Unit 05: Calculus (Weeks 28-36)

Content Area: **Template**
Course(s):
Time Period: **Full Year**
Length: **FY**
Status: **Published**

Standards Alignment

New Jersey Student Learning Standards

MATH.9-12.F.BF.A.1	Write a function that describes a relationship between two quantities.
LA.K-12.NJSLSA.R2	Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
LA.K-12.NJSLSA.R3	Analyze how and why individuals, events, and ideas develop and interact over the course of a text.
LA.K-12.NJSLSA.R4	Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.
LA.K-12.NJSLSA.R5	Analyze the structure of texts, including how specific sentences, paragraphs, and larger portions of the text (e.g., a section, chapter, scene, or stanza) relate to each other and the whole.
MATH.9-12.F.BF.B	Build new functions from existing functions
MATH.9-12.F.BF.B.4	Find inverse functions.
LA.K-12.NJSLSA.R10	Read and comprehend complex literary and informational texts independently and proficiently with scaffolding as needed.
LA.RST.11-12.2	Determine the central ideas, themes, or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
LA.K-12.NJSLSA.W	Writing
LA.RST.11-12.3	Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks; analyze the specific results based on explanations in the text.
MATH.9-12.F.IF	Interpreting Functions
MATH.9-12.F.IF.A	Understand the concept of a function and use function notation
LA.K-12.NJSLSA.W1	Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence.
LA.RST.11-12.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
LA.K-12.NJSLSA.W2	Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
LA.RST.11-12.5	Analyze how the text structures information or ideas into categories or hierarchies, demonstrating understanding of the information or ideas.

LA.K-12.NJSLSA.W4	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
LA.RST.11-12.10	By the end of grade 12, read and comprehend science/technical texts in the grades 11-CCR text complexity band independently and proficiently.
LA.K-12.NJSLSA.W9	Draw evidence from literary or informational texts to support analysis, reflection, and research.
LA.WHST.11-12.1	Write arguments focused on discipline-specific content.
LA.WHST.11-12.1.D	Establish and maintain a style and tone appropriate to the audience and purpose (e.g., formal and objective for academic writing) while attending to the norms and conventions of the discipline in which they are writing.
LA.WHST.11-12.1.E	Provide a concluding paragraph or section that supports the argument presented.
LA.WHST.11-12.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/experiments, or technical processes.
LA.WHST.11-12.2.D	Use precise language, domain-specific vocabulary and techniques such as metaphor, simile, and analogy to manage the complexity of the topic; convey a knowledgeable stance in a style that responds to the discipline and context as well as to the expertise of likely readers.
LA.WHST.11-12.2.E	Provide a concluding paragraph or section that supports the argument presented.
MATH.9-12.F.LE	Linear and Exponential Models
LA.WHST.11-12.4	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
LA.WHST.11-12.9	Draw evidence from informational texts to support analysis, reflection, and research.
MATH.9-12.F.TF	Trigonometric Functions

Integration of Career Readiness, Life Literacies and Key Skills

CRP.K-12.CRP1	Act as a responsible and contributing citizen and employee.
CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP3	Attend to personal health and financial well-being.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP5	Consider the environmental, social and economic impacts of decisions.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP7	Employ valid and reliable research strategies.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP9	Model integrity, ethical leadership and effective management.
CRP.K-12.CRP10	Plan education and career paths aligned to personal goals.
CRP.K-12.CRP11	Use technology to enhance productivity.
CRP.K-12.CRP12	Work productively in teams while using cultural global competence.

Technology / Integration of Computer Science and Design Thinking

Interdisciplinary Connections: NJSLS for ELA, Social Studies, Science and/or Math Section

Capacities of the Literate Individual
Students Who are College and Career Ready in Reading, Writing, Speaking, Listening, & Language

They demonstrate independence.

They build strong content knowledge.

They comprehend as well as critique.

They value evidence.

MA.F-IF	Interpreting Functions
MATH.K-12.1	Make sense of problems and persevere in solving them
MA.F-IF.A	Understand the concept of a function and use function notation
MA.F-IF.A.1	Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$.
MATH.K-12.2	Reason abstractly and quantitatively
MA.F-IF.A.2	Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
MATH.K-12.4	Model with mathematics
MATH.K-12.5	Use appropriate tools strategically
MATH.K-12.6	Attend to precision
MA.F-IF.C	Analyze functions using different representations
MA.F-IF.C.7a	Graph linear and quadratic functions and show intercepts, maxima, and minima.
MA.F-IF.C.7b	Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
MA.F-IF.C.7c	Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.
MA.F-IF.C.7d	Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.
MA.F-IF.C.9	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
MA.F-LE	Linear and Exponential Models

MA.F-LE.A	Construct and compare linear and exponential models and solve problems
MA.F-LE.A.3	Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.

