Authentic Assessments Core Assessments	Cumulative Exam Final Exam	Application Projects Graphing explorations Anticipatory Set/Warm Up Homework Quizzes Open-Ended Leading Questions Highlighting Prior Knowledge
Unit 5: Analytic Trigonometry	• Given the relationships between the six basic trigonometric functions, it is possible to simplify the trigonometric expressions, making it easier to work with for mathematical application. • Mathematics is a study of patterns, and the goal of algebra and trigonometry is to simplify complex patterns into easy forms that are more manageable. Trigonometric identities are just an extension of this basic mathematical skill.	9 blocks	Unit Quizzes Open-Ended Questions Class Discussion In-class Assignments: (Group-work, Mini-Projects, Practice Material) Observations Exit Slips Quizzes	Unit Test with Varying Types of Questions Projects Authentic Assessments Core Assessments	Cumulative Exam Final Exam	Application Projects Graphing explorations Anticipatory Set/Warm Up Homework Quizzes Open-Ended Leading Questions Highlighting Prior Knowledge

			Chapter Test			
Unit 6: Additional Topics in Trigonometry: Law of Sines/Law of Cosines	• Trigonometry goes beyond the right triangle. • Sides and angles of all triangles can be found, providing solutions to real-world problems.	5 blocks	Unit Quizzes Open-Ended Questions Class Discussion In-class Assignments: (Group-work, Mini-Projects, Practice Material) Observations Exit Slips Quizzes Chapter Test	Unit Test with Varying Types of Questions Projects Authentic Assessments Core Assessments	Cumulative Exam Final Exam	Application Projects Graphing explorations Anticipatory Set/Warm Up Homework Quizzes Open-Ended Leading Questions Highlighting Prior Knowledge
Unit 7: Additional Topics in Trigonometry: Vectors	• Trigonometry can be extended beyond geometric applications into a variety of areas, such as physics and the complex number system. Trigonometry can also be used to help develop non-rectangular or function graphing systems.	5 blocks	Unit Quizzes Open-Ended Questions Class Discussion In-class Assignments: (Group-work, Practice Material) Observations Exit Slips Quizzes	Unit Test with Varying Types of Questions Projects Authentic Assessments Core Assessments	Cumulative Exam Final Exam	Application Projects Graphing explorations Anticipatory Set/Warm Up Homework Quizzes Open-Ended Leading Questions Highlighting Prior Knowledge

Unit 8: Matrices	• We can use algebraic techniques to break down a complicated expression into smaller and more manageable parts. • Knowing how to use matrices in the calculator can support algebraic techniques and make solving problems simpler.	7 blocks	Unit Quizzes Open-Ended Questions Class Discussion In-class Assignments: (Group-work, Practice Material) Observations Exit Slips Quizzes Chapter Test	Unit Test with Varying Types of Questions Projects Authentic Assessments Core Assessments	Cumulative Exam Final Exam	Application Projects Graphing explorations Anticipatory Set/Warm Up Homework Quizzes Open-Ended Leading Questions Highlighting Prior Knowledge
Unit 9: Conic Sections	• Conic Sections are formed when a plane intersects a cone. • There are four types of curves known as conic sections: parabolas, circles, ellipses, and hyperbolas. Each curve has its own distinct shape and properties. • Conic Sections reflect real-world phenomena.	8 blocks	Open-Ended Questions Class Discussion In-class Assignments: (Group-work, Mini-Projects, Practice Material) Observations Exit Slips Quizzes Chapter Test	Unit Test with Varying Types of Questions Projects Authentic Assessments Core Assessments	Cumulative Exam Final Exam	Application Projects Graphing explorations Anticipatory Set/Warm Up Homework Quizzes Open-Ended Leading Questions Highlighting Prior Knowledge

Robbinsville Public Schools

Unit #1: Functions and Their Graphs

Enduring Understandings:	**Essential Questions:**
● Relations and functions can be represented algebraically, numerically, and graphically. ● The domain of a function changes when two or more functions are graphically or algebraically combined or composed. ● A function and its inverse undo each other using the property that the input and output of function respectively become the output and input of an inverse function. ● The properties of functions and function operations are used to model and analyze real-world applications and quantitative relationships.	● What characteristics of a function are based on its domain? ● How is the domain affected when a function is algebraically manipulated? ● How do the parameters a, b, c and d of a transformed parent function affect the domain and range of a function?

Interdisciplinary Connections

Literacy SL.9-10.1.B Collaborate with peers to set rules for discussions (e.g. informal consensus, taking votes on key issues, presentation of alternate views); develop clear goals and assessment criteria (e.g. student developed rubric) and assign individual roles as needed.
Example: Students, when preparing and conducting peer and class error analysis, assign roles and set group norms for conducting respectful and constructive feedback.

9.4.12.CT.2: Explain the potential benefits of collaborating to enhance critical thinking and problem solving
Example: Students will work together to review prerequisite problems from the summer packet

Career/Real World Connections

Example: Functions are found all over the real world, anywhere there is an input and an output. Some examples include: A circle's circumference is a function of its diameter, the length of a person's shadow along the floor is a function of their height, and when driving a car, location is a function of time. Students will create functions based on real world quantitative relationships and examine their inverse relationships.

