Overall Learning Objectives

By the end of each chapter you should be able to do the following things

1. Limits of Functions
   1. Define a function
   2. Identify and describe the component of a function
   3. Define what it means to take a limit
   4. Describe a limit in words
   5. Differentiate between point and infinite limits
   6. Apply the methods used to solve point and infinite limits
   7. Apply limit algebraic properties () to solve more complex limits
2. Limits of Continuous Functions
   1. Distinguish between then left and right limit approach, and a point’s existence
   2. Define the existence of a limit
   3. Determine and define the continuity of a point
   4. Describe the 3 types of discontinuities
   5. Identify and/or illustrate the 3 types of discontinues given a function and a point, or limit information
   6. Determine the continuity of a function
   7. Describe where a function is continuous and/or discontinuous
   8. Apply the algebraic properties of continuous function to determine the continuity of more complex functions
3. Rates of Changed
   1. Calculate **estimates** for average and instantaneous rates of change given a function OR data
   2. Determine the units for a rate of change
   3. Define velocity and describe how it relates to rates of change
   4. Define the limit definition of instantaneous rates of change for a point
   5. Calculate the **true** instantaneous rate of change for a point
   6. Provide examples of real-world rates of change
4. Derivatives of Functions
   1. Define the limit definition of a function
   2. Differentiate between the limit definition of a point and a function
   3. Apply the limit definition of a derivative function to find the derivative
   4. Apply the rules for derivatives to find the derivative of basic functions
   5. Define a tangent line
   6. Calculate the tangent line for a point along a basic function
   7. Determine where a function or illustration of a function is differentiable
   8. Prove or disprove a function is differentiable at a given point
   9. Describe what a derivative is in relation to its “parent” function
5. Computing Derivatives
   1. Apply the power rule to differentiate a variable raised to a power
   2. Define the components of a composite function
   3. Apply the chain rule to differentiate composite functions
   4. Apply the reciprocal and quotient rules to differentiate functions being divided
   5. Identify the overall “structure” of a function, the relevant components, and the rules needed to differentiate it
   6. Identify exponential functions and the rules used to differentiate it
   7. Calculate higher order derivatives
   8. Identify higher order derivative symbols
   9. Determine how a function’s units change under higher derivatives
6. Maxima and Minima
   1. Define local and global maxima and minima
   2. Calculate the maxima and minima and determine the max and min points of a given function
      1. Using the first derivative test
      2. Using the second derivative test
   3. Given a first or second derivative test determine the critical (maxima, minima, and inflection) of a function and describe its concavity
   4. Produce an approximate sketch of a function, given the function or its first or second derivative test and indicate critical and describe its concavity
   5. Apply the mean value theorem to find the points that have the same slope as the slope between points and
   6. Define concavity
   7. Calculate the inflection points of a function
   8. Determine and describe the concavity of a function (concave up & concave down)
   9. Prove a function has global max or global min, or neither and identify the global max or min if it exists
   10. Determine the absolute maximum and minimum of a function over an interval
   11. Apply your knowledge of maxima and minima to find the optimize a word problem
       1. Extract relevant information from a word problem
       2. Translate words into mathematical equations
       3. Identify your object function
       4. Calculate the max or min of the object function
7. Estimating the area under a curve
   1. Describe how area under a curve relates a rate of change to its “parent” function
   2. Determine the units for the area under a curve given a function and a rate of change
   3. Identify methods to improve our estimate of the area under a curve
   4. Apply the left, right, and trapezoid method to calculate the area under a curve
   5. Recognize summation notation and identify the components
   6. Differentiate how area below the horizontal is treated when calculating “net change” and “total change”
8. Antiderivatives and the Fundamental Theorem of Calculus
   1. Define an integral using the sum of rectangles
   2. Define an integral in terms of area
   3. Summarize, in simple terms, the fundamental theorem of calculus
   4. Explain how the fundamental theorem of calculus links integrals and derivatives
   5. Define an antiderivative and explain how it relates to integrals
   6. Explain what the (or other variable) at the end of an integral represents
   7. Distinguish between definite and indefinite integrals and the types of questions they can answer
   8. Calculate definite and indefinite integrals of common functions
   9. Explain why the is necessary for the indefinite integral of a function
   10. Determine the units of an integral of a function
   11. Utilize the algebraic properties of integrals to calculate integrals of more complex functions
   12. Determine the average change of a given function
   13. Determine the units of the average change of a function
9. Methods of Integration
   1. Distinguish between the types of functions u-substitution and integration by parts are used integrate
   2. Identify the overall “structure” of a function, the relevant components, and the rules (u-substitution and integration by parts) needed to integrate it
   3. Calculate the definite and indefinite integral of functions using u-substitution and integration by parts
   4. Recall that some functions may require both u-substitution and integration by parts to fully solve
10. Applications of Integrals to Area and Volume
    1. Calculate the area between two curves
    2. Identify the need for sub-regions, when calculating the area between two curves
    3. Determine the start and end points of reach sub region and/or the start and end points of the area between two curves
    4. Recognize the types of questions requiring you to find the area between two curves
    5. Calculate the volume of a solid made be revolving a function about the x-axis
    6. Calculate the total number of objects in a 3-dimensional space using a density function
11. Separation of Variables
    1. Determine the value of in standard differential equations given a boundary condition