

Computer Aided Mathematics in Calculus I

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Overview of Calculus I at Tarleton State University

- Early Transcendentals.
- Stewart 7th edition, chapters 1-5 or openstax (<https://openstax.org/>).
- Semesters: MWF for 50 minutes and TR for 75 minutes.
- Introduce Learning Objective: Technology.
- Students use *Mathematica* and graphing calculators to help with concepts.
- Tarleton, through the Texas A&M system, has a program that allows students to install *Mathematica* on their personal computers for free. All open access and teaching computer labs have *Mathematica* installed.

The Audience

- Predominately freshmen and sophomores.
- Engineering, mathematics and science majors.
- Moderately skilled with graphing calculators.
- Unskilled with Computer Algebra Systems (CAS, like *Mathematica*).

- Introduce mathematical concept(s) in class and assign homework.
- Use a teaching computer lab to reinforce concept(s) with a *Mathematica* assignment. Technology labs usually include:
 - Review of mathematical concept(s).
 - Give example(s) of how to use a CAS to aid in the computations.
 - Assign targeted problems for the student to complete using the CAS.

Technology Lab Topics

- Lab 01 Introduction: Notebook that reviews expressions, functions and graphing. Introduces students to the *CAS Mathematica*, the command structure and interface.
- Lab 02 Limits: Notebook that strengthens the relationship between graphs of functions and limits. One-sided and two-sided limits are explored.
- Lab 03 Derivatives Part 1: Review the limit definition of a derivative and introduce the *Mathematica* commands for computing a derivative.
- Lab 04 Derivatives Part 2: Use the CAS to compute the derivatives of the commonly used functions - powers, trigonometric, exponential and logarithmic functions. Composite functions and higher order derivatives are also explored.
- Lab 05 Implicit Graphs: The graphs of families of implicitly defined functions are explored using the CAS's animation (the *Manipulate* command).

Technology Lab Topics (Continued)

- Lab 06 Linear Approximations: The CAS is used to graph a function and its tangent line near a point of interest. The tangent line is then used to approximate the value of the function.
- Lab 07 Max and Min's: The CAS is used to explore absolute extreme of a function on closed intervals.
- Lab 08 Graphs: the First and Second Derivative Tests, increasing/decreasing, concavity and graphing are investigated.
- Lab 09 Riemann Sums: "Area Under a Curve" using rectangles. A complimentary notebook is provided that includes subroutines (Modules) that implement right-, left-, and mid-point methods.
- Lab 10 Introduction to Integrals: the CAS is used to compute definite and indefinite integrals.

The Web Page

These *Mathematica* notebooks for Calculus I can be found at:

<https://faculty.tarleton.edu/white/calculus1index.html>

-or-

Go to my main web page at:

<https://faculty.tarleton.edu/white/>

click on “Courses Taught” and then choose the Calculus I course.

Note that there are technology labs for Calculus II and III as well as Differential Equations under the other courses taught.

Thank You.