Guiding / Topical Questions with Specific Standards		**Content, Themes, Concepts, and Skills**	**Teaching Strategies**	**Instructional Resources and Materials**	**Assessment Strategies**
A-REI.B.4 A-APR.D.6	How can we use factoring to simplify polynomials and rational expressions?	Factor polynomials. Divide polynomials using long and synthetic division.	Administer pre-test and reflection. Give a stations activity in which students check answers to their	Pre test and reflection. Summer packet answer key.	Written test/quiz Cooperative activities (rubrics) Notebooks

A-APR.D.7 F-IF.B.4	What characteristics of a graph should we be able to visually identify?	Simplify, multiply, and divide rational expressions by factoring and reducing. Identify key characteristics of graphs (domain, range, increasing interval, decreasing interval, constant interval, x-intercepts, y-intercept, maximum, and minimum) visually using interval notation where appropriate.	packet and work on additional problems in their weak areas. Provide videos for students to look up similar problems. Pair up students to work together and guide each other. Work with small groups as needed.	Videos on chromebooks. Additional practice problems and homework.	Class participation Homework/written assignments Response to discussion questions Anticipatory Sets/Do Now Problems Diagnostic Assessments to determine readiness Closure question/ Exit Slips Oral presentations Special projects
A-APR.D.6 A-APR.D.7 F-IF.B.4	What are the similarities and differences between the parent functions? How do the parameters a, b, c and d affect the graph of a function? How can one function be created from several functions on a specified domain?	Graph transformations of the parent functions including quadratic, square root, cubic, cube root, absolute value, greatest integer and reciprocal functions. Graph piecewise functions. Write the equation of a parent and piecewise functions based on a given graph.	Anticipatory sets to measure background knowledge and engage students Use guided and independent practice activities Use the Mimeo, whiteboard, and worksheets to reinforce the concepts Use cooperative learning activities Use discovery based learning activities that require students to make conjectures and investigate patterns Use whiteboards to show immediate feedback on questions Use colored pencils to visually distinguish between the pieces of a piecewise function.	Worksheets and sample problems to analyze step-by-step solutions of the problems Mimeo lessons www.desmos.com www.ixl.com Geometer's Sketchpad GeoGebra TI Smart View with TI 84 Graphing Calculators	

F-IF.A.1 F-IF.A.2 F-IF.B.5	How can you find the domain of a function based on its algebraic properties?	Determine the domain of a function algebraically.	Same as above Have students first graph the problems to find the connection between the graphical and algebraic domain.		
F-BF.A.1b F-BF.A.1c	When two or more functions are combined, how does the domain of the combined function change from the domain of the individual functions? What notation is used to specify how to combine and compose functions algebraically and numerically?	Add, subtract, multiply, and divide two functions algebraically and for a specified value. State the domain of a combined function. Compose functions algebraically and for a specified value. State the domain of a composite function.	Same as above Use color to reinforce the difference between the inner and outer function Create metaphors to describe the idea of a composition		
F-BF.B.4a F-BF.B.4b	What is the relationship between a function and its inverse?	Find the inverse of a function algebraically. Determine if the inverse of a given function is a function using the horizontal line test. Prove functions are inverses using compositions.	Same as above Create a function. Find its inverse and use the composition test to verify your answer.		

Robbinsville Public Schools

Unit #2: Polynomials, Quadratics, and Rational Functions

Enduring Understandings:	**Essential Questions**
● There is a direct relationship between the graphs of polynomial and rational functions in terms of algebraically solving their equations when equal to zero. ● Technology allows us to approximate solutions easily, whereas solving for solutions algebraic gives us exact answers. We need to know when the difference between the two is relevant in a problem.	● How are the techniques for solving a quadratic applied to solving polynomial or rational function? ● What are the relationships between the graphs of different polynomial and rational functions?

Interdisciplinary Connections

Tech 8.2.12.A.3 The relationships among technologies and the connections between technology and other fields of study
Example: Students will use technology to graph multiple function types and analyze, compare and contrast the graphs

9.3.12.BM-MGT.2 Access, evaluate, and disseminate information for business decision making.
Example: Students will access, evaluate, and disseminate information given by polynomials to optimize profit for businesses

Career/Real World Connections

Example: Since polynomials are used to describe curves of various types, people use them in the real world to graph curves. For example, roller coaster designers may use polynomials to describe the curves in their rides. Additionally, polynomials are used in physics to describe the trajectory of projectiles. Rational functions can represent direct, inverse, and joint variation in the real world. From anesthesia to economics, rational functions are used in multiple areas of study to help predict outcomes.

Guiding / Topical Questions with Specific Standards		**Content, Themes, Concepts, and Skills**	**Teaching Strategies**	**Instructional Resources and Materials**	**Assessment Strategies**
A-REI.B.4 A-SSE.B.3a N-CN.C.9 A-APR.B.2	How can you use the Zero Product Property to find solutions of quadratic equations? What methods are necessary to completely factor a higher order polynomial function?	Find the zeros of quadratics by factoring, completing the square or using the quadratic formula. Find the zeros of polynomials algebraically, by factoring or using synthetic or long division. Apply the Upper and Lower Bound Theorems, Descartes Rule of Signs,	Anticipatory sets to measure background knowledge and engage students Use guided and independent practice activities Use the Mimeo, whiteboard, and worksheets to reinforce the concepts	Worksheets and sample problems to analyze step-by-step solutions of the problems Textbook & associated materials Teacher created worksheets	Written test/quiz Cooperative activities (rubrics) Notebooks Class participation Homework/written assignments

	How many solutions can a quadratic equation have? What type are they?	Rational Root Theorem on polynomials to find zeros algebraically Apply the Fundamental Theorem of Algebra to graph and write equations of polynomials	Use cooperative learning activities Use discovery based learning activities that require students to make conjectures and investigate patterns Use whiteboards to show immediate feedback on questions	www.ixl.com Mimeo lessons Geometer's Sketchpad GeoGebra TI Smart View with TI 84 Graphing Calculators	Response to discussion questions Anticipatory Sets/Do Now Problems Diagnostic Assessments to determine readiness Closure question/ Exit Slips Oral presentations Special projects
N-CN.C.7	What patterns emerge when determining complex roots of a polynomial?	Find imaginary zeros of a polynomial or quadratic. Use the complex conjugate theorem to find remaining zeros of polynomials.	Same as above		
F-IF.C.7c F-IF.C.8a A-APR.B.3	How does the degree and leading coefficient of a polynomial affect the shape of the graph of the function? How does the multiplicity of the zeros or factors of a function affect the graph of the function?	Find the x intercept(s), y intercept, and end behavior of polynomials. Graph polynomials. Write equations of polynomials based on a graph or given characteristics.	Same as above Provide a template to assist with organization.		
F-IF.C.7d	What are the six characteristics of rational functions that help us to create their graphs? How are they found?	Determine vertical, asymptotes, horizontal or slant asymptotes, zero(s), y intercept, and removable discontinuities of rational functions. Graph rational functions. Write equations of rational functions based on a graph or given characteristics.	Same as above Use prompts as to what criteria needs to be found for rational functions. Create flashcards with instructions on how to find each characteristic of a rational function and use them to quiz each other.		

