CHAPTERS 1 AND 2: REVIEW OUTLINE

CHAPTER 1: REVIEW

(Topic 1) Functions

- Types of Functions
- Domain and Range
- Representing Subsets of Real Numbers
  - Set-Builder Form, Interval Form, Graphical Form
- Graphs of Functions and the Vertical Line Test (VLT)
- Even and Odd Functions; Symmetry
- Combining Functions: Arithmetic Operations and Compositions

(Topics 2 and 3) Trig Functions

- Angles and Evaluating Trig Functions
  - "THE" Table of Special Trig Values
  - Quadrants and Signs (ASTC)
  - Quadrantal Angles, Coterminal Angles, Reference Angles
- Right Triangle (SOH-CAH-TOA) and Unit Circle Approaches
- Identities (Fundamental IDs and Advanced IDs)
- Domains, Ranges, and Graphs of the Six Basic Trig Functions
- Simplifying Trig Expressions and Verifying IDs
- Solving Trig Equations

CHAPTER 2: LIMITS AND CONTINUITY

(2.1) Intro

- Evaluating Limits at a Point
  - Limit Theorems for Rational Functions
- Limits are Local
- One- and Two-Sided Limits
  - Analyzing Piecewise-Defined Functions
  - Drawing and Analyzing Graphs
- "Ignore *a*" Theorems
- When a Limit Does Not Exist (DNE)

(2.2) Properties of Limits

- Algebra of Limits, Linearity of Limits
- Limit of a Root: Discussion
- Limit Theorem for Algebraic Functions

(2.3) Limits and Infinity I

- Notation for Nonexistent Limits
- Horizontal Asymptotes (HAs)
- "Long-Run" Limits $\lim_{x\to\infty} f(x)$, $\lim_{x\to-\infty} f(x)$
- When a Limit can be Described as ∞ or $-\infty$ ("Special Cases of DNE")
- Limit Forms
  - Signs and Rescaling
- "Long-Run" Limit Rules for $\frac{c}{x^k}$
- "Long-Run" Limits for Polynomial Functions and Dominance
- "Long-Run" Limits for Rational Functions
  - "Twin Limits" Property
  - Technique for Evaluating Limits
    - Dividing Numerator and Denominator by the Highest Power of *x* (for example) in the Denominator
  - Short Cut: Dominant Term Substitution
  - Short Cuts Based on Degrees of Numerator, Denominator
  - Long Division and Slant Asymptotes
- "Long-Run" Limits for Algebraic Functions and Dominance
- Word Problems

(2.4) Limits and Infinity II

Vertical Asymptotes (VAs)
Infinite Limits at a Point
Limit Forms
When a Limit can be Described as ∞ or $-\infty$ ("Special Cases of DNE")
Factoring, Sign Analysis can help

(2.5) The Indeterminate Forms 0/0 and ∞ / ∞

Techniques for the 0/0 Form:
Factoring and Canceling / Dividing
Rationalizing a Numerator or Denominator
Working with Compound Fractions
L'Hôpital's Rule (to be seen later)
VAs and Holes
Techniques for the ∞ / ∞ Form:
(See Section 2.3.)

(2.6) The Squeeze (Sandwich) Theorem

Using the Theorem to Prove a Limit Statement at a Point
Using the (Modified) Theorem to Prove a "Long-Run" Limit Statement

(2.7) Precise Definitions of Limits

Precise ε-δ Definition of a Limit at a Point: $\lim_{x \to a} f(x) = L$
One-Sided Variations: $\lim_{x \to a^+} f(x) = L$ and $\lim_{x \to a^-} f(x) = L$
Proving a Limit Statement Involving a Constant or Linear f

Precise Definitions of "Long-Run" Limits
$\lim_{x \to \infty} f(x) = L$ and $\lim_{x \to -\infty} f(x) = L$

Precise Definitions of Infinite Limits at a Point
$\lim_{x \to a} f(x) = \infty$ and $\lim_{x \to a} f(x) = -\infty$

(2.8) Continuity

Definition of Continuity …
- 1) at a Point
- 2) on an Open Interval
- 3) on a Closed Interval

Classifying Discontinuities
- Removable
- Jump
- Infinite

One-Sided Continuity

Continuity Theorems
- Algebra of Continuity
- Continuity of Rational Functions
- Continuity of Composite Functions
- Continuity of Basic Trig Functions
- Intermediate Value Theorem (IVT) and
  - The Bisection Method for Approximating Zeros of a Function

Where is a Function Continuous / Discontinuous?