Unit 4 Derivatives

Content Area: **Mathematics**
Course(s): **Pre-Calculus**
Time Period: **May**
Length: **6 weeks**
Status: **Published**

Unit Overview

During this unit, students will…

- Find average and instantaneous rate of change.
- Calculate slope of tangent lines at a point of a graph.
- Relate how the process of limits obtains a derivative (rate of change at any moment in time of a function).
- Use the rate of change formula and determine rules to find first and second derivatives.

BLITZER- Chapter 11

Transfer

Students will be able to independently use their learning to...

- Recognize mastering of limits is the foundation of derivatives and calculus.
- Explain movement of objects in terms of avarage and instantaneous velocity.

For more information, read the following article by Grant Wiggins.

http://www.authenticeducation.org/ae_bigideas/article.lasso?artid=60

Meaning

Understandings

Students will understand that...

- Derivatives are used to explain movement of objects in terms of velocity and acclearation.
- Fermat's Formula (limits) develops how to determine the derivative of a function.

- The rate of change of a graph and the slope of the tangent line at that point are equal.

Essential Questions

Students will keep considering...

- How are limits and derivatives preparing me for calculus?
- What connections can be made between position and velocity functions?
- How will the skills I have learned help me explain real-world occurances?
- How do mathematical ideas interconnect and build on one another to produce a coherent whole?

Application of Knowledge and Skill

Students will know...

Students will know...

- That limits are used to explain tangent and secant lines relationship.
- Limits are the foundation of derivatives and ultimately all of calculus.
- A derivative represents the slope of the tangent line, instantaneous rate of change and instantaneous velocity.
- Derivative rules exist as short cuts to using the definition of the derivative.

Students will be skilled at...

Students will be skilled at...

- Calculate first derivative and instantaneous rate of change.
- Using the power rule and constant rule to determine derivatives for polnomials.
- Use the product, quotient, and chain rule to determine derivatives for polynomials and rational expressions.

Academic Vocabulary

limit

secant line

tangent line

average rate of change

instantaneous rate of change

velocity

acceleration

power rule

constant rule

product rule

quotient rule

chain rule

slope

Learning Goal 4.1

SWBAT identify limits as the foundation to mastering how to determine and explain instantaneous rates of change.

Target 4.1.1 (Fermat's Formula - Limit Definition to Discover Derivative Concept)

SWBAT:

- Show that the limit of a secant line becomes the tangent line at a specified point of a function. **(DOK 2)**
- Use the definition of a limit to define a derivative using Fermat's Method. **(DOK 2)**
- Recognize that a derivative is used to determine instantaneous velocity of objects. **(DOK 1)**

Section 11.4

MA.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.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.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.K-12.5	Use appropriate tools strategically.
MA.F-IF.B.6	Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

Target 4.1.2 Write Tangent Line Equations

- Find the derivative of a function at a specified point. **(DOK 2)**
- Write the tangent line equation at a specified point of a function. **(DOK 2)**

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MA.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.K-12.2	Reason abstractly and quantitatively.
MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.F-IF.B.6	Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.
MA.F-IF.C	Analyze functions using different representations
MA.K-12.8	Look for and express regularity in repeated reasoning.
MA.F-IF.C.8	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

Target 4.1.3 Compute Derivatives

SWBAT:

- Connect Fermat's Formula to create the constant rule and power rule to find derivatives for polynomials. **(DOK 4)**
- Determine the derivative of polynomials using the product and quotient rules. **(DOK 2)**
- Determine the derivative of polynomials using the chain rule. **(DOK 2)**
- Determine the derivative of trigonometric functions. **(DOK 2)**

Section 11.4

MA.K-12.1	Make sense of problems and persevere in solving them.

MA.K-12.3	Construct viable arguments and critique the reasoning of others.
MA.N-RN.A.2	Rewrite expressions involving radicals and rational exponents using the properties of exponents.
MA.K-12.6	Attend to precision.
MA.F-IF.B.6	Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.
MA.K-12.7	Look for and make use of structure.

Formative Assessments and Performance Opportunities

- Academic Games
- Class Discussions
- Classwork
- Do Nows
- Exit Tickets
- Homework
- Problem Based Learning
- Student Interviews
- Teacher Observation
- Whiteboard/Communicator Opportunities

Summative Assessment

- Link It Exams
- Projects
- Quizzes
- Student Interviews
- Tests
- Unit Exam

21st Century Life and Careers

CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP2.1	Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications, and they make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.
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.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
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.
CAEP.9.2.12.C.3	Identify transferable career skills and design alternate career plans.

Technology

TECH.8.1.12.C	Communication and Collaboration: Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.
TECH.8.1.12.D	Digital Citizenship: Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.
TECH.8.1.12.D.CS1	Advocate and practice safe, legal, and responsible use of information and technology.
TECH.8.1.12.D.CS2	Demonstrate personal responsibility for lifelong learning.
TECH.8.1.12.E	Research and Information Fluency: Students apply digital tools to gather, evaluate, and use information.
TECH.8.1.12.E.1	Produce a position statement about a real world problem by developing a systematic plan of investigation with peers and experts synthesizing information from multiple sources.
TECH.8.1.12.E.CS1	Plan strategies to guide inquiry.
TECH.8.1.12.E.CS4	Process data and report results.
TECH.8.2.12.A.CS2	The core concepts of technology.

Accommodations and Modifications

- 504 Accomodations
- Academic Games of Review Packet for each section
- Centers/Stations
- Challenge Questions
- IEP Modifications
- Individual vs. Large Group Wipeboard Q & A
- Manipulatives (highlighting, underlining, starring critical information)
- Provide You Tube Videos (Calc Phobe Tutorials)
- Scaffolding Questions
- Small group instruction (opportunity to work with teacher 1-on-1)
- Use of technology such as google classroom to provide answer keys

Unit Resources

- Geometer's Sketchpad
- Google Classroom
- Kuta Software
- NCTM website

- Online Textbook Materials

- Text

- You Tube & Internet Videos

Interdisciplinary Connections

Using the limit process in order to define a derivative, students are able to understand that a derivative can determine the rate of change at any moment in time. Therefore, with derivatives, we can determine the instanteneous rate of change of an object at any moment. Some examples include determining a car's velocity upon impact in an accident or the temperature of an object as it heats or cools. (MA.9-12.F-IF.B.6)

9-12.HS-PS1-5	Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.
9-12.HS-PS1-5.6.1	Apply scientific principles and evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.
9-12.HS-PS2-2.PS2.A.1	Momentum is defined for a particular frame of reference; it is the mass times the velocity of the object.