			Provide a template to assist with organization.		
A-REI. D.11 A-REI. A.2	What real world scenarios represent asymptotes in word problems?	Solve word problems that are modeled by rational functions. Use the calculator to solve rational and polynomial word problems using the intersect, zero, max/min, and value feature.	Same as above Use leveled practice activities		

Robbinsville Public Schools

Unit #3: Exponential and Logarithmic Functions

Enduring Understandings:	**Essential Questions**
● Data that multiplies by a constant factor increases and decreases rapidly over time is represented by an exponential equation ● All exponential and logarithmic functions can be written in either exponential or logarithmic form ● Predictions for population, carbon dating, compound interest, and cooling are all examples of how exponential and logarithmic models are used to interpret real world data	● What are the characteristics of exponential and logarithmic models? ● How can you tell if the exponential or logarithmic form of a function is needed to solve a problem? ● When and how are exponential and logarithmic models used in everyday life?

Interdisciplinary Connections

Tech HS-ETS1-4. Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
Example: Students will graph exponential functions and discuss the real world factors that affect rate of growth or decay

Science HS-ESS3-6 Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity (i.e., climate change).
Example: Students will study the spread of disease to a population as exponential growth, and how human activity can affect spread

Career/Real World Connections

Example: Coronavirus is a global pandemic that exemplifies exponential growth. Human behavior, among other factors, can affect the rate of infection. Students can study different states and countries to see how their behavior changed the course of the virus

Guiding / Topical Questions with Specific Standards		**Content, Themes, Concepts, and Skills**	**Teaching Strategies**	**Instructional Resources and Materials**	**Assessment Strategies**
F-BF.B.3 A-SSE.B.3c F-IF.C.7e	What is the difference between the graphs of exponential growth and decay? What graphical properties do both exponential growth and exponential decay share? How do the transformation rules affect	Graph transformations of exponential functions. Graph transformations of logarithmic functions. Find the intercepts and other characteristics of exponential and logarithmic functions.	Anticipatory sets to measure background knowledge and engage students Use guided and independent practice activities Use the Mimeo, whiteboard, and worksheets to reinforce the concepts	Worksheets and sample problems to analyze step-by-step solutions of the problems Textbook & associated materials	Written test/quiz Cooperative activities (rubrics) Notebooks Class participation Homework/written assignments

F-LE. A.3	the graphs of exponential and logarithmic functions? How is a logarithmic graph related to an exponential graph?		Use cooperative learning activities Use discovery based learning activities that require students to make conjectures and investigate patterns Use whiteboards to show immediate feedback on questions Compare and contrast summary of exponential versus logarithmic graphs and their characteristics.	Teacher created worksheets www.desmos.com www.ixl.com Mimeo lessons Geometer's Sketchpad GeoGebra TI Smart View with TI 84 Graphing Calculators Same as above SAT 2 property problems	Response to discussion questions Anticipatory Sets/Do Now Problems Diagnostic Assessments to determine readiness Closure question/ Exit Slips Oral presentations Special projects
A-SSE .B.3c F-BF. B.5	How are exponential functions written in logarithmic form and vice versa? How are the properties of logarithmic functions related to the properties of exponents?	Convert between exponential and logarithmic form. Evaluate logarithms without a calculator. Condense and expand logarithms using their properties.	Same as above Split up the class into groups based on readiness. Work with a small group while the other group works with each other.		
F-LE. A.4	What are the different ways of solving exponential and logarithmic equations? How can you use the form of an exponential or logarithmic equation to determine the algebraic solving strategy?	Solve exponential and logarithmic equations. Apply algebraic techniques to solving exponential and logarithmic problems.	Same as above Classify types of exponential and logarithmic solving problems by solving technique.		

A-REI.D.11 F-IF.C.8b A-CED.A.1 F-BF.A.1b F-LE.B.5	Given a set of data, how can you represent the data with a mathematical model both algebraically and using technology? How can you create exponential or logarithmic models from word problems? How can you use solving techniques to solve for the missing variable in the problem? How can you verify algebraic techniques for solving exponential equations using technology?	Interpret an exponential model through the context of a word problem. Create exponential models (growth and decay) and logarithmic models for real world applications and use them to solve problems. Solve exponential and logarithmic word problems as a system of equations using technology to find the point of intersection.	Same as above Use expert jigsaw to have groups solve a word problem and teach another group their solution.		
S-ID.B.6a S-ID.C.8 F-IF.B.6	What determines if a mathematical model should be linear, quadratic, or exponential? What is another word for average rate of change? How and why is the average rate of change different based on the model chosen and the parameters used?	Compare and contrast linear models, quadratic, and exponential models. Find and interpret the average rate of change in the context of a real world problem using linear, quadratic, and exponential models.	Same as above		

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Unit #4: Trigonometric Functions

Enduring Understandings:	**Essential Questions**
● Periodic behavior is behavior that repeats over intervals of equal length. ● The measure of an angle is the input for two important functions called sine and cosine. ● You can translate periodic functions in the same way that you translate other functions. ● Sine, cosine, and tangent have reciprocals.	● How can the unit circle be used to calculate the six trigonometric functions? ● How can you model periodic behavior? ● What information does a trigonometric function provide of its graph? ● If you know the value of sin, how can you find the values of all of the other trigonometric functions at that same angle?

