Class: MAT 1140
Date assigned: Monday, Septermeber 3rd
Date due: Sunday, September 9th
Time estimate to complete this assignment: 40 minutes

Overview/Introduction

The derivative of a function gives a measure for the rate at which the function is changing. The derivative at a particular point on the graph of the function tells the instantaneous rate of change of the function at that point. This rate of change is essentially found by calculating the slope between two very close points on the graph of a function. In the lesson, you will develop an understanding of the definition of derivative of a function, learn to calculate derivatives using the definition, and determine when a function would fail to have a derivative.

Learning Objectives

Basic objectives

1. Be able to define the derivative of a function with respect to a specific variable.
2. Be able to define "differentiable" in terms of a function.
3. List the different notations used to represent the first derivative of the function y = f(x).
4. Provide an example of a function with a specific point where the derivative fails to exist.

Advanced objectives

1. Calculate the derivative of a function using the definition of derivative.

2. Explain why the derivative fails to exist at a specific point for the example chosen in the basic objective.

Preparatory Activities and Resources:

Text: Read section 3.2 in your textbook.
Video (optional): "Formal and Alternative Form of the Derivative"
https://www.khanacademy.org/math/ap-calculus-ab/ab-differentiation-1-new/modal/v/alternate-form-of-the-derivative

Exercises: Please complete by _Sunday, September 9th_____.

Step 1: Read through the first subsection of section 3.2 and take notes.
- **Write** down the definition of derivative.
- **Write** down the definition of differentiable.

Step 2: Read through the second and third subsections "Calculating Derivatives from the Definition" and "Notation."
- **List** the various notation used to denote the first derivative of a function y of x.

Step 3: Read through the remaining three subsections ("Graphing the Derivative," Differentiable on an Interval," "When Does a Function…", and "Differentiable Functions are…").
- **Spend** 1 -2 minutes analyzing the graphs on page 129.

- **Write** down a function whose derivative does not exist at a particular point.

Deliverable: **Create a Word Document answering the "write" and "list" bulleted items. Save it as a PDF and upload to Blackboard by Sunday, September 9th.**

Questions?

- Email me
- Come to office hours
- Watch video resource
- Visit the Learning Resource Center
- Collaborate with classmates(s)

Lesson Plan

Lesson: __MAT 1140: 3.2 The Derivative of a Function_____

Timeframe: Note how long will it take the learner to complete all of the activities from pre-class to post-class activities.

Pre-class: 40 minutes
In-class: 65 minutes
Post-class: 60 - 90 minutes

Materials needed: Describe what items will be needed to complete the in-class activities.

Textbook, notes from pre-class work.
Whiteboard, dry-erase markers, computer, projector, list of functions whose derivatives will be calculated, kahoot quiz.

Objectives: List out the basic objectives tied to pre-class activities and the advanced objectives tied to in-class and post-class activities.

Basic:
1. Be able to define the derivative of a function with respect to a specific variable.

2. Be able to define "differentiable" in terms of a function.

3. List the different notations used to represent the first derivative of the function y = f(x).

4. Provide an example of a function with a specific point where the derivative fails to exist.

Advanced:
1. Calculate the derivative of a function using the definition of derivative.

2. Explain why the derivative fails to exist at a specific point for the example chosen in the

basic objective.

Background to the Lesson: Note the typical composition of learners in the class, how this lesson fits into the course design/schedule, prerequisite knowledge required, and typical challenges that learners face with this content area.

Typical students of the course may be in one of two places. One: they recently took precalculus/calculus and have already mentally processed the transition from algebra to calculus. These students will be able to, in theory, understand the concept of a derivative with some ease. Two: they have little to no experience with any math beyond algebra. These students may have a more difficult time conceptualizing the idea of a derivative of a function.

Introduction to Lesson: Describe the purpose of this content area for learners and timeline of activities for the flipped lesson.

