**ROBBINSVILLE PUBLIC SCHOOLS**

**OFFICE OF CURRICULUM AND INSTRUCTION**

**Mathematics**

# Honors Calculus

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## Course Philosophy

Every individual develops an understanding of the concepts of calculus and gains experience with its methods and applications. This understanding and experience is achieved through a multi-representational approach, which emphasizes the relationships between graphical, numerical, analytical, and verbal representations of concepts, problems, and solutions. The connections among the multiple representations of concepts and functions are strengthened by the regular use of technology by students and teachers. Technology also plays a key role in verifying written work and in aiding in the interpretation of experimentation results. Several unifying themes serve to bring cohesion to the course. These themes include derivatives, integrals, limits, approximation, and applications and modeling. They are developed using all of the major mathematical functions with which students are already familiar.

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

Grade: 11-12 Credits: 5

Course Length: 1 year Prerequisite(s): Grade of A or B in Pre-Calculus or completion of Pre-Calculus Honors

Calculus begins with a review of precalculus concepts followed by an introduction to limit theory and continuity. This is followed by an in-depth study of techniques of differentiation and integration.Throughout the year, application of differentiation and integration will be emphasized, including examples of optimization, related rates, area, and volumes of solids. Graphing calculators are used throughout the course. This course is weighted like an honors course.

## Core and Supplemental Instructional Materials

| Core Materials | Supplemental Materials |
|---|---|
| • Textbook | • Graphing websites (geogebra.com, desmos.com, etc.)<br>• Graphing calculator<br>• Online Resources<br>• Guided Notes<br>• 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

# Integration of 21st Century Themes and Skills

| NJSLS-CLKS 9.4: Life Literacies and Key Skills | |
|---|---|
| **Creativity and Innovation** | *See specific standards and their connections/examples for this disciplinary concept listed within each individual unit*<br><br>Can be found in unit: 3,4,7 |
| **Critical Thinking and Problem Solving** | *See specific standards and their connections/examples for this disciplinary concept listed within each individual unit*<br><br>Can be found in unit: 1,2,3,4,5,6,7 |
| **Digital Citizenship** | *See specific standards and their connections/examples for this disciplinary concept listed within each individual unit*<br><br>Can be found in unit: n/a |
| **Global and Cultural Awareness** | *See specific standards and their connections/examples for this disciplinary concept listed within each individual unit*<br><br>Can be found in unit: 3,7 |
| **Information and Media Literacy** | *See specific standards and their connections/examples for this disciplinary concept listed within each individual unit*<br><br>Can be found in unit: 2,5,6,7 |
| **Technology Literacy** | *See specific standards and their connections/examples for this disciplinary concept listed within each individual unit*<br>Can be found in unit: 2,3,4,6,7 |

## 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.

| Career Awareness and Planning Standards 9.2 | |
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| 9.2.12.CAP.6: Identify transferable skills in career choices and design alternative career plans based on those skills. | **Example**: Students learn about different available careers in mathematics and engineering and explore pathways of school and/or life experiences needed to pursue one of these careers |
| 9.2.12.CAP.13: Analyze how the economic, social, and political conditions of a time period can affect the labor market. | **Example:** In units 3,6, and 7, students will explore real-world topics in and how they can apply calculus. Examples are rate of change, work performed, maximizing profits, and exponential growth/decay (such as disease spread) |

**Robbinsville Public Schools**
**Scope, Sequence, Pacing and Assessment**

**Honors Calculus**

| Unit Title | Unit Understandings and Goals | Recommended Duration/ Pacing | Assessments |
|---|---|---|---|
| Unit 1: Limits and Their Properties | ● Develop the connection between Pre-Calculus & limits, and Calculus<br>● Find limits graphically and numerically<br>● Evaluate limits analytically<br>● Determine continuity at a point and on an open interval<br>● Determine one-sided limits<br>● Determine infinite limits and find vertical and horizontal asymptotes | 9 blocks | Formative<br>· Unit Quizzes<br>· Open-Ended Questions<br>· Class Discussion<br>· In-class Assignments: (Group-work, Mini-Projects, Practice Material)<br>· Review Games<br>· Exit Slips<br>· Chapter Test<br><br>Summative<br>· Unit Test with Varying Types of Questions<br>· Projects<br>· Authentic Assessments<br>· Core Assessments<br><br>Common Benchmark Assessments (mid/end of course)<br>· Cumulative Exams<br>· Final Exam<br><br>Alternative Assessments (projects, etc when appropriate)<br>· Application Projects<br>· Graphing explorations<br>· Anticipatory Set/Warm Up<br>· Homework Quizzes<br>· Open-Ended Leading Questions Highlighting Prior Knowledge<br>· Student interview/presentation of works |
| Unit 2: Differentiation | ● Find the derivative of a function using the limit definition | 15 blocks | Formative<br>· Unit Quizzes<br>· Open-Ended Questions |