Interdisciplinary Connections

Tech HS-ETS1-4. Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
Example: Students will graph trigonometric functions on the computer

9.3.12.ED.2 Demonstrate effective oral, written, and multimedia communication in multiple formats and contexts.
Example: Students will derive special trig values a number of ways, including using special right triangles, the unit circle, and several shortcuts

Career/Real World Connections

Example: Trigonometry is used in oceanography in calculating the height of tides in oceans. The sine and cosine functions are fundamental to the theory of periodic functions, those that describe the sound and light waves. Jobs that may use trigonometry are navigation, land surveying, mathematics, science, engineering, architecture, cartography, computer graphics, machining, meteorology, music theory, oceanography, phonetics, seismology, and statistics.

Guiding / Topical Questions with Specific Standards		**Content, Themes, Concepts, and Skills**	**Teaching Strategies**	**Instructional Resources and Materials**	**Assessment Strategies**
F-TF. A.1 F-TF. A.2 G-SR T.C.6	What is a radian measure? How do you convert between degrees and radians? How do trigonometric functions relate to right angles?	Convert between degree and radian measure. Use angles to model and solve real world problems. Evaluate trigonometric functions of acute angles.	Anticipatory sets to measure background knowledge and engage students Use guided and independent practice activities Use the Mimeo, whiteboard, and worksheets to reinforce the concepts	Worksheets and sample problems to analyze step-by-step solutions of the problems Textbook & associated materials www.ixl.com	Written test/quiz Cooperative activities (rubrics) Notebooks Class participation Homework/written assignments

G-SR T.C.8	What is special about the trigonometric functions of 30, 45, and 60-degree angles? How does each trigonometric function relate to the others?	Use a calculator to evaluate trigonometric functions. Use the fundamental trigonometric identities. Solve real-world problems using trigonometric functions.	Use cooperative learning activities Use discovery based learning activities that require students to make conjectures and investigate patterns Use whiteboards to show immediate feedback on questions	Teacher created worksheets Mimeo lessons Geometer's Sketchpad GeoGebra TI Smart View with TI 84 Graphing Calculators www.desmos.com	Response to discussion questions Anticipatory Sets/Do Now Problems Diagnostic Assessments to determine readiness Closure question/ Exit Slips Oral presentations Special projects
F-TF. A.2 F-TF. A.3 F-TF. A.4	What is a unit circle? How do special right triangles help determine measures on the unit circle? How does the unit circle make it easier to determine values of trigonometric functions?	Identify a unit circle and describe its relationship to real numbers. Create a unit circle. Use special right triangles to determine values of trigonometric functions on the unit circle. Evaluate trigonometric functions using the unit circle.	Same as above Give students blank unit circles to fill out as do-nows. Partner practice activities on evaluating trigonometric functions. Emphasize connections between items on the unit circle to minimize memorization.		
F-TF. A.2 F-TF. A.3 F-TF. A.4	In what way do the coordinates on the unit circle differ based on which quadrant they are in? Can the coordinates in each quadrant determine how each trigonometric function is affected between different angles?	Determine which trigonometric functions are negative in each quadrant. Evaluate trigonometric functions of any angle. Find reference angles.	Same as above		

F-TF. B.5	How can the sine and cosine functions be graphed using the unit circle? What does it mean for a function to have continuous cycles? How do the constants in sin and cosine equations affect what the graph looks like? How many ways can sine and cosine by translated? How are the sine and cosine graphs related? What real world applications do sine and cosine functions have?	Sketch the parent graphs of the sine and cosine functions. Use amplitude and period to sketch graphs of sine and cosine functions. Graph reflections, midline, and phase shift translations of sine and cosine functions. Solve real-life problems involving directional bearings. Solve real-life problems involving harmonic motion.	Same as above Provide a template for critical information. Display parent graphs on a word wall. Give stations with leveled difficulty of problems. Describe characteristics of the graphs in real world language (uphill, downhill, flipped out, etc.)		
F-TF. B.5	How can the secant and cosecant functions be graphed using the unit circle? How do the constants in secant and cosecant equations affect what the graph looks like? How many ways can secant and cosecant be translated?	Sketch the parent graphs of the secant and cosecant functions. Use amplitude and period to sketch graphs of secant and cosecant functions. Graph reflections, midline, and phase shift translations of secant and cosecant functions. Solve real-life problems involving directional bearings. Solve real-life problems involving harmonic motion.	Same as above Provide a template for critical information. Display parent graphs on a word wall. Give stations with leveled difficulty of problems. Describe characteristics of the graphs in real world language (uphill, downhill, flipped out, etc.)		

	How are the secant and cosecant graphs related? How are the secant and cosecant graphs related to the sine and cosine graphs?				
F-TF. B.5	How can the tangent and cotangent functions be graphed using the unit circle? What differences do the tangent and cotangent graphs have to the other trigonometric functions? How do the constants in tangent and cotangent equations affect what the graph looks like? How many ways can tangent and cotangent be translated? How is the tangent and cotangent graph related?	Sketch the parent graphs of the tangent and cotangent functions. Use amplitude and period to sketch graphs of tangent and cotangent functions. Graph reflections, midline, and phase shift translations of tangent and cotangent functions. Solve real-life problems involving directional bearings. Solve real-life problems involving harmonic motion.	Same as above Provide a template for critical information. Display parent graphs on a word wall. Give stations with leveled difficulty of problems. Describe characteristics of the graphs in real world language (uphill, downhill, flipped out, etc.)		
F-TF. B.7	How can trigonometric functions be inverted? What does an inverse trigonometric function help you find?	Evaluate and graph inverse trigonometric functions. Solve real world problems using inverse trigonometric functions. Evaluate compositions of trigonometric functions.	Same as above Construct a chart of which quadrant applies to which inverse trigonometric function. Relate the graph of the inverse function to the quadrants you are using.		

