# Calculus 12

**Fall 2021**      **Period 1**
**Mr. Sheldon**      **Room 108**

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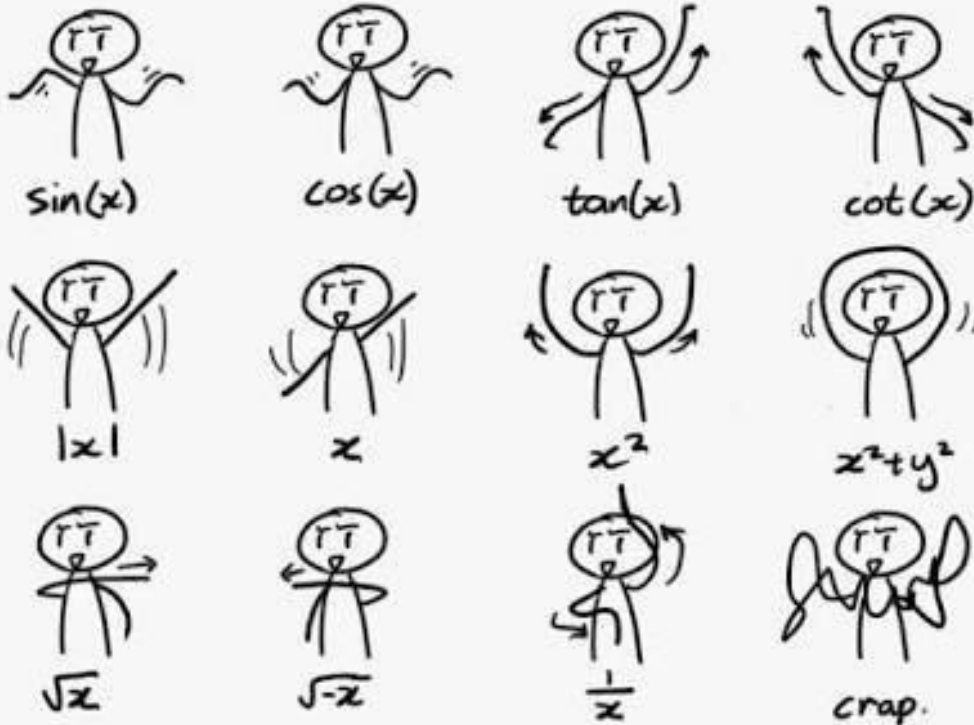


**About the Course:**

"*Calculus* is the most powerful weapon of thought yet devised by the wit of man."
    -- W. B. Smith

" *Calculus is the greatest aid we have to the application of physical truth in the broadest sense of the word."*
    -- W. F. Osgood

Calculus is a fascinating, powerful, and challenging topic. It is the mathematics of change. While much of what we do in Mathematics is somewhat artificial, Calculus is the mathematic of real life. For example:

- In algebra we find the slopes of straight lines. In calculus we find the slopes of complex curves.
- In algebra we find the area of triangles and rectangles. In calculus we find the areas under curves.

- In algebra we deal with constant speeds and motion. In calculus we deal with varying speeds and motion.
- Algebra is more regular and less real. Calculus is more real and less regular.

**There are three basic parts to Calculus:**
1. Limits – the tools we use to precisely describe how a function approaches a value
2. Derivatives – the tools we use for describing how a function changes
3. Integrals / Antiderivatives – the tools used to give the area under the curve of a function

**TextBook**   You will be assigned a textbook for this course, and we will be reading and working from it regularly.

**Teams**
You have all been added to a class Team. I will be uploading and sharing material to our class Team. Please check it regularly for announcements.

**Major Units/Topics:**
**Unit 1**
Chapter 0: Review of Pre-Calculus
Lesson 1 – Introduction to Calculus
Lesson 2 – Review of Functions
Lesson 3 – Graphing Calculators
Lesson 4 – Composition
Lesson 5 – Some Common Functions
Lesson 6 – Inverse Functions
Lesson 7 – Exponential & Logarithmic Functions
Chapter 1: Limits and Rates of Change
Lesson 1 – Introduction to Limits
Lesson 2 – Properties of Limits
Lesson 3 – Limits Involving Infinity
Lesson 4 – Continuity
Lesson 5 – Applications of Limits
**Unit 2**
Chapter 2: Derivatives
Lesson 1: The Derivative
Lesson 2: Rules of Differentiation
Lesson 3: Trigonometric Derivatives and The Chain Rule
Lesson 4: Derivatives of Exponential, Log, and Inverse Trig Functions
Lesson 5: Implicit Differentiation
Chapter 3: Applications of Derivatives
Lesson 1: Analyzing Functions Part I: Curve Sketching
Lesson 2: Analyzing Functions Part II: Maximums and Minimums
Lesson 3: Applied Maximum and Minimum Problems
Lesson 4: Distance, Velocity, Acceleration and Rectilinear Motion
Lesson 5: Related Rates

Lesson 6: The Mean-Value Theorem

**Unit 3**

Chapter 4: Integration
Lesson 1: Area Approximation and Riemann Sums
Lesson 2: Introduction to the Definite Integral
Lesson 3: The Fundamental Theorem of Calculus
Lesson 4: Integrals and Antiderivatives
Lesson 5: Integration by Substitution
Lesson 6: The Definite Integral

**Unit 4**

Chapter 6: Application of Integrals
Lesson 1: Finding the Area Under and Between Curves
Lesson 2: Volume by Discs (Slicing)
Lesson 3: Volume by Shells
Lesson 4: Work
Lesson 5: Average Value of a Function and Rectilinear Motion Revisited

Chapter 7: Differential Equations
Lesson 1: Differential Equations – An Introduction
Lesson 2: Initial Value Problems, Slope Fields, and Euler's Method
Lesson 3: Linearization and Newton's Method
Lesson 4: Numerical Approximation Methods with Integrals

Chapter 8: Supplemental Topics
Lesson 1: Exploring the Graphs of f, f'
Lesson 2: Relative Rates of Growth
Lesson 3: Using Calculus With Data in a Table
Lesson 4: Functions Defined By Integrals

**Students are expected to know the following:**
- functions and graphs
- limits:
  - left and right limits
  - limits to infinity
  - continuity
- differentiation:
  - rate of change
  - differentiation rules
  - higher order, implicit
  - applications
- integration:
  - approximations
  - fundamental theorem of calculus
  - methods of integration
  - applications

**Big Ideas**
- The concept of a limit is foundational to calculus.

- Differential calculus develops the concept of instantaneous rate of change.
- Integral calculus develops the concept of determining a product involving a continuously changing quantity over an interval.
- Derivatives and integrals are inversely related.

**Equipment Needed:**
a computer with internet access and headphones/speakers in addition to a graphing/scientific calculator.

**Marks Breakdown:**
- Tests/Projects          (30%)
  - Midterm and Final Exam
  - Chapter Tests
- Quizzes                (20%)
  - Usually have quizzes Wednesdays and Fridays
- Homework/Participation    (20%)
- Term Projects         (30%)
  - Two Presentation Projects
    - (Applications of Derivatives, Applications of Integrals)

**Links**
https://curriculum.gov.bc.ca/curriculum/mathematics/12/calculus
https://math.libretexts.org/Bookshelves/Calculus
https://sites.google.com/site/mrkerkhoven/calculus-12
http://www.wadgemath.ca/calculus-12.html