Prior to the flipped in-class lesson, the students will actively read through the section of the textbook, taking notes. This will introduce them to the main concepts of the section and help prepare them for the in-class activities. During class, the student will participate in a number of activities to re-introduce/familiarize them with the definition of the derivative of a function, how to calculate it, and when it fails to exist. By participating in the in-class activities, they should be able to complete the post-class activity (working through problems on MyMathLab) with a fair amount of understanding.

Procedure [Time needed, include additional steps if needed].

Pre-Class Individual Space Activities and Resources: Outline the major steps for the preparatory activities and be sure to tie the steps to the basic learning objectives you have noted above. Note resources required for learner preparation.

Steps	Purpose	Estimated Time	Learning Objective
Step 1: In the textbook, read through the first subsection of section 3.2. **Write down the definition of derivative.** **Write down the definition of differentiable.**	**Familiarize students with next version of the definition of derivative (following section 3.1) and differentiability.**	**10 min.**	**Basic 1.** **Basic 2.**

Step			
Step 2: Read through the second and third subsections "Calculating Derivatives from the Definition" and "Notation." **List the various notation used to denote the first derivative of a function y of x.**	**Understand how to use the definition to calculate the derivative of a function and recognize the differing notation for first derivative.**	**15 min.**	**Basic 1.** **Basic 2.** **Basic 3.**
Step 3: Read through the remaining three subsections ("Graphing the Derivative," Differentiable on an Interval," and "When Does a Function...") and analyze the graphs. Write down a function whose derivative does not exist at a particular point.	**Analyze and be able to recognize when the derivative of a function fails to exist.**	**15 min.**	**Basic 4.**

In-Class Group Space Activities and Resources. Outline the major steps for the in-class activities and be sure to tie the steps to the advanced learning objectives you have noted above. Also note any resources needed/developed to provide effective active learning activities within class.

Steps	Purpose	Estimated Time	Learning Objective
Step 1: Quick quiz on basic learning objectives using a tool with immediate feedback.	**Accountability for individual space activities.**	**5 - 10 min.**	**Basic 1.** **Basic 2.** **Basic 3.** **Basic 4.**
Step 2: Use "Pass the Chalk" to use the definition to calculate the derivative of a function on the board as a class.	**Walk through and familiarize students with the steps for calculating a derivative, preparing them from group work.**	**10 min.**	**Adv 1.**

Step	Purpose	Time	Objective
Step 3: Work in pairs to calculate the derivative of a function.	**Practice using the definition and steps to calculate the derivative of a function.**	**15 - 20 min.**	**Adv 1.**
Step 4: Use Kahoot to quiz on functions whose derivative fails to exist, including reasoning for the failure.	**Recognize and understand when and where a derivative would fail to exist for different functions.**	**10 - 15 min.**	**Basic 1. Adv 2.**
Step 5: Answer questions/have discussion about muddiest point(s).	**Summarize, solicit questions.**	**5 - 10 min.**	**All**

Post-Class Individual Space Activities and Resources. Outline the major steps for the post-class activities and be sure to tie the steps to the advanced learning objectives you have noted above. Also note any resources learners will need to complete any post-class activities assigned after the group space activities.

Steps	Purpose	Estimated Time	Learning Objective
Step 1: Complete MyMathLab homework assignment for section 3.2	**Students should be able to understand and synthesize the content covered in section 3.2.**	**60 - 90 min.**	**All**

Evaluation:

Analysis. In this section, note what you think will work, and what challenges you think you may face in implementation.

What I believe will work well is working in pairs to calculate the derivative of a function. This is because, when it is time for this activity, we will have just walked through an example as a class. The students will have those steps, as well as their notes and classmate's help, to complete the task.
A challenge that I foresee is, while implementing "pass the chalk," if a student did not complete the pre-class work or is confused about the topic, he or she will be unprepared to participate. I may address this potential challenge by allowing students to ask a neighbor for help during this activity.

Connections to Future Lessons. In this section, note how you think this lesson plan connects to your next topics in the course.

The material covered in this lesson is foundational for almost all subsequent material that the students will learn in the course. I can use the in-class "Step 1" in future lessons to test/remind them of how the definition of derivative has evolved from when they first learned it.