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Unit #5: Analytic Trigonometry

Enduring Understandings:	**Essential Questions:**
● Given the relationships between the six basic trigonometric functions, it is possible to simplify the trigonometric expressions, making it easier to work with for mathematical application. ● Mathematics is a study of patterns, and the goal of algebra and trigonometry is to simplify complex patterns into easy forms that are more manageable. Trigonometric identities are just an extension of this basic mathematical skill.	● How can you identify and model periodic behavior? ● How can you verify trigonometric functions as an identity? ● How are trigonometric identities used to solve equations?

Interdisciplinary Connections

ELA NJSLSA.SL2. Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.
Example: Students will use previously learned identities to solve problems presented in new ways.

ELA NJSLSA.SL3. Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric.
Example: Students will discuss different ways to solve the same problem, and determine the best method when appropriate

Career/Real World Connections

Example: Students will have to use problem solving skills in this unit while collaborating with classmates. They will have to determine the most efficient method for solving and reason with their peers about each method. These are skills that they will need in any future job when working with coworkers.

Guiding / Topical Questions with Specific Standards		**Content, Themes, Concepts, and Skills**	**Teaching Strategies**	**Instructional Resources and Materials**	**Assessment Strategies**
A-SSE .A.1a A-SSE .A.1b A-SSE .A.2 F-TF. C.8	What is a trigonometric identity? How can we use problem solving skills to transform trigonometric expressions using identities?	Simplify trigonometric expressions using trigonometric identities. Apply algebraic techniques to trigonometric expressions. Describe the trigonometric identities.	Anticipatory sets to measure background knowledge and engage students Use guided and independent practice activities Use the Mimeo, whiteboard, and worksheets to reinforce the concepts	Worksheets and sample problems to analyze step-by-step solutions of the problems Textbook & associated materials www.ixl.com	Written test/quiz Cooperative activities (rubrics) Notebooks Class participation Homework/written assignments

			Use cooperative learning activities Use discovery based learning activities that require students to make conjectures and investigate patterns Use whiteboards to show immediate feedback on questions Administer puzzle proofs. Have students see, say, and write the trigonometric identities to memorize them. Create a checklist of simplifying strategies on a word wall	Teacher created worksheets Mimeo lessons TI Smart View with TI 84 Graphing Calculators Send a Problem Matching Game	Response to discussion questions Anticipatory Sets/Do Now Problems Diagnostic Assessments to determine readiness Closure question/ Exit Slips Oral presentations Special projects
A-SSE .A.1a A-SSE .A.1b A-SSE .A.2 F-TF. C.8	How can we use problem solving skills to transform trigonometric expressions using identities?	Verify trigonometric identities.	Same as above. Administer puzzle proofs. Create a checklist of simplifying strategies on a word wall		
A-SSE .A.1a A-SSE .A.1b A-SSE .A.2 F-TF. B.7	How can we use properties of inverse trigonometric functions and the unit circle to determine the angles that satisfy the trigonometric equations?	Solve trigonometric equations over a general and specified interval. Solve trigonometric equations with a multiple angle as an input. Apply algebraic techniques to solving trigonometric equations.	Same as above. Use a send a problem partner activity Show how the algebraic solution to equations is represented graphically		

	Can there be more than one solution to trigonometric equations? What are the strategies for solving trigonometric equations?	Use inverses to solve trigonometric equations for values that are not defined on the unit circle.			
A-SSE .A.2 F-TF. B.7 F-TF. C.9	How are trigonometric identities used to simplify and solve equations? How can we use sum and difference identities to evaluate trigonometric functions that are not on the unit circle?	Apply the sum and difference identities to simplifying and verifying problems. Evaluate trigonometric expressions numerically using sum and difference identities. Solve trigonometric equations using sum and difference identities.	Same as above. Administer a matching game between the problem and solution to sum and difference problems		

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Unit #6: Additional Topics in Trigonometry: Law of Sines/Law of Cosines

Enduring Understandings:	**Essential Questions**
● Trigonometry goes beyond the right triangle. ● Sides and angles of all triangles can be found, providing solutions to real-world problems.	● How are oblique triangles solved using the law of sines and law of cosines? ● In a real world situation, how can the law of sines and law of cosines be used?

Interdisciplinary Connections

9.4.12.CT.1: Identify problem-solving strategies used in the development of an innovative product or practice
Example: Students will have to determine how to solve the ambiguous case and how many triangles are possible

RST.11-12.7 Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
Example: Many mathematical applications of Law of Sines and Law of Cosines are given in word problem form and students must interpret the writing assign variables, and then solv

Career/Real World Connections

Example: Many real-world applications involve oblique triangles, where the Law of Sines and Cosines can be used to find certain measurements. The Law of Cosines is used to find a side, given an angle between the other two sides, or to find an angle given all three sides. For all other questions, the Law of Sines can be used.