Integration of Diversity, Equity and Inclusion; Climate Change; Informational and Media LiteracyNew Section

see Crosswalks

21st Century Life and Careers

Stage I: Desired Results

Transfer/Overview/Rationale

Transfer / Overview / Rationale

Unit Rationale

The purpose of this unit…

Meaning

Essential Questions

Essential Questions

- What is meant by a limit?
- What is the relationship between position, velocity, and acceleration?
- How do we use derivatives?

- How do you find the limit of a function?
- What does it mean to be continuous at a point?
- When is a function discontinuous?
- How do you find the equation of a tangent to a curve?
- Is it better to solve a problem graphically or algebraically?
- What is a derivative?

Enduring Understanding/Indicators of Understanding

Enduring Understanding/Indicators of Understanding

- Limits can be used to describe continuity, the derivative, and the integral.
- Limits can be used to describe the behavior of the function for numbers large in absolute value.
- The derivative is the key to modeling instantaneous change mathematically.
- The rules for differentiation help us find derivatives of functions analytically.
- The chain rule is the most widely used differentiation rule in math.
- Implicit differentiation allows us to find derivatives of functions that are not defined or written explicitly as a function of a single variable.
- Derivatives give the rates at which things change in the world.

Acquisition (Student Learning Objectives)

Knowledge

Knowledge

Students will know…

- instantaneous and average speed
- definition of a limit
- properties of limits
- one sided and two sided limits
- sandwich theorem
- end behavior
- continuity
- intermediate value theorem
- average rates of change
- tangent to a curve
- slope of a curve
- derivative
- differentiability
- power rule
- product rule
- quotient rule
- velocity
- accelerations
- displacement
- speed

- chain rule
- implicit differentiation

Skills

Skills

Student will be skilled at …

- find average speed
- find instantaneous speed
- find limits approaching numerical values
- find limits using the sandwich theorem
- find limits as x approaches infinite
- use end behavior models to find limits
- find end behavior models
- determine if a function is continuous
- use the intermediate value theorem to solve problems
- find average rates of change
- find the slope of a curve
- find the normal to a curve
- find the tangent to a curve
- use the definition of a derivative
- determine where a function is not differentiable
- find derivatives using the calculator
- find derivatives using powers, sums, differences, multiples, products, and quotients
- solve problems involving velocity and other rates of change
- find derivatives involving the six basic trig functions
- find the derivative of a composite function
- find the derivative using the chain rule
- use implicit differentiation

Stage 3: Learning Plan

Resource and Mentor Texts

Resources and Mentor Texts

Finney, Ross L., Franklin D. Demana, Bert K. Waits, and Daniel Kennedy. *Calculus-Graphical, Numerical, Algebraic*. Menlow Park: Scott Forseman Addison Wesley, 1999.

- Teacher created materials.
- Resources supplied by publisher.
- Resource from the Internet.

Formative Assessment Strategies

Formative Assessment Strategies

-Announced quizzes

-Short unannounced quizzes

-Homework quizzes

-Exit tickets

-Teacher observations

Learning Activities/Unit of Study

Learning Activities/Unit of Study

Chapter 1

Students will work in groups to complete various problems from the textbook. These problems will review the most important concepts from the year so far that the students will continue to use as we begin calculus.

Chapter 2

2.1: Rates of Change and Limits

- notes/examples
- Group Activity: Using a calculator to investigate limits approaching 0 for functions with discontinuities. (in notes)
- practice with groups

2.2: Limits Involving Infinity

- notes/examples
- Group Acitivity: Exploring end behavior functions
- practice with groups

2.3: Continuity

- notes/examples
- Group Activity: Exploring asymptotes and removal discontinuities (in notes)
- practice with groups

2.4: Rates of Change and Tangent Lines

- notes/example
- Group Activity: Using the calculator to investigate slopes of secant and tangent lines (in notes)
- practice with groups

Chapter 3

3.1: Definition of a Derivative

- notes/examples
- practice with groups

3.3: Rules for differentiation

- Group activity: Discovering the constant multiple rule and power rule.
- notes/examples

3.4: Velocity

- notes/examples

- practice with groups

3.5: Derivatives of Trigonometric functions

- notes/examples
- Group Activity: Deriving the derivatives of tangent, secant, cotangent, and cosecant
- practice with groups

