Math 145A
Winter 2020

UPDATED GENERAL INFORMATION – NOVEMBER 22, 2019

***Supplementary readings for Chapters* 1 – 4**

Here are some documents and descriptions of their contents.

http://math.ucr.edu/~res/math144-2017/corestrictions.pdf

If f is a function from A to B such that the image of f is contained in a subset C, then the graph of f can also be viewed as the graph of a function from A to C whose values at elements of A are identical to those of f. This file summarizes a few formal properties of this construction (which is generally not formulated explicitly in mathematical writings).

http://math.ucr.edu/~res/math144-2017/nonelementary-integrals.pdf

To quote from the beginning of this document, "Although the methods in standard calculus textbooks allow one to find the indefinite integrals (or antiderivatives) of many functions that arise in the subject, there are also many examples that cannot be handled using elementary techniques like change of variables, integration by parts, partial fraction expansions or trigonometric substitutions." This document discusses some of the most basic examples and includes references for further information.

http://math.ucr.edu/~res/math144-2017/lambert-fcn-2017.pdf

If f is a strictly increasing continuous function which is defined on the reals and its image is the entire real line, then f has a continuous image g with the same properties. Furthermore, if f is differentiable everywhere then the formula for derivatives of inverse functions shows that g is also differentiable. However, one can find examples where f is expressible in terms of the functions studied in first year calculus but its inverse g has no such expression. This file describes a very simple example of such a function f and gives references to proofs that the inverse g cannot be described in terms of elementary functions from first year calculus.

http://math.ucr.edu/~res/math144-2017/inverses.pdf

Since we use the notation f^{-1} for both inverse images and inverse functions, some confusion is possible when both concepts occur simultaneously. This file shows that the overlapping notations are consistent in the case of one potential ambiguity.

http://math.ucr.edu/~res/math145A-2017/numberexpansions.pdf

This document gives a rigorous justification for standard facts about writing numers in base **10** and decimal forms.

http://math.ucr.edu/~res/math145A-2017/maximality-of-reals.pdf

http://math.ucr.edu/~res/math145A-2017/uniqreals.pdf

These documents indicate how one can construct a rigorous proof that the real number system is the unique maximal number system such the rational numbers form a dense subsystem.

http://math.ucr.edu/~res/math145A-2017/Sequences_Basic_Convergence.mp4

This is an animation illustrating the concept of a sequence limit.

http://math.ucr.edu/~res/math145A-2017/2-limit_of_sequence_animation.mp4
http://math.ucr.edu/~res/math145A-2017/limit-animations.pdf
http://math.ucr.edu/~res/math145A-2017/limit-drawing.pdf
http://math.ucr.edu/~res/math145A-2017/limit-laws.pdf

The first three documents contain graphic illustrations for the definition of a limit, and the fourth describes several properties of limits which play important roles in single variable calculus.

http://math.ucr.edu/~res/math145A-2017/continuity-example.pdf

This file gives a detailed verification that the function $\mathbf{1/x}$ is continuous at an arbitrary positive real number $\boldsymbol{a}$.

http://math.ucr.edu/~res/math145A-2017/Cantor_Set_-_YouTube.mp4

The Cantor Set is defined to be an intersection of subsets $\boldsymbol{A_n}$ such that each one is a finite union of closed disjoint intervals and each one contains the next set in the sequence. This video depicts the first two steps in the intersection process.