Guiding / Topical Questions with Specific Standards		Content, Themes, Concepts, and Skills	Teaching Strategies	Instructional Resources and Materials	Assessment Strategies
G.SRT .D.11	What is an oblique triangle? How can we solve missing sides and angles of an oblique triangle? How can a triangle have no solution? How can a triangle have two solutions?	Use the law of sines to solve oblique triangles (AAS or ASA). Use the law of sines to solve oblique triangles (SSA). Use the law of sines to solve real world problems, including problems with bearings. Find the area of an oblique triangle using the law of sines.	Anticipatory sets to measure background knowledge and engage students Use guided and independent practice activities Use the Mimeo, whiteboard, and worksheets to reinforce the concepts Use cooperative learning activities Use discovery based learning activities that require students to make conjectures and investigate patterns Use whiteboards to show immediate feedback on questions Create a chart of all possible triangles and the strategy to solve them. Create leveled stations on solving word problems.	Worksheets and sample problems to analyze step-by-step solutions of the problems Textbook & associated materials Teacher created worksheets www.ixl.com Mimeo lessons Geometer's Sketchpad GeoGebra TI Smart View with TI 84 Graphing Calculators	Written test/quiz Cooperative activities (rubrics) Notebooks Class participation Homework/written assignments Response to discussion questions Anticipatory Sets/Do Now Problems Diagnostic Assessments to determine readiness Closure question/ Exit Slips Oral presentations Special projects

G.SRT .D.11	How can we find angles of a triangle using only its side lengths? How can the law of cosines be used to find the area of a triangle?	Use the law of cosines to solve oblique triangles (SSS or SAS). Use the law of cosines to solve real-world problems. Use Heron's Area Formula to find areas of triangles.	Same as above		

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Unit #7: Additional Topics in Trigonometry: Vectors

Enduring Understandings:	**Essential Questions**
● Trigonometry can be extended beyond geometric applications into a variety of areas, such as physics and the complex number system. Trigonometry can also be used to help develop non-rectangular or function graphing systems.	● How is trigonometry used in other fields of math and science?

Interdisciplinary Connections

Sci HS-PS2-1. Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.
Example: Students will use vectors to model motion of an object

Science HS-ESS2-3 Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.
Example: Students will use vectors to show flow of materials such as lava, water, or weather patterns

Career/Real World Connections

Example: Vectors are used to show both magnitude and direction in the real world and are often used to graphically represent weather patterns

Guiding / Topical Questions with Specific Standards		**Content, Themes, Concepts, and Skills**	**Teaching Strategies**	**Instructional Resources and Materials**	**Assessment Strategies**
N-VM. A.1	What are the characteristics of vectors? How is a vector represented graphically?	Sketch a vector on the coordinate plane. Write a vector in component form given the initial and terminal point or a graph.	Anticipatory sets to measure background knowledge and engage students Use guided and independent practice activities	Worksheets and sample problems to analyze step-by-step solutions of the problems	Written test/quiz Cooperative activities (rubrics) Notebooks

N-VM. A.2 N-VM. B.4c		Find the magnitude of vectors. Find the direction angle of a vector.	Use the Mimeo, whiteboard, and worksheets to reinforce the concepts Use cooperative learning activities Use discovery based learning activities that require students to make conjectures and investigate patterns Use whiteboards to show immediate feedback on questions Show what is a vector video clip from Despicable Me Give guided reading homework on vocabulary from the unit	Textbook & associated materials Teacher created worksheets www.ixl.com Mimeo lessons Geometer's Sketchpad GeoGebra TI Smart View with TI 84 Graphing Calculators http://illuminations.nctm.org/Activity.aspx?id=3536	Class participation Homework/written assignments Response to discussion questions Anticipatory Sets/Do Now Problems Diagnostic Assessments to determine readiness Closure question/ Exit Slips Oral presentations Special projects
N-VM. B.4a N-VM. B.4b N-VM. B.4c	How can vectors be represented in different ways? In what ways are unit vectors similar to the unit circle? How can vectors be added and subtracted graphically?	Apply the arithmetic of vectors as related to trigonometry, both graphically and numerically Determine the unit vector of a vector Write vectors as linear combinations Find the Dot Product of two vectors Find the angle between two vectors	Same as above		
N-VM. A.3	How are vectors used to represent real world situations?	Solve application problems involving velocity using vectors.	Same as above		

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Unit #8: Matrices

Enduring Understandings:	**Essential Questions**
• We can use algebraic techniques to break down a complicated expression into smaller and more manageable parts. • Knowing how to use matrices in the calculator can support algebraic techniques and make solving problems simpler.	• How can we use matrices to solve real world problems? • What are the pros and cons of using matrices to solve problems?

Interdisciplinary Connections

Tech 8.1.12.E.1 Evaluate and select information sources and digital tools based on the appropriateness for specific tasks.
Example: Students will use technology to set up and solve matrices when appropriate

ELA NJSLSA.SL4. Present information, findings, and supporting evidence such that listeners can follow the line of reasoning and the organization, development, and style are appropriate to task, purpose, and audience
Example: Students will determine when systems of equations should be solved graphically, algebraically, or using matrices

Career/Real World Connections

Example: Systems of equations in the real world (such as business or science) are often so complicated and full of variables that they cannot be solved by hand. So, students will learn to use matrices to solve such systems.

Guiding / Topical Questions with Specific Standards		**Content, Themes, Concepts, and Skills**	**Teaching Strategies**	**Instructional Resources and Materials**	**Assessment Strategies**
N-VM. C.6 N-VM. C.7 N-VM. C.8 A-REI .C.8	How can we perform matrix operations by hand and using the calculator? How are matrices used to organize information?	Add, subtract, and perform scalar multiplication on matrices Represent data using a matrix Solve scalar word problems using matrices	Anticipatory sets to measure background knowledge and engage students Use guided and independent practice activities Use the Mimeo, whiteboard, and worksheets to reinforce the concepts Use cooperative learning activities	Worksheets and sample problems to analyze step-by-step solutions of the problems Textbook & associated materials Teacher created worksheets www.ixl.com	Written test/quiz Cooperative activities (rubrics) Notebooks Class participation Homework/written assignments Response to discussion questions

