Review sheet for final exam

The topics listed below are mostly taken from the previous review sheets. I've deleted some small things and added a section for the most recent material.

Here is a selection of problems to practice:

- Chapter 2 Review: Concept check, true–false quiz, 1-20, 29, 35, 43
- Chapter 3 review: Concept check (Skip 2o-t and 5), True-False Quiz. Also 1-42, 53, 59, 66, 69, 79, 83, 97, 98, 107
- Chapter 4 review: Concept Check (skip 8, 9), True–False Quiz. Also 1, 3, 5, 7, 13, 15, 19, 23, 25, 33, 54, 66, 67, 69
- Chapter 5 review: Concept Check (skip 4), True–False Quiz. Also 1, 3, 7, 8, 9, 13, 15, 23, 25, 28, 29, 31, 45, 47, 55, 61
- Chapter 10 review: 21, 22, 25, 26, 28
- Multivariable: See practice problems posted on the course website.

The following is a list of the topics that I think are important:

Chapter 2

- **Summary:** Know the definition of 1 and 2–sided limits and how to compute them at finite points and at infinity. Know what an infinite limit is. Know about continuity and discontinuity. Know the definition of the derivative and how to use it to compute derivatives. Know how to compute the tangent line to the graph of a function at a point.
- 2.2: Limits
  - Definition of the limit of a function at a point.
  - Understand how to interpret the definition both graphically and numerically.
  - Know the definitions of 1–sided limits and their relationship with 2–sided limits.
  - Know what it means for a function to have an infinite limit and the connection with vertical asymptotes.
- 2.3: Computing limits
  - Know the limit laws and how to use them to manipulate limits.

- Be able to compute limits (knowing how to do every problem in 2.3: 11-30 is a start)
- Know the statement of the squeeze theorem and be able to use it.

- 2.5: Continuity
  - Know the definition of continuity.
  - Be able to identify the different types of discontinuity (removable, jump, infinite).

- 2.6: Limits at infinity
  - Understand the meaning of limits at infinity and the definition of a horizontal asymptote.
  - Know the techniques for computing limits at infinity (Factoring out largest power, multiplying by conjugate...)

- 2.7: Definition of the derivative
  - Know and be able to use the definition of the derivative.

- 2.8: The derivative as a function
  - Know how to detect where a function is not differentiable.
  - Know how to find an equation for the tangent line to a curve at a given point.

Chapter 3

- **Summary:** Know how to find the derivative of all elementary functions. Know how to use the product, quotient, and chain rules. Know how to use implicit differentiation, logarithmic differentiation. Know how to find the derivative of an inverse function. Know how to do related rates problems.

- 3.1: Derivatives of polynomials and exponentials
  - Know the power rule
  - Derivatives of sums of power functions
  - Derivative of e^x

- 3.2 The product and quotient rules
  - Product rule

  - Quotient rule

- 3.3: Derivatives of trigonometric functions
  - Know derivatives of sin, cos, tan, csc, sec, cot.

- 3.4: The chain rule
  - Know the statement of and how to use the chain rule
  - Know the derivative of a^x.

- 3.5: Implicit differentiation
  - Implicit differentiation.
  - Know the derivatives of $\arcsin x$ and $\arctan x$.

- 3.6: Derivatives of logarithmic functions.
  - Derivative of $\log_a x$
  - Logarithmic differentiation

- 3.9: Related rates
  - Related rates problems.

Chapter 4

- **Summary:** Know how to fully describe the graph of a function using calculus: local extrema, global extrema, increasing/decreasing behavior, concavity, asymptotes. Know how to use calculus for optimization problems. Know the basics of antiderivatives.

- 4.1: Minimum and maximum values
  - Know the definitions of absolute max/min, local max/min.
  - Know the statement of the Extreme Value Theorem and how to use it.
  - Know what a critical number/point of a function is.

- 4.3: First and second derivative tests
  - Understand what the derivative and second derivative of a function tells you about the graph of a function.
  - Know how to use the first and second derivative test.

- 4.4: L'Hôpital's rule
  - Know the statement of and how to use L'Hôpital's rule.
- 4.5: Curve sketching
  - Be able to sketch graphs that take into account the domain, intercepts, symmetry, asymptotes, periodicity, intervals of increase and decrease, local extrema, concavity and inflection points of a function.
- 4.7: Optimization
  - Know how to use calculus to solve optimization problems.
- 4.9: Antiderivatives
  - Know the definition of an antiderivative.
  - Know how to compute antiderivatives using the techniques of 4.9.
  - Know how to solve initial value problems.
  - Understand the relationship between the graph of a function and its antiderivative.

Chapter 5

- **Summary:** Understand the definition of area as definite integral. Know how to compute definite integrals using the fundamental theorem of calculus and the substitution rule. Understand functions of the form $g(x) = \int_a^x f(t)\,dt$.
- 5.1: Areas and distances
  - Know and understand the definition of area
  - Be able to compute L_n, R_n, and M_n and know how to interpret these quantities geometrically.
  - Understand the connection between distance and area
- 5.2: The definite integral
  - Know the definition of the definite integral.
  - Given a definite integral, know how to rewrite it as a limit of Riemann sums.
  - Understand the interpretation of an integral as net area.

- Be able to compute definite integrals by calculating the net area bounded by a graph.
- Know and know how to use the properties of integrals.

- 5.3: The fundamental theorem(s) of calculus
  - Know the statements of both of the fundamental theorems of calculus.
  - Understand how a function defined by an integral behaves. I'm referring to functions of the form

$$g(x) = \int_a^x f(t)\,dt.$$

    You should be able to take the derivative of functions defined in this way. Integrate this knowledge with what you learned about graph sketching in chapter 4.
  - Know how to use the part 2 of the fundamental theorem to compute definite integrals.

- 5.4: Indefinite integrals
  - Know the definition of indefinite integral.
  - Know the indefinite integrals listed on page 392. Note that this table can be memorized by remembering derivative rules. You don't need to know sinh or cosh.

- 5.5: The substitution rule
  - Know how to use the substitution rule for definite and indefinite integrals.

Miscellany from chapters 10 and 14

- **Summary:** Know what a parametrically defined curve is. Know how to compute derivatives. Know what a function of 2–variables is and how to compute and work with partial derivatives.

- 10.1: Parametrically defined curves
  - Know what it means to say that a curve is defined parametrically by $c(t) = (x(t), y(t))$.

- 10.2: Calculus with parametric curves

- Know how to compute the slope of the tangent line to a parametrically defined curve:
$$\frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}}$$
- Also be able to compute the second derivative.

- Functions of 2 variables
  - Understand 3–dimensional Cartesian coordinates and how functions of two variables work.
  - Be able to compute first and second partial derivatives.