Final Exam Study Guide

Math 106

Chapter 1

- Pre-Calculus
  - Exponential functions and logarithms (1.2, 1.4) ☐
  - Trigonometric functions (1.5) ☐
  - Making new functions from old - including shifts, stretches, compositions, inverses (1.3) ☐
- Continuity
  - Continuity on an interval (1.7) ☐
  - Intermediate Value Theorem (1.7) ☐
  - Continuity at a point (1.8) ☐
- Limits
  - Two-sided limits (1.8) ☐
  - One-sided limits (1.8) ☐
  - Limits at infinity (1.8) ☐

Chapter 2

- Velocity
  - Average velocity over (a, b) (2.1) ☐
  - Instantaneous velocity at $t = a$ (2.1) ☐
- Definition of derivative
  - Derivative at a point (2.2) ☐
  - Slopes/equations of tangent lines and relationship with $f'(a)$ (2.2) ☐
  - Derivative function (limit definition) (2.3) ☐
  - Using $f'(x)$ to determine when $f(x)$ is increasing/decreasing (2.3) ☐
  - Interpretations of $f'(x)$ when $f(x)$ has context (2.4) ☐
  - Second derivative and using $f''(x)$ to determine when $f(x)$ is concave up/down (2.5) ☐
  - Relationship of position, velocity, and acceleration (2.5) ☐
  - When a derivative does not exist (2.6) ☐

Chapter 3

- Differentiation Rules
  - Rules for constant multiples, sums, differences of functions (3.1) ☐
  - Power rule (3.1) ☐
  - Rules for exponential functions (both $y = e^x$ and $y = a^x$) (3.2) ☐
  - Product, quotient, and chain rules (3.3, 3.3, 3.4, respectively) ☐

- Derivatives of $\sin x$, $\cos x$, and $\tan x$ (3.5) ☐
- Derivatives of inverse functions (3.6) ☐
- Derivatives of natural log, arcsin, arctan, arcsec (3.6) ☐
- Using all the above rules to find equations of tangent lines and $f''(x)$ (all) ☐

- Implicit differentiation (3.7) ☐
- Finding equations of tangent lines of implicit functions (3.7) ☐
- Definitions and basic properties of hyperbolic functions (3.8) ☐
- Derivatives of hyperbolic functions (3.8) ☐

- Theorems on differentiable functions (3.10)
  - Mean Value Theorem (Rolle's Theorem) ☐
  - The Racetrack Principle ☐
  - The Increasing Function Theorem ☐
  - The Constant Function Theorem ☐
- Linear approximation (3.9)
  - Tangent line approximation/local linearization ☐
  - Using local linearization to approximate nearby values ☐

Chapter 4

- Using first and second derivatives
  - Determining local maxima and minima (4.1)
    - Critical points and values ☐
    - First derivative test ☐
    - Second derivative test ☐
  - Inflection points (4.1) ☐
  - Determining where a function is increasing/decreasing, concave up/concave down (4.1) ☐
  - Using derivative data to sketch graphs (4.1) ☐
  - Finding global maximum and minimum (4.2)
    - Extreme Value Theorem ☐
    - On closed intervals ☐
    - On open intervals/all real numbers ☐
- Optimization and Geometry (4.3)
  - Setting up problems described by functions on a graph ☐
  - Setting up problems involving geometric objects ☐
  - Setting up problems described in words ☐
- Families of Functions (4.4)

- Motion under gravity, bell shaped curves, exponential model with a limit, logistic model ☐
- Investigating parameters, finding critical points/inflection points in a family ☐

- Related Rates (4.6)
  - Drawing an appropriate picture ☐
  - Finding solutions ☐

- Applications of Differentiation
  - L'Hôpital's rule (4.7)
    - Indeterminate forms $\frac{0}{0}$ and $\frac{\infty}{\infty}$ ☐
    - Indeterminate forms $0 \cdot \infty$, $\infty - \infty$, 1^∞, 0^0, ∞^0 ☐
  - Parametric equations (4.8)
    - Determining curve traced out by parametric equations ☐
    - Finding parametric equations of a given curve ☐
    - Finding the speed and velocity of an object whose position is given by parametric equations ☐
    - Finding tangent lines of parametric equations ☐

Chapter 5

- Integration
  - Left-hand and right-hand Riemann sums (5.1) ☐
  - Computing definite integrals with geometry (5.2) ☐
  - Computing definite integrals as areas below/above the curve (5.2) ☐
  - Average value of $f(x)$ (5.3) ☐
  - Interpreting Integrals (5.3) ☐
  - The Fundamental Theorem of Calculus (Part 1) (5.3) ☐
  - Properties of definite integrals (arithmetic, even/odd, comparison) (5.4) ☐
  - Computing area between curves (5.4) ☐

Chapter 6

- Antiderivatives and Integration
  - Graphing antiderivatives (6.1) ☐
  - Computing indefinite integrals (6.2) ☐
  - Computing definite integrals with antiderivatives and the Fundamental Theorem of Calculus (6.2) ☐
  - Solving differential equations with antiderivatives (6.3) ☐
  - Using differential equations to describe motion (6.3) ☐
  - The Second Fundamental Theorem of Calculus (6.4) ☐

Chapter 7

- Computing indefinite integrals with substitution (7.1) ☐
- Computing definite integrals with substitution (7.1) ☐