A-REI .C.9			Use discovery based learning activities that require students to make conjectures and investigate patterns Use whiteboards to show immediate feedback on questions	Mimeo lessons Geometer's Sketchpad GeoGebra TI Smart View with TI 84 Graphing Calculators	Anticipatory Sets/Do Now Problems Diagnostic Assessments to determine readiness Closure question/ Exit Slips Oral presentations Special projects
N-VM. C.9 N-VM. C.10	When can matrices be multiplied? What properties of real numbers are maintained through matrix operations?	Multiply matrices using the calculator Find the inverse of matrix using the calculator Determine which algebraic properties hold true for matrix operations.	Same as above Have students self discover which matrices can be multiplied using examples Have students discover and/or prove which properties are true		
N-VM. C.6 A.REI. C.8 A.REI. C.9	How can we use matrices to solve real world problems that can be represented through a system of equations in two or more variables?	Solve systems of equations in up to three variables using matrices in the calculator Recognize special cases for solutions of systems of equations Solve real world problems using matrices	Same as above Expert jigsaw on practice problems the second day Make a summary chart of the special cases		
A.SSE. B.3	What is partial fraction decomposition?	Write the partial fraction form for the decomposition of a rational function Solve for the constants using matrices in partial fraction decomposition	Same as above Match the decomposition to the original problem Emphasize vocabulary to review the rules Show both algebraic and technological ways of solving		

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Unit #9: Conic Sections

Enduring Understandings:	**Essential Questions**
• Conic Sections are formed when a plane intersects a cone. • There are four types of curves known as conic sections: parabolas, circles, ellipses, and hyperbolas. Each curve has its own distinct shape and properties. • Conic Sections reflect real-world phenomena.	• How is each conic section related to a cone? • What properties does an equation have to graph a circle, ellipse, parabola, and hyperbola? • What applications can be drawn for the analysis of conic graphs?

Interdisciplinary Connections

NJSLSA.SL2. Integrate and evaluate information presented in diverse media and formats, including visually, quantitatively, and orally.
Example: Students will graph and/or describe conic sections given an equation, description, or graph.

Tech 8.2.12.A.3 The relationships among technologies and the connections between technology and other fields of study
Example: Students will use technology to graph multiple conic functions function types and analyze, compare and contrast the graphs given the equations

Career/Real World Connections

Example: The paths of the planets around the sun are ellipses with the sun at one focus. Parabolic mirrors are used to converge light beams at the focus of the parabola. Hyperbolic as well as parabolic mirrors and lenses are used in systems of telescopes.

Guiding / Topical Questions with Specific Standards		**Content, Themes, Concepts, and Skills**	**Teaching Strategies**	**Instructional Resources and Materials**	**Assessment Strategies**
G-.GPE.A.1	What are the characteristics of a circle? How can we identify an equation as a circle equation? How do we find the center and radius of a circle?	Recognize a conic as the intersection of a plane and a double-napped cone. Write equations of circles in standard form given characteristics of the circle. Sketch a circle using its equation. Complete the square to write the equation of a circle from general to standard form. Model and solve real world situations using circle equations.	Anticipatory sets to measure background knowledge and engage students Use guided and independent practice activities Use the Mimeo, whiteboard, and worksheets to reinforce the concepts Use cooperative learning activities	Worksheets and sample problems to analyze step-by-step solutions of the problems Textbook & associated materials Teacher created worksheets www.ixl.com	Written test/quiz Cooperative activities (rubrics) Notebooks Class participation Homework/written assignments Response to discussion questions

			Use discovery based learning activities that require students to make conjectures and investigate patterns Use whiteboards to show immediate feedback on questions Review completing the square on prior homework. Video on all four types of conic sections.	Mimeo lessons Geometer's Sketchpad GeoGebra TI Smart View with TI 84 Graphing Calculators	Anticipatory Sets/Do Now Problems Diagnostic Assessments to determine readiness Closure question/ Exit Slips Oral presentations Special projects
G.GP E.A.3	What are the characteristics of an ellipse? How can we identify an equation as an ellipse equation? How do we find the center, foci, and axes of an ellipse?	Write equations of ellipses in standard form. Complete the square in quadratic equations to write the equation of the ellipse from general to standard form. Sketch an ellipse using its equation. Find eccentricity of an ellipse. Model and solve real world situations using elliptical equations.	Same as above Give partner practice on ellipse and circle problems in which each partner has the other's answers. Create an ellipse using a string.		
G.GP E.A.3	What are the characteristics of a hyperbola? How can we identify an equation as an ellipse equation? What are the similarities and differences between a hyperbola and an ellipse?	Write equations of hyperbolas in standard form given its characteristics. Complete the square on quadratic equations to write the equation of the hyperbola from general to standard form. Find the asymptotes of a hyperbola. Sketch a hyperbola using its equation. Find eccentricity of a hyperbola.	Same as above Give partner practice on ellipse and circle problems in which each partner has the other's answers. Compare and contrast the ellipse and hyperbola formulas and characteristics.		

	How do we find the center, foci, and axes of a hyperbola?	Model and solve real world situations using hyperbolic equations.			
G.GPE.A.2	What are the characteristics of a parabola? How can we identify an equation as a parabola equation? How do we find the vertex, directrix, and axis of a parabola?	Write equations of parabolas in standard form given its characteristics. Complete the square on quadratic equations to write the equation of the parabola from general to standard form. Sketch a parabola using its equation. Find the tangent line at a point on a parabola. Model and solve real world situations using parabolic equations.	Same as above Match the parabola to its graph.		