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| | • Describe the relationship between continuity and differentiability<br>• Find the derivative of a function using basic differentiation rules<br>• Find the derivative of a function using the Product Rule and Quotient Rule<br>• Find the derivative of a function using the Chain Rule and General Power Rule<br>• Find the derivative of a function using implicit differentiation<br>• Evaluate Related Rates | | · Class Discussion<br>· In-class Assignments: (Group-work, Mini-Projects, Practice Material)<br>· Review Games<br>· Exit Slips<br>· Chapter Test<br>Summative<br>· Unit Test with Varying Types of Questions<br>· Projects<br>· Authentic Assessments<br>· Core Assessments<br>Common Benchmark Assessments (mid/end of course)<br>· Cumulative Exams<br>· Final Exam<br>Alternative Assessments (projects, etc when appropriate)<br>· Application Projects<br>· Graphing explorations<br>· Anticipatory Set/Warm Up<br>· Homework Quizzes<br>· Open-Ended Leading Questions Highlighting Prior Knowledge<br>· Student interview/presentation of works |
| Unit 3: Applications of Differentiation | • Use a derivative to locate the minimum and maximum values of a function on a closed interval<br>• Solve applications of Rolle's Theorem and the Mean Value Theorem<br>• Use the first derivative to determine whether a function is increasing and decreasing<br>• Use the second derivative to determine whether the graph of a function is concave upward or concave downward<br>• Analyze a function and sketch its graph based on data from the first and second derivative test<br>• Solve optimization problems<br>• Use approximation techniques and differential equations to solve problems | 12 blocks | Formative<br>· Unit Quizzes<br>· Open-Ended Questions<br>· Class Discussion<br>· In-class Assignments: (Group-work, Mini-Projects, Practice Material)<br>· Review Games<br>· Exit Slips<br>· Chapter Test<br>Summative<br>· Unit Test with Varying Types of Questions<br>· Projects<br>· Authentic Assessments<br>· Core Assessments<br>Common Benchmark Assessments (mid/end of course)<br>· Cumulative Exams<br>· Final Exam<br>Alternative Assessments (projects, etc when appropriate)<br>· Application Projects<br>· Graphing explorations |

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| | | | · Anticipatory Set/Warm Up<br>· Homework Quizzes<br>· Open-Ended Leading Questions Highlighting Prior Knowledge<br>· Student interview/presentation of works |
| Unit 4: Integration | ● Evaluate indefinite integrals using basic integration rules<br>● Evaluate a sum and approximate the area of a plane region<br>● Evaluate a definite integral using a limit<br>● Evaluate a definite integral using the Fundamental Theorem of Calculus<br>● Evaluate different types of definite and indefinite integrals using a variety of methods such as the Trapezoidal Rule and Simpson's Rule | 10 blocks | Formative<br>· Unit Quizzes<br>· Open-Ended Questions<br>· Class Discussion<br>· In-class Assignments: (Group-work, Mini-Projects, Practice Material)<br>· Review Games<br>· Exit Slips<br>· Chapter Test |
| | | | Summative<br>· Unit Test with Varying Types of Questions<br>· Projects<br>· Authentic Assessments<br>· Core Assessments |
| | | | Common Benchmark Assessments (mid/end of course)<br>· Cumulative Exams<br>· Final Exam |
| | | | Alternative Assessments (projects, etc when appropriate)<br>· Application Projects<br>· Graphing explorations<br>· Anticipatory Set/Warm Up<br>· Homework Quizzes<br>· Open-Ended Leading Questions Highlighting Prior Knowledge<br>· Student interview/presentation of works |
| Unit 5: Exponential and Logarithmic Functions and Calculus | ● Recognize, evaluate, and graph exponential and logarithmic functions<br>● Use properties of logarithms to evaluate, rewrite, expand, or condense logarithmic functions<br>● Solve exponential and logarithmic equations<br>● Use exponential growth models, exponential decay models, Gaussian models, logistic growth models, and logarithmic models to solve real-life problems | 14 blocks | Formative<br>· Unit Quizzes<br>· Open-Ended Questions<br>· Class Discussion<br>· In-class Assignments: (Group-work, Mini-Projects, Practice Material)<br>· Review Games<br>· Exit Slips<br>· Chapter Test |
| | | | Summative<br>· Unit Test with Varying Types of Questions<br>· Projects<br>· Authentic Assessments |

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| | • Find the derivative and antiderivative of the natural exponential function<br>• Find the derivative of the natural logarithmic functions, use logarithms as an aid in differentiating non logarithmic functions, and find the derivatives of exponential and logarithmic functions in bases other than *e*<br>• Use an exponential function to model growth and decay | | · Core Assessments<br>Common Benchmark Assessments (mid/end of course)<br>· Cumulative Exams<br>· Final Exam<br>Alternative Assessments (projects, etc when appropriate)<br>· Application Projects<br>· Graphing explorations<br>· Anticipatory Set/Warm Up<br>· Homework Quizzes<br>· Open-Ended Leading Questions Highlighting Prior Knowledge<br>· Student interview/presentation of works |
| Unit 6: Trigonometry Review, Functions, and Calculus | • Describe angles using radian and degree measures<br>• Evaluate trigonometric functions using the unit circle<br>• Use fundamental trigonometric identities<br>• Evaluate trigonometric functions of acute angles<br>• Use reference angles to evaluate trigonometric functions of any angle<br>• Sketch the graphs of sine, cosine, tangent, cotangent, secant, and cosecant functions<br>• Evaluate inverse trigonometric functions<br>• Use the fundamental trigonometric identities to evaluate, simplify, and rewrite trigonometric expressions<br>• Verify trigonometric identities<br>• Use standard algebraic techniques to solve trigonometric equations<br>• Solve trigonometric equations of quadratic type and involving multiple angles<br>• Use inverse trigonometric functions to solve trigonometric equations<br>• Determine limits of trigonometric functions<br>• Find derivatives of trigonometric functions<br>• Find antiderivatives of trigonometric functions<br>• Find derivatives of inverse trigonometric functions | 13 blocks | Formative<br>· Unit Quizzes<br>· Open-Ended Questions<br>· Class Discussion<br>· In-class Assignments: (Group-work, Mini-Projects, Practice Material)<br>· Review Games<br>· Exit Slips<br>· Chapter Test<br>Summative<br>· Unit Test with Varying Types of Questions<br>· Projects<br>· Authentic Assessments<br>· Core Assessments<br>Common Benchmark Assessments (mid/end of course)<br>· Cumulative Exams<br>· Final Exam<br>Alternative Assessments (projects, etc when appropriate)<br>· Application Projects<br>· Graphing explorations<br>· Anticipatory Set/Warm Up<br>· Homework Quizzes<br>· Open-Ended Leading Questions Highlighting Prior Knowledge<br>· Student interview/presentation of works |

