Math 261
Exam 3 Review Sheet

Section 4.1 Extrema of Functions

• Know the definitions of increasing, decreasing, constant, maximum value, minimum value, local maximum, and local minimum and be able to apply them to the graph of a function.
• Know the statement of the Extreme Value Theorem (EVT) and be able to determine whether a given function satisfies the hypotheses of the this theorem.
• Understand the connection between critical numbers and local extrema and be able to find the critical numbers of a given function by finding where the derivative is either zero or undefined.
• Be able to find the extrema of a continuous function on a closed interval.

Section 4.2 The Mean Value Theorem

• Memorize the statements of the Mean Value Theorem (MVT) and the Intermediate Value Theorem (IVT).
• Be able to determine whether a given function satisfies the hypotheses of the MVT and/or the IVT.
• Be able to apply the MVT a function given by an equation in order to find points where the slope of a secant line to the function and the slope of the tangent line are equal to each other.
• Be able to apply the MVT and/or IVT to reach conclusions about a function given as a table of values.

Section 4.3 The First Derivative Test

• Understand the connection between the sign of the derivative and the increasing/decreasing behavior of a function.
• Know how to find the intervals where a function is increasing/decreasing and classify its local extrema by analyzing the first derivative of the function.
• Be able to reach conclusions about the shape of the graph of a function by looking at its graph or by looking at the graph of its derivative.

Section 4.4 Concavity and the Second Derivative Test

• Know and understand the definition of concave up and concave down and be able to apply it to qualitative problems.
• Understand the connection between the concavity of a function and the sign of the second derivative of the function.
• Know how to find the intervals where a function is concave up/down and find any inflection points by analyzing the second derivative of the function.
• Know how to classify the local extrema of a function using the second derivative test.
• Be able to reach conclusions about the shape of the graph of a function by looking at the graph of its second derivative.

Section 4.5 Summary of Graphical Methods

• Understand how to find the vertical and horizontal asymptotes of a function as well as the intercepts of a function.
• Be able to analyze the first and second derivatives of a function in order to find the intervals where it is increasing/decreasing, concave up/down, and to find the coordinates of all local extrema and inflection points.
• Be able to combine information about asymptotes, intercepts, local extrema, inflection points, increasing/decreasing intervals, and concavity in order to draw an accurate graph of a function.

Section 4.6 Optimization Problems

• Understand the idea of optimization and how to use information from the first and second derivative in order to find maximum and minimum values for a given function under certain constraints.
• Be able to apply the method for solving optimization problems to a specific situation.

Section 4.7 Rectilinear Motion and Other Applications

• Understand the concepts of position/displacement, velocity, speed, and acceleration and how these function relate to one another.
• Be able to apply these concepts to solve application problems involving projectile motion.
• Be able to apply these concepts to solve application problems involving simple harmonic motion.

Note: I will not expect you to memorize the basic equations for projectile motion or harmonic motion for this exam. I will expect you to understand how they are related using differentiation.