Intro to Calculus - Unit C - Derivatives

Unit Focus

Students are introduced to the derivative as the slope of the line tangent to a function at any point. Students will practice finding derivative first using the limit definition and then using the rules and algebraic computation and the chain rule. Student will study implicit differentiation and apply this concept to related rate problems.

By then end of this unit students should be able to determine the equation of the tangent to a graph using explicit or implicit derivatives. Students should also be able to distinguish between position, velocity and acceleration and how they relate to each other in terms of being derivatives of each other.

There are many places to be careful and apply numerous rules at the same time. If extra time is necessary, take that time. Students must know derivative before they can do integral.

Stage 1: Desired Results - Key Understandings

Standard(s)

Common Core
Mathematics: 9-12

- Make sense of problems and persevere in solving them. (CCSS.MATH.MP.1)
- Reason abstractly and quantitatively. (CCSS.MATH.MP.2)
- Model with mathematics. (CCSS.MATH.MP.4)
- Attend to precision. (CCSS.MATH.MP.6)
- Look for and make use of structure. (CCSS.MATH.MP.7)

Madison Public Schools Profile of a Graduate

- Analyzing: Examining information/data/ evidence from multiple sources to identify possible underlying assumptions, patterns, and relationships in order to make inferences. (POG.1.2)
- Collective Intelligence: Working respectfully and responsibly with others, exchanging and evaluating ideas to achieve a common objective. (POG.3.1)

Transfer

Students will be able to independently use their learning to...
T1 demonstrate fluency with math facts, computation and concepts.
T2 justify reasoning using clear and appropriate mathematical language.

Meaning

Understanding(s)

Students will understand that...
U1 Mathematicians represent and analyze mathematical situations and structures using algebraic symbols to communicate thinking.
U2 Mathematicians use models to represent and make meaning of quantitative relationships.
U3 Mathematicians argue the relationships between problem scenarios and mathematical representation.

Essential Question(s)

Students will keep considering...
Q1 How do you express and describe a pattern and use it to make predictions and solve a problem?
Q2 How can change be described?
Q3 How do I interpret this mathematical model?

Acquisition of Knowledge and Skill

Knowledge

Students will know...
K1 the slope of tangent to a function at a given point if the function is the limit of the slopes of the of the secants through points close to the given point
K2 whether or not a limit exists at a given point

Skill(s)

Students will be skilled at...
S1 finding the slope of a tangent to a function using the a) limit of the difference quotient formula b) visual inspection c) tables on the calculator
S2 finding equations of tangent lines

Stage 1: Desired Results - Key Understandings		
	K3 the limit definition of a derivative **K4** how to find high order derivatives **K5** $\lim_{x\to\infty} \frac{sinx}{x} = 0$ **K6** the chain rule **K7** the difference between implicit and explicit differentiation **K8** slope is the rate of change **K9** meaning between positive and negative slopes **K10** Rolle's Theorem **K11** Mean Value Theorem **K12** Vocabulary: implicit differentiation, implicit differentiation	**S3** using the limit definition to find a derivative in polynomial, rational and radical functions **S4** sketching a graph of f'(x) given the graph of f(x) and the graph of f(x) given f'(x) **S5** using the power rule and the general derivative rule to find derivatives algebraically **S6** computing velocity and acceleration given the position equation **S7** using the derivative to find where the slope of a tangent is 0 and then determining its significance **S8** using product and quotient rules to determine a derivative algebraically **S9** using the derivative rules for the six trig functions **S10** using the derivative rules for exponential and log functions **S11** using the chain rule to find derivatives of composite functions algebraically **S12** finding derivatives using implicit differentiation **S13** solving related rates application problems by a) sketching (words -> diagram) b) setting up an appropriate formulaic equation c) differentiating with respect to time d) solving for the unknown **S14** using the mean value theorem to a) determine the point where instantaneous rate of change is equivalent to the average rate of change (and what that means) b) determine whether or not zero(s) exist in a given interval for a given function