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| | • Find antiderivatives involving inverse trigonometric functions | | |
| Unit 7: Applications of Integration (Time Permitting) | • Use a definite integral to find the area of a region bounded by two curves<br>• Find the volume of a solid of revolution by the disk and shell methods<br>• Find the length of a curve and the surface area of a surface of revolution<br>• Find the work done by a constant force and by a variable force | 9 blocks | Formative<br>· Unit Quizzes<br>· Open-Ended Questions<br>· Class Discussion<br>· In-class Assignments: (Group-work, Mini-Projects, Practice Material)<br>· Review Games<br>· Exit Slips<br>· Chapter Test |
| | | | Summative<br>· Unit Test with Varying Types of Questions<br>· Projects<br>· Authentic Assessments<br>· Core Assessments |
| | | | Common Benchmark Assessments (mid/end of course)<br>· Cumulative Exams<br>· Final Exam |
| | | | Alternative Assessments (projects, etc when appropriate)<br>· Application Projects<br>· Graphing explorations<br>· Anticipatory Set/Warm Up<br>· Homework Quizzes<br>· Open-Ended Leading Questions Highlighting Prior Knowledge<br>· Student interview/presentation of works |

**Robbinsville Public Schools**

## Unit #1: Limits and Their Properties

| **Enduring Understandings:** | **Essential Questions:** |
|---|---|
| • Develop the connection between Pre-Calculus & limits, and Calculus<br>• Find limits graphically and numerically<br>• Evaluate limits analytically<br>• Determine continuity at a point and on an open interval<br>• Determine one-sided limits<br>• Determine infinite limits and find vertical and horizontal asymptotes | • What is the difference between average and instantaneous rate of change?<br>• How does the limit of a function correlate with end behavior?<br>• How can one sided limits and the limit of a function at a value be used to determine the continuity of a function at a single point?<br>• How is the instantaneous rate of change of a curve related to the slope of a line tangent to the curve?<br>• How do combinations of functions both graphically and algebraically affect the value of the limit of a function at a given point? |

**Interdisciplinary Connections**

**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

**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 derivatives to model the rate of change of an object

**Career/Real World Connections**

**Example:** Among the disciplines that utilize calculus include physics, engineering, economics, statistics, and medicine. It is used to create mathematical models in order to arrive at an optimal solution.

| **Guiding / Topical Questions with Specific Standards** | | **Content, Themes, Concepts, and Skills** | **Teaching Strategies** | **Instructional Resources and Materials** | **Assessment Strategies** |
|---|---|---|---|---|---|
| A-APR.B.3<br><br>F-IF.B.4 | What is the limit of a function?<br><br>How do the basic operations of algebra apply to limits?<br><br>What are the geometric and numeric relationships of the limit of a function? | Understand what Calculus is and how it compares with Precalculus, such as the tangent line problem and the area problem and their essential ties to Calculus.<br><br>Estimate a limit using a numerical or graphical approach.<br><br>Determine ways for a limit to fail to exist. | Anticipatory sets to measure background knowledge and engage students<br><br>Use guided and independent practice activities<br><br>Use the Mimeo, whiteboard, and worksheets to reinforce the concepts | Worksheets and sample problems to analyze step-by-step solutions of the problems<br><br>Textbook & associated materials<br><br>Teacher created worksheets | Written tests and quizzes<br><br>Worksheets<br><br>Notebook assessments<br><br>Response to discussion questions |

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| | | Evaluate limits using their properties.<br><br>Develop and use a strategy for finding limits and evaluate a limit using dividing out and rationalizing techniques. | Use cooperative learning activities<br><br>Use discovery based learning activities that require students to make conjectures and investigate patterns<br><br>Use whiteboards to show immediate feedback on questions | Mimio lessons<br>Geometer's Sketchpad<br><br>GeoGebra<br><br>TI Smart View with TI 84 Graphing Calculators<br><br>Desmos | Anticipatory Sets/Do Now Problems<br><br>Diagnostic Assessments to determine readiness<br><br>Closure question/ Exit Slips |
| F-IF.B.4 | How is a limit used to determine continuity?<br><br>What does it mean to be continuous? | Determine continuity at a point and continuity on an open interval.<br><br>Determine one-sided limits and continuity on a closed interval and use properties of continuity. | Same as above | Same as above | Same as above |
| A-APR.D.6<br><br>A-APR.D.7 | How can limits be used to find vertical and horizontal asymptotes of a function?<br><br>What is the application of the Intermediate Value Theorem? | Understand and apply the Intermediate Value Theorem.<br><br>Determine infinite limits from the left and from the right.<br><br>Find and sketch vertical and horizontal asymptotes of the graph of a function. | Same as above | Same as above | Same as above |