General Differentiated Instruction Strategies	
• Leveled texts • Chunking texts • Choice board • Socratic Seminar • Tiered Instruction • Small group instruction • Guided Reading • Sentence starters/frames • Writing scaffolds • Tangible items/pictures • Adjust length of assignment	• Repeat, reword directions • Brain breaks and movement breaks • Brief and concrete directions • Checklists for tasks • Graphic organizers • Assistive technology (spell check, voice to type) • Study guides • Tiered learning stations • Tiered questioning • Data-driven student partnerships • Extra time

Possible Additional Strategies for Special Education Students, 504 Students, At-Risk Students, and English Language Learners (ELLs)			
Time/General	**Processing**	**Comprehension**	**Recall**
• Extra time for assigned tasks • Adjust length of assignment • Timeline with due dates for reports and projects • Communication system between home and school • Provide lecture notes/outline	• Extra Response time • Have students verbalize steps • Repeat, clarify or reword directions • Mini-breaks between tasks • Provide a warning for transitions • Reading partners	• Precise step-by-step directions • Short manageable tasks • Brief and concrete directions • Provide immediate feedback • Small group instruction • Emphasize multi-sensory learning	• Teacher-made checklist • Use visual graphic organizers • Reference resources to promote independence • Visual and verbal reminders • Graphic organizers

Assistive Technology	Assessments and Grading	Behavior/Attention	Organization
• Computer/whiteboard • Tape recorder • Spell-checker • Audio-taped books	• Extended time • Study guides • Shortened tests • Read directions aloud	• Consistent daily structured routine • Simple and clear classroom rules • Frequent feedback	• Individual daily planner • Display a written agenda • Note-taking assistance • Color code materials

Enrichment

The goal of Enrichment is to provide learners with the opportunity to participate in extension activities that are differentiated and enhance the curriculum. All enrichment decisions will be based upon individual student needs.

- Show a high degree of intellectual, creative and/or artistic ability and demonstrate this ability in multiple ways.
- Pose questions and exhibit sincere curiosity about principles and how things work.
- The ability to grasp concepts and make real world and cross-curricular connections.
- Generate theories and hypotheses and pursue methods of inquiry.
- Produce products that express insight, creativity, and excellence.
- Possess exceptional leadership skills.
- Evaluate vocabulary
- Elevate Text Complexity
- Inquiry based assignments and projects
- Independent student options
- Tiered/Multi-level activities
- Purposeful Learning Center
- Open-ended activities and projects
- Form and build on learning communities
- Providing pupils with experiences outside the 'regular' curriculum
- Altering the pace the student uses to cover regular curriculum in order to explore topics of interest in greater depth/breadth within their own grade level
- A higher quality of work than the norm for the given age group.
- The promotion of a higher level of thinking and making connections.
- The inclusion of additional subject areas and/or activities (cross-curricular).

- Using supplementary materials in addition to the normal range of resources.

English Language Learner (ELL) Resources

- Learning style quiz for students- http://www.educationplanner.org/students/self-assessments/learning-styles-quiz.shtml
- "Word clouds" from text that you provide-http://www.wordle.net/
- Bilingual website for students, parents and educators: http://www.colorincolorado.org/
- Learn a language for FREE-www.Duolingo.com
- Time on task for students-http://www.online-stopwatch.com/
- Differentiation activities for students based on their Lexile-www.Mobymax.com
- WIDA-http://www.wida.us/
- Everything ESL - http://www.everythingESL.net
- ELL Tool Box Suggestion Site http://www.wallwisher.com/wall/elltoolbox
- Hope4Education - http://www.hope4education.com
- Learning the Language http://blogs.edweek.org/edweek/learning-the-language/
- FLENJ (Foreign Language Educators of NJ) 'E-Verse' wiki: http://www.flenj.org/Publications/?page=135
- OELA - http://www.ed.gov/offices/OBEMLA
- New Jersey Department of Education- Bilingual Education information http://www.state.nj.us/education/bilingual/

Special Education Resources

- Animoto -Animoto provides tools for making videos by using animation to pull together a series of images and combining with audio. Animoto videos or presentations are easy to publish and share. https://animoto.com
- Bookbuilder -Use this site to create, share, publish, and read digital books that engage and support diverse learners according to their individual needs, interests, and skills. http://bookbuilder.cast.org/
- CAST -CAST is a non-profit research and development organization dedicated to Universal Design for Learning (UDL). UDL research demonstrates that the challenge of diversity can and must be met by making curriculum flexible and responsive to learner differences. http://www.cast.org
- CoSketch -CoSketch is a multi-user online whiteboard designed to give you the ability to quickly visualize and share your ideas as images. http://www.cosketch.com/
- Crayon -The Crayon.net site offers an electronic template for students to create their own newspapers. The site allows you to bring multiple

sources together, thus creating an individualized and customized newspaper. http://crayon.net/ Education Oasis -Education Oasis offers a collection of graphic organizers to help students organize and retain knowledge – cause and effect, character and story, compare and contrast, and more! http://www.educationoasis.com/printables/graphic-organizers/

- Edutopia -A comprehensive website and online community that increases knowledge, sharing, and adoption of what works in K-12 education. We emphasize core strategies: project-based learning, comprehensive assessment, integrated studies, social and emotional learning, educational leadership and teacher development, and technology integration. http://www.edutopia.org/
- Glogster -Glogster allows you to create "interactive posters" to communicate ideas. Students can embed media links, sound, and video, and then share their posters with friends. http://edu.glogster.com/?ref=personal
- Interactives – Elements of a Story -This interactive breaks down the important elements of a story. Students go through the series of steps for constructing a story including: Setting, Characters, Sequence, Exposition, Conflict, Climax, and Resolution. http://www.learner.org/interactives/story/index.html
- National Writing Project (NWP) -Unique in breadth and scale, the NWP is a network of sites anchored at colleges and universities and serving teachers across disciplines and at all levels, early childhood through university. We provide professional development, develop resources, generate research, and act on knowledge to improve the teaching of writing and learning in schools and communities. http://www.nwp.org
- Pacecar -Vocab Ahead offers videos that give an active demonstration of vocabulary with audio repeating the pronunciation, definition, various uses, and synonyms. Students can also go through flash cards which give a written definition and visual representation of the word. http://pacecar.missingmethod.com/