3.6: Chain Rule

- notes/examples
- practice with groups

3.7: Implicit Differentiation

- notes/examples
- practice with groups

trig calc ch 2 notes.pdf
trig calc ch 3 notes.pdf
trig derivative formula discovery.docx
calc 4 03 14.doc
calc 4 11 14.doc
trig 4 03 14.doc
trig 4 11 14.doc
trig 5 12 14.doc
trig 5 20 14.doc
calc 5 29 14.doc

Modifications and/or Accommodations

Suggested Modifications (ELL, Sp. Ed, GIfted, At-risk of Failure)

English Language Learners

Native language support: The teacher provides auditory or written content to students in their native language.

Adjusted Speech: The teacher changes speech patterns to increase student comprehension. This could include facing the students, paraphrasing, clearly indicating the most important ideas, and

speaking more slowly.

Visuals: The teacher uses graphics, pictures, visuals, and manipulatives. This helps ELL students better understand and comprehend the subjects at hand.

Front-Loading Vocabulary: The teacher front loads vocabulary. This means providing students with a list of important vocabulary words they will need to know for a book, lesson, etc. prior to the lesson being taught. Including pictures to go with the vocabulary words is also very beneficial for the students.

Special Education Students

Chunking: The teacher presents information in a way that makes it easy for students to understand and remember. Chunking is based on the presumption that our working memory is easily overloaded by excessive detail. The best way to deliver information is to organize it into meaningful units. Because students with special needs get overloaded easily, chunking is an effective strategy to use with them.

Checking for Understanding: It is important to constantly check for understanding, especially for students who have accommodations. Teachers want to make sure students understand the concepts being covered in a way that makes sense to them.

Extra time: The teacher provides students with special needs extra time to complete work or answer questions. It is important to give students enough time to process their thoughts.

Oral Reading: The teacher will read work orally to students. Class work such as tests and literature circles may need to be read aloud to the student.

Timers: The teacher will use timers as an instructional tool. The use of timers is beneficial for students who have trouble completing tasks. Timers can be helpful so the student is aware of how much time they have to complete an assignment.

Students with 504 Plans

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Gifted & Talented Strategies

Extensions/Enrichments: Teachers will provide gifted and talented students with extension/enrichment projects. Students will be challenged to further their understanding, to apply acquired knowledge, and/or to produce something in reference to acquired knowledge.

Modify/Change Activities: Teachers will monitor and modify activities to accommodate those students who need to be challenged further. Additional reading, problem-solving, writing, or project work is necessary for those students who are ready to move on at a rate more accelerated than their peers. In this way, G & T students are provided the same opportunity for support as special needs students.

Students at Risk of School Failure

Directions or Instructions: Make sure directions and/or instructions are given in limited numbers. Give directions/instructions verbally and in simple written format. Ask students to repeat the instructions or directions to ensure understanding occurs. Check back with the student to ensure he/she hasn't forgotten.

Peer Support: Peers can help build confidence in other students by assisting in peer learning. Many teachers use the 'ask 3 before me' approach. This is fine, however, a student at risk may have to have a specific student or two to ask. Set this up for the student so he/she knows who to ask for clarification before going to you.

Alternate or Modified Assignments: Always ask yourself, "How can I modify this assignment to ensure the students at risk are able to complete it?" Sometimes you'll simplify the task, reduce the length of the assignment or allow for a different mode of delivery. For instance, many students may hand something in, the at-risk student may jot notes and give you the information verbally. Or, it just may be that you will need to assign an alternate assignment.

Increase One to One Time: When other students are working, always touch base with your students at risk and find out if they're on track or needing some additional support. A few minutes here and there will go a long way to intervene as the need presents itself.

Contracts: It helps to have a working contract between you and your students at risk. This helps prioritize the tasks that need to be done and ensure completion happens. Each day write down what needs to be completed, as the tasks are done, provide a checkmark or happy face. The goal of using contracts is to eventually have the student come to you for completion sign-offs.

Hands On: As much as possible, think in concrete terms and provide hands-on tasks. This means a child doing math may require a calculator or counters. The child may need to tape record comprehension activities instead of writing them. A child may have to listen to a story being read instead of reading it him/herself.

Tests/Assessments: Tests can be done orally if need be. Break tests down in smaller increments by having a portion of the test in the morning, another portion after lunch and the final part the next day.

Seating: Seat students near a helping peer or with quick access to the teacher. Those with hearing or sight issues need to be close to the instruction which often means near the front.