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**Unit #2: Differentiation**

| **Enduring Understandings:** | **Essential Questions:** |
|---|---|
| • Find the derivative of a function using the limit definition<br>• Describe the relationship between continuity and differentiability<br>• Find the derivative of a function using basic differentiation rules<br>• Find the derivative of a function using the Product Rule and Quotient Rule<br>• Find the derivative of a function using the Chain Rule and General Power Rule<br>• Find the derivative of a function using implicit differentiation<br>• Evaluate Related Rates | • How do the graphs of *f, f', and f"* relate to one another?<br>• Does continuity imply differentiability or differentiability imply continuity?<br>• What are the necessary conditions for a derivative to exist?<br>• How can you recognize and apply the appropriate scenario for the various rules of differentiation of polynomial functions?<br>• How can the derivative of a function be taken with respect to variables other than $x$?<br>• How are derivatives used to model and solve real world problems? |

**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 related rates problems

**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** |
|---|---|---|---|---|---|
| S-ID.C.7<br><br>A-APR.C.5<br><br>F-IF.B.6 | How do the slope of a graph and the slope of a tangent line compare?<br><br>What is the importance of limits in finding the derivative? | Find the slope of a tangent line to a curve, use the limit definition to find the derivative of a function, at a point.<br><br>Use the limit definition to find the derivative of a function. | Anticipatory sets to measure background knowledge and engage students<br><br>Use guided and independent practice activities | Worksheets and sample problems to analyze step-by-step solutions of the problems<br><br>Textbook & associated materials | Written tests and quizzes<br><br>Worksheets<br><br>Notebook assessments |

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|---|---|---|---|---|---|
| | What is a derivative?<br><br>What are the rules for differentiation?<br><br>What is the meaning of second, third or higher order derivatives?<br><br>Why do some functions require the need to have their derivatives determined implicitly? | Find the derivative using the various rules of differentiation: Constant Rule, Power Rule, Constant Multiple Rule, Sum/Difference Rules, Product Rule, and Quotient Rule.<br><br>Find a higher order derivative of a function. Find the derivative of a composite function using the Chain Rule.<br><br>Distinguish between functions written in implicit form and explicit form and use implicit differentiation where appropriate to find the derivative. | Use the Mimeo, whiteboard, and worksheets to reinforce the concepts<br><br>Use cooperative learning activities<br><br>Use discovery based learning activities that require students to make conjectures and investigate patterns<br><br>Use whiteboards to show immediate feedback on questions | Teacher created worksheets<br><br>Mimio lessons<br>Geometer's Sketchpad<br><br>GeoGebra<br><br>TI Smart View with TI 84 Graphing Calculators<br><br>Desmos | Response to discussion questions<br><br>Anticipatory Sets/Do Now Problems<br><br>Diagnostic Assessments to determine readiness<br><br>Closure question/ Exit Slips |
| S-ID.C.7<br><br>A-APR.B.3<br><br>F-IF.B.4 | How can a derivative fail to exist?<br><br>What is the relationship between the derivative of a function and the continuity of a function? | Analyze the relationship between differentiability and continuity. | Same as above | Same as above | Same as above |
| S-ID.C.7<br><br>A-REI.A.1 | How can derivatives be used to model and solve real world problems? | Find a related rate and use related rates to solve real world problems | Same as above | Same as above | Same as above |

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**Unit #3: Applications of Differentiation**

| **Enduring Understandings:** | **Essential Questions:** |
|---|---|
| • Use a derivative to locate the minimum and maximum values of a function on a closed interval<br>• Solve applications of Rolle's Theorem and the Mean Value Theorem<br>• Use the first derivative to determine whether a function is increasing and decreasing<br>• Use the second derivative to determine whether the graph of a function is concave upward or concave downward<br>• Analyze a function and sketch its graph based on data from the first and second derivative test<br>• Solve optimization problems<br>• Use approximation techniques and differential equations to solve problems | • How are derivatives used to model and solve real world problems?<br>• How do the graphs of *f, f', and f"* relate to one another?<br>• How does the range of *f'* correlate to the graph of *f*?<br>• How does the range of *f"* correlate to the graph of *f* ?<br>• How can the second derivative be used to identify a critical point as a maximum or minimum value of the function?<br>• How do the Mean Value and Rolle's Theorem aid in determining intervals in which the function is increasing, decreasing or constant?<br>• What does it mean to be "Locally Linear"?<br>• How can linearization of differential equations be used to approximate values of a function? |

**Interdisciplinary Connections**

**9.3.12.BM-MGT.2** Access, evaluate and disseminate information for business decision making.
Students will solve optimization problems to determine maximum profit and other business-related problems.

**8.1.12.DA.1:** Create interactive data visualizations using software tools to help others better understand real world phenomena, including climate change.
Students will use technology to visualize the rate of change and the slope of a tangent line, and howderivatives change as a function of time.

