Calculus 1, Chapter 2 "Limits and Continuity" Study Guide

Prepared by Dr. Robert Gardner

The following is a *brief* list of topics covered in Chapter 2 of *Thomas' Calculus*.

2.1 Rates of Change and Tangents to Curves. Average speed, average rate of change, slope of a curve.

2.2 Limits of a Function and Limit Laws. Informal Definition of Limit, Dr. Bob's Anthropomorphic Definition of Limit, Limit Rules (Theorem 2.1), limits of Polynomials and Rational Functions (Theorems 2.2 and 2.3), Factor/Cancel/Substitute technique ("FCS"), Dr. Bob's Limit Theorem (Theorem 2.2.A), Sandwich Theorem (Theorem 2.4).

2.3 The Precise Definition of a Limit. Isaac Newton, Gottfried Leibniz, Augustin Cauchy, Formal Definition of Limit, given ϵ find δ, proofs using the Formal Definition, negating the Formal Definition.

2.4 One-Sided Limits. Informal Definition of Right-Hand and Left-Hand Limits, Formal Definitions of One-Sided Limits, proof that $\lim_{x\to 0^+} \sqrt{x} = 0$, Relation Between One-Sided and Two-Sided Limits (Theorem 2.6), $\lim_{\theta\to 0}(\sin\theta)/\theta = 1$ (Theorem 2.7), $\lim_{h\to 0}(\cos h - 1)/h = 0$ (Example 2.4.5(a).

2.5 Continuity. Definition of continuity at an interior point and endpoint of the domain, polynomials/rational functions/trig functions are continuous on their domains (Theorem 2.5.A), the Continuity Test, removable discontinuity, jump discontinuity, infinite discontinuity, oscillating discontinuities, Properties of Continuous Functions (Theorem 2.8), inverse trig/exponential/logarithmic functions are continuous on their domains (Theorem 2.5.B), Compositions of Continuous Functions (Theorem 2.9), Limits of Continuous Functions (Theorem 2.10), Intermediate Value Theorem (Theorem 2.11).

2.6 Limits Involving Infinity; Asymptotes of Graphs. Formal Definition of Limits at Infinity, Informal Definition of Limits Involving Infinity, proof that $\lim_{x\to\infty} 1/x = 0$ (Example 2.6.1(a)), Rules for Limits as $x \to \pm\infty$ (Theorem 2.12), horizontal asymptote, other results hold for $x \to \pm\infty$ (Theorems 2.6.A and 2.6.B), oblique asymptote, Infinity and Negative Infinity as Limits, vertical asymptote, Dr. Bob's Infinite Limits Theorem, dominant term for a polynomial function.