**Career/Real World Connections**

**Example:** Students will access, evaluate, and disseminate information for decision making on a regular basis as they apply the skills learned in

| **Guiding / Topical Questions with Specific Standards** | | **Content, Themes, Concepts, and Skills** | **Teaching Strategies** | **Instructional Resources and Materials** | **Assessment Strategies** |
|---|---|---|---|---|---|
| A-APR.B.3<br><br>F-IF.B.5 | How does the derivative of a function provide information about the shape of the graph? | Develop the definition of relative extrema on an open interval, absolute extrema on a closed interval.<br><br>Use first and second derivative tests to find extrema of a function as well as intervals of increasing, decreasing and constant. | Anticipatory sets to measure background knowledge and engage students<br><br>Use guided and independent practice activities | Worksheets and sample problems to analyze step-by-step solutions of the problems<br><br>Textbook & associated materials | Written tests and quizzes<br><br>Worksheets<br><br>Notebook assessments |

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|---|---|---|---|---|---|
| F-IF.B.6 | What information can be determined by the first derivative test?<br><br>What information can be determined by the second derivative test? | Analyze and sketch the graph of a function. | Use the Mimeo, whiteboard, and worksheets to reinforce the concepts<br><br>Use cooperative learning activities<br><br>Use discovery based learning activities that require students to make conjectures and investigate patterns<br><br>Use whiteboards to show immediate feedback on questions | Teacher created worksheets<br><br>Mimio lessons<br>Geometer's Sketchpad<br><br>GeoGebra<br><br>TI Smart View with TI 84 Graphing Calculators<br><br>Desmos | Response to discussion questions<br><br>Anticipatory Sets/Do Now Problems<br><br>Diagnostic Assessments to determine readiness<br><br>Closure question/ Exit Slips |
| S-ID.C.7 | How can derivatives be used to model and solve real world problems? | Use calculus to solve applied maximum and minimum problems. | Same as above | Same as above | Same as above |
| S-ID.C.8<br><br>F-IF.B.4 | How can the tangent line to a curve be used to model other points on the curve?<br><br>What is a differential equation and how can it be used to approximate the values of a function? | Develop the concept of tangent line approximation and compare the value of the differential with the actual change to estimate the error created by using the differential. | Same as above | Same as above | Same as above |

**Robbinsville Public Schools**

**Unit #4: Integration**

| **Enduring Understandings:** | **Essential Questions:** |
|---|---|
| • Evaluate indefinite integrals using basic integration rules<br>• Evaluate a sum and approximate the area of a plane region<br>• Evaluate a definite integral using a limit<br>• Evaluate a definite integral using the Fundamental Theorem of Calculus<br>• Evaluate different types of definite and indefinite integrals using a variety of methods such as the Trapezoidal Rule and Simpson's Rule | • What is the value of the Fundamental Theorem of Calculus? Why is it important to the development of Calculus?<br>• How is the Fundamental Theorem of Calculus influential in the ability to problem solve?<br>• What is the necessity of an initial condition when integrating an indefinite integral?<br>• What is the graphical representation of a definite integral?<br>• How can you recognize and apply the appropriate scenario for the various rules of differentiation of polynomial functions?<br>• What are the methods for approximating the value of a definite integral? In which situations are each of the approximations more exact? |

**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 complex functions but use Reimann sums to approximate area under the curve, then interpret the result.

**9.3.12.ED.2** Demonstrate effective oral, written, and multimedia communication in multiple formats and contexts.
*Example:* Students will work together to explore anti-differentiation and create a list of rules that can be applied to solve definite integrals.

**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-APR.B.3<br><br>A-APR.D.6<br><br>A-APR.D.7<br><br>F-IF.C.7<br><br>F-IF.C.9 | What is an integral of a function?<br><br>What are the rules for antidifferentiation?<br><br>What is the difference between a definite and indefinite integral?<br><br>Why is it necessary for integration to require a change of variables?<br><br>What is the geometric analogy for an integral?<br><br>How do the basic operations of algebra affect integration?<br><br>What methods for approximations are there for integration? | Write the general solution of a differential equation and use definite integral notation for antiderivatives.<br><br>Use basic integration rules to find antiderivatives.<br><br>Develop the concept of area under the curve and use rectangles to approximate the area of a plane region.<br><br>Find the area of a plane region using limits.<br><br>Develop the definition of a Riemann sum and evaluate a definite integral using limits.<br><br>Evaluate a definite integral using properties of definite integrals.<br><br>Use pattern recognition to find an indefinite integral.<br><br>Use a change of variables to find an indefinite integral.<br><br>Use the General Power Rule for Integration to find an indefinite integral.<br><br>Use a change of variables to evaluate a definite integral and evaluate a definite integral involving an even or odd function.<br><br>Approximate a definite integral using the Trapezoidal Rule and Simpson's Rule. | Anticipatory sets to measure background knowledge and engage students<br><br>Use guided and independent practice activities<br><br>Use the Mimeo, whiteboard, and worksheets to reinforce the concepts<br><br>Use cooperative learning activities<br><br>Use discovery based learning activities that require students to make conjectures and investigate patterns<br><br>Use whiteboards to show immediate feedback on questions | Worksheets and sample problems to analyze step-by-step solutions of the problems<br><br>Textbook & associated materials<br><br>Teacher created worksheets<br><br>Mimio lessons<br>Geometer's Sketchpad<br><br>GeoGebra<br><br>TI Smart View with TI 84 Graphing Calculators<br><br>Desmos | Written tests and quizzes<br><br>Worksheets<br><br>Notebook assessments<br><br>Response to discussion questions<br><br>Anticipatory Sets/Do Now Problems<br><br>Diagnostic Assessments to determine readiness<br><br>Closure question/ Exit Slips |

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|---|---|---|---|---|---|
| F-BF-A.1 | How does the Fundamental Theorem of Calculus relate differential and integral calculus?<br><br>What is the significance of the Fundamental Theorem of Calculus? | Evaluate a definite integral using the Fundamental Theorem of Calculus. | Same as above | Same as above | Same as above |
| F-IF.B.6 | How is the Mean Value for Integrals applied?<br><br>What is the Net Change Theorem? | Use the Mean Value Theorem for Integrals and find the average value of a function over a closed interval.<br><br>Use the Second Fundamental Theorem of Calculus and understand and use the Net Change Theorem. | Same as above | Same as above | Same as above |

# Unit #5: Exponential and Logarithmic Functions and Calculus

| **Enduring Understandings:** | **Essential Questions:** |
|---|---|
| • Recognize, evaluate, and graph exponential and logarithmic functions<br>• Use properties of logarithms to evaluate, rewrite, expand, or condense logarithmic functions<br>• Solve exponential and logarithmic equations<br>• Use exponential growth models, exponential decay models, Gaussian models, logistic growth models, and logarithmic models to solve real-life problems | • What is the relationship between an exponential and logarithmic function?<br>• How do exponential functions and their graphs help us interpret events that occur in the world around us (population and calculating interest)?<br>• How are the properties of logarithms with the same base related to the properties of exponents with the same base?<br>• How can you find the derivative and antiderivative of exponential and logarithmic functions?<br>• How are logarithms useful in differentiating and integrating functions that are non logarithmic? |

**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:** Covid-19 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-LE.A.1-4<br><br>F-IF.B.4 | How is a logarithmic graph related to an exponential graph?<br><br>How are exponential functions written in logarithmic form? | Graph exponential and logarithmic functions.<br><br>Recognize and evaluate exponential and logarithmic functions. | Anticipatory sets to measure background knowledge and engage students<br><br>Use guided and independent practice activities | Worksheets and sample problems to analyze step-by-step solutions of the problems<br><br>Textbook & associated materials | Written tests and quizzes<br><br>Worksheets<br><br>Notebook assessments |

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|---|---|---|---|---|---|
| F-IF.B.5<br><br>A-SSE.B.3c | How are the properties of logarithmic functions related to the properties of exponents? | Use properties of logarithms to evaluate, rewrite, expand or condense logarithmic expressions. | Use the Mimeo, whiteboard, and worksheets to reinforce the concepts<br><br>Use cooperative learning activities<br><br>Use discovery based learning activities that require students to make conjectures and investigate patterns<br><br>Use whiteboards to show immediate feedback on questions | Teacher created worksheets<br><br>Mimio lessons<br>Geometer's Sketchpad<br><br>GeoGebra<br><br>TI Smart View with TI 84 Graphing Calculators<br><br>Desmos | Response to discussion questions<br><br>Anticipatory Sets/Do Now Problems<br><br>Diagnostic Assessments to determine readiness<br><br>Closure question/ Exit Slips |
| F-LE.A.1-4<br><br>F-LE.B.5<br><br>F-BF.B.4<br><br>F-BF.B.5 | How are exponential and logarithmic equations solved?<br><br>In what ways can you verify algebraic techniques for solving exponential equations using technology?<br><br>How can we use the properties of logarithms to solve logarithmic equations?<br><br>What real-world phenomenon can be modeled using exponential and logarithmic equations? | Solve exponential and logarithmic equations.<br><br>Use exponential and logarithmic models to solve real-life problems. | Same as above | Same as above | Same as above |
| F-LE.A.1-4<br><br>F-BF.B.4<br><br>F-BF.B.5 | How can we differentiate and integrate a natural exponential function? | Differentiate natural exponential functions.<br><br>Integrate natural exponential functions | Same as above | Same as above | Same as above |

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|---|---|---|---|---|---|
| F-LE.A .1-4<br><br>A-SSE. B.3c | What are the rules for differentiating a natural logarithm?<br><br>How does logarithmic differentiation enable us to differentiate non logarithmic functions?<br><br>What is unique in differentiating exponential and logarithmic functions for bases other than e? How is it done? | Differentiate natural logarithmic functions.<br><br>Use logarithmic differentiation to differentiate non logarithmic functions.<br><br>Differentiate exponential and logarithmic functions for bases other than e. | Same as above | Same as above | Same as above |
| F-LE.A .1-4 | What is the Log Rule for Integration?<br><br>How is the Log Rule for Integration used to integrate a rational function?<br><br>How can exponential functions with bases other than e be integrated? | Use the Log Rule for Integration to integrate a rational function.<br><br>Integrate exponential functions for bases other than e | Same as above | Same as above | Same as above |
| F-LE.A .1-4<br><br>F-LE.B .5 | How can simple differential equations be solved using the separation of variables technique?<br><br>What real world phenomenon can be solved using exponential functions? | Use separation of variables to solve simple differential equations.<br><br>Use exponential functions to model growth and decay. | Same as above | Same as above | Same as above |

**Robbinsville Public Schools**

## Unit #6: Trigonometry Review, Functions, and Calculus

| **Enduring Understandings:** | **Essential Questions:** |
|---|---|
| • Describe angles using radian and degree measures<br>• Evaluate trigonometric functions using the unit circle<br>• Use fundamental trigonometric identities<br>• Evaluate trigonometric functions of acute angles<br>• Use reference angles to evaluate trigonometric functions of any angle<br>• Sketch the graphs of sine, cosine, tangent, cotangent, secant, and cosecant functions<br>• Evaluate inverse trigonometric functions<br>• Use the fundamental trigonometric identities to evaluate, simplify, and rewrite trigonometric expressions<br>• Verify trigonometric identities<br>• Use standard algebraic techniques to solve trigonometric equations<br>• Solve trigonometric equations of quadratic type and involving multiple angles<br>• Use inverse trigonometric functions to solve trigonometric equations<br>• Determine limits of trigonometric functions<br>• Find derivatives of trigonometric functions<br>• Find antiderivatives of trigonometric functions<br>• Find derivatives of inverse trigonometric functions<br>• Find antiderivatives involving inverse trigonometric functions | • How is a trigonometric function evaluated?<br>• How is an inverse trigonometric function evaluated? What is the relationship between the two?<br>• How can you verify a trigonometric function as an identity?<br>• What are the similarities and differences between the trigonometric functions and their reciprocals (graphically, numerically, and algebraically)?<br>• How do the limits of trigonometric functions affect the derivative of a trigonometric function?<br>• How are the rules for the derivatives and antiderivatives of trigonometric and inverse trigonometric functions related to their graphs and properties? |

**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 |
|---|---|---|---|---|---|
| F-TF.A.1<br><br>F-TF.A.2<br><br>F-TF.A.3<br><br>F-TF.A.4<br><br>G-SRT.C.6 | What are the domain and range of trigonometric functions?<br><br>How can trigonometric functions be evaluated using the unit circle?<br><br>What other techniques (reference angles, period, domain, calculator) can be used to evaluate trigonometric functions of any angle? | Describe angles.<br><br>Convert between degrees and radians.<br><br>Describe the relationship between real numbers and the unit circle.<br><br>Evaluate trigonometric functions using the unit circle.<br><br>Use domain and period to evaluate sine and cosine functions.<br><br>Evaluate trigonometric functions of angles.<br><br>Use fundamental trigonometric identities.<br><br>Use reference angles to evaluate trigonometric functions.<br><br>Use trigonometric functions to model and solve real-life problems. | Anticipatory sets to measure background knowledge and engage students<br><br>Use guided and independent practice activities<br><br>Use the Mimeo, whiteboard, and worksheets to reinforce the concepts<br><br>Use cooperative learning activities<br><br>Use discovery based learning activities that require students to make conjectures and investigate patterns<br><br>Use whiteboards to show immediate feedback on questions | Worksheets and sample problems to analyze step-by-step solutions of the problems<br><br>Textbook & associated materials<br><br>Teacher created worksheets<br><br>Mimio lessons<br>Geometer's Sketchpad<br><br>GeoGebra<br><br>TI Smart View with TI 84 Graphing Calculators<br><br>Desmos | Written tests and quizzes<br><br>Worksheets<br><br>Notebook assessments<br><br>Response to discussion questions<br><br>Anticipatory Sets/Do Now Problems<br><br>Diagnostic Assessments to determine readiness<br><br>Closure question/ Exit Slips |
| F-TF.B.5<br><br>F.IF.C.7<br><br>F.BF.B.4 | How are the sine and cosine functions generated from the unit circle?<br><br>What are the parent graphs and transformations of the sine, cosine, tangent, cotangent, secant, and cosecant function? | Graph sine, cosine, tangent, cotangent, secant, and cosecant functions.<br><br>Use sine and cosine to model real-life data. | Same as above | Same as above | Same as above |
| F-TF.B.6<br><br>F-TF.B.7 | What restrictions on the domain are necessary to graph inverse trigonometric functions?<br><br>How does the domain change when trigonometric functions are composed? | Evaluate and graph inverse trigonometric functions.<br><br>Evaluate and graph compositions of trigonometric functions. | Same as above | Same as above | Same as above |

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|---|---|---|---|---|---|
| G-SRT.C.8<br><br>F-TF.C.8<br><br>F-TF.C.9<br><br>A.SSE.A.2 | How can trigonometric expressions be simplified using the fundamental trigonometric identities and algebraic techniques?<br><br>What strategies are helpful in verifying trigonometric identities effectively?<br><br>What algebraic techniques are used to solve trigonometric equations?<br><br>How can the solution of trigonometric equations be verified using technology? | Use the fundamental trigonometric identities to evaluate trigonometric functions and simplify and rewrite trigonometric expressions.<br><br>Verify trigonometric identities.<br><br>Solve trigonometric equations using standard algebraic techniques, quadratic types, multiple angles, and inverse trigonometric functions. | Same as above | Same as above | Same as above |
| A-CED.A.2<br><br>F-BF.B.4<br><br>F-IF.C.7 | What are the geometric and numeric relationships of the limit of a trigonometric function? | Determine the limits of trigonometric functions. | Same as above | Same as above | Same as above |
| F-TF.C.8<br><br>F-TF.C.9<br><br>F-IF.C.7 | What are the derivatives of the trigonometric functions? How are they derived?<br><br>What information can be determined by the first derivative test | Find and use the derivatives of the sine, cosine, and other trigonometric functions.<br><br>Apply the First Derivative Test to find the minima and maxima of a function. | Same as above | Same as above | Same as above |
| A.SSE.A.1<br><br>A.SSE.A.2 | What are the rules for antidifferentiation of trigonometric functions?<br><br>What is u-substitution? How is it used to integrate trigonometric functions? | Integrate trigonometric functions using trigonometric identities and u-substitution.<br><br>Use integrals to find the average value of a function. | Same as above | Same as above | Same as above |

| | | | | | |
|---|---|---|---|---|---|
| F-TF.B.7<br><br>F-TF.C.8<br><br>F-TF.C.9<br><br>F-IF.C.7 | What are the derivative rules for inverse trigonometric functions? How are they derived? | Differentiate an inverse trigonometric function and review the basic differentiation rules for elementary functions. | Same as above | Same as above | Same as above |
| F-TF.B.7<br><br>A.SSE.A.1<br><br>A.SSE.A.2 | What are the rules for antidifferentiation of inverse trigonometric functions?<br><br>How is completing the square used to assist in the integration of a function? | Integrate functions whose antiderivatives involve inverse trigonometric functions.<br><br>Use the method of completing the square to integrate a function.<br><br>Review the basic integration rules involving elementary functions. | Same as above | Same as above | Same as above |

**Robbinsville Public Schools**

## Unit #7: Applications of Integration (*Time Permitting)

| **Enduring Understandings:** | **Essential Questions:** |
|---|---|
| • Use a definite integral to find the area of a region bounded by two curves<br>• Find the volume of a solid of revolution by the disk and shell methods<br>• Find the length of a curve and the surface area of a surface of revolution<br>• Find the work done by a constant force and by a variable force | • How can we use known formulas: such as the area of a rectangular region, the volume of a circular disk, or work done by a constant force in application problems to create a new integration formula?<br>• How can you use an integral to represent change over time?<br>• How can integrals be used to determine the volume of three-dimensional solids formed by the rotation of two-dimensional functions?<br>• How are integrals used to determine the length of a curve and area of a surface? |

**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 calculate the work done by a constant and a variable force

**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 functions and then find the volume when revolved around different axes using the disc or washer method

**Career/Real World Connections**

**Example:** Disc and washer methods can be used to find volume of obscure shapes, rather than typical solids (cube, cylinder, etc.), which is what is more likely to come up in the real world

| **Guiding / Topical Questions with Specific Standards** | | **Content, Themes, Concepts, and Skills** | **Teaching Strategies** | **Instructional Resources and Materials** | **Assessment Strategies** |
|---|---|---|---|---|---|
| A.SSE.A.2<br><br>A-CED.A.2<br><br>F.IF.C.7<br><br>F.IF.C.8 | What is a surface of revolution?<br><br>How can known formulas for area aid in the determination of the volume of a solid? | Find the area of a region between two curves using integration.<br><br>Describe integration as an accumulation process.<br><br>Find the volume of a solid of revolution with the Disk, Washer and Shell Methods. | Anticipatory sets to measure background knowledge and engage students<br><br>Use guided and independent practice activities<br><br>Use the Mimeo, whiteboard, and worksheets to reinforce the concepts | Worksheets and sample problems to analyze step-by-step solutions of the problems<br><br>Textbook & associated materials | Written tests and quizzes<br><br>Worksheets<br><br>Notebook assessments<br><br>Response to discussion questions |

| | | | | | |
|---|---|---|---|---|---|
| G-GM D.A.1<br><br>G-GM D.A.3<br><br>G-GM D.B.4 | How can an integral be used to determine volume?<br><br>How can an integral be used to determine the length of a curve?<br><br>How can an integral be used to determine the area of a surface? | Find the volume of a solid with known cross sections.<br><br>Find the arc length of a smooth curve.<br><br>Find the area of a surface of revolution. | Use cooperative learning activities<br><br>Use discovery based learning activities that require students to make conjectures and investigate patterns<br><br>Use whiteboards to show immediate feedback on questions | Teacher created worksheets<br><br>Mimio lessons<br>Geometer's Sketchpad<br><br>GeoGebra<br><br>TI Smart View with TI 84 Graphing Calculators<br><br>Desmos | Anticipatory Sets/Do Now Problems<br><br>Diagnostic Assessments to determine readiness<br><br>Closure question/ Exit Slips |
| G-MG. A.1<br><br>G-GM D.B.4 | How can an integral be used to calculate the work done on an object? | Find the work down by a constant and by a variable force. | Same as above | Same as above | Same as above |

| General Differentiated Instruction Strategies | |
|---|---|
| • Leveled texts<br>• Chunking texts<br>• Choice board<br>• Socratic Seminar<br>• Tiered Instruction<br>• Small group instruction<br>• Guided Reading<br>• Sentence starters/frames<br>• Writing scaffolds<br>• Tangible items/pictures<br>• Adjust length of assignment | • Repeat, reword directions<br>• Brain breaks and movement breaks<br>• Brief and concrete directions<br>• Checklists for tasks<br>• Graphic organizers<br>• Assistive technology (spell check, voice to type)<br>• Study guides<br>• Tiered learning stations<br>• Tiered questioning<br>• Data-driven student partnerships<br>• 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<br>• Adjust length of assignment<br>• Timeline with due dates for reports and projects<br>• Communication system between home and school<br>• Provide lecture notes/outline | • Extra Response time<br>• Have students verbalize steps<br>• Repeat, clarify or reword directions<br>• Mini-breaks between tasks<br>• Provide a warning for transitions<br>• Reading partners | • Precise step-by-step directions<br>• Short manageable tasks<br>• Brief and concrete directions<br>• Provide immediate feedback<br>• Small group instruction<br>• Emphasize multi-sensory learning | • Teacher-made checklist<br>• Use visual graphic organizers<br>• Reference resources to promote independence<br>• Visual and verbal reminders<br>• Graphic organizers |
| **Assistive Technology** | **Assessments and Grading** | **Behavior/Attention** | **Organization** |
| • Computer/whiteboard<br>• Tape recorder<br>• Spell-checker<br>• Audio-taped books | • Extended time<br>• Study guides<br>• Shortened tests<br>• Read directions aloud | • Consistent daily structured routine<br>• Simple and clear classroom rules<br>• Frequent feedback | • Individual daily planner<br>• Display a written agenda<br>• Note-taking assistance<br>• 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 combine them 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, from 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/