The intention of these notes is record and comment on the course topics - with reference to the course text. While most will be visited in lecture, some will be covered through the assigned reading in the text. This particularly applies to review material such as that in In their assigned reading, students should be particularly mindful of the topics addressed in these notes. In anticipation of, and in studying for the course exams, students should pay particular attention to the terms addressed here. Some comments may be denoted $[NE]$ in the few instances where they need not be considered in preparation for the exams.

# 1 Day 1. Sec. 1.1,1.2,1.3.

The lecture is mostly a review of precalculus.

**About section 1.1.** Summary on pages 9,10.

1. In 1.1, review the notations for absolute value, intervals. Also review the types of real numbers, distance formula, and meaning of inequalities and equations.

2. Review the distance formula in the plane and plotting of axes and points.

3. Carefully, review the definition of a function $f : D \to Y$. Learn the meaning of domain, range, target ($= Y$ - not in the book), meaning of terms monotonic, increasing, non increasing, decreasing, non decreasing.

4. Review basic sketching. Typically, this is best left to a calculator/computer. You should, however, learn how to identify points and intervals of interest. Remember that sometimes graphs of equations can also be sketched.

5. Review concepts of symmetry of graphs. Also study the parity (even or odd) of a function.

6. Certain changes in the formula of a function produce related graphs. These include translations, scaling and reflection.

7. $[NE]$. There are issues with some statements about functions in the book. While not a serious problem for this course, these could result in misconceptions that are easily avoided. These will be discussed in class and should be noted.

**About section 1.2.** Summary on pages 18-19.

1. Review linear functions and equations of lines. Learn the slope of a line and note that a vertical line has undefined slope.

2. Study the various forms of equations of lines. Missing from the book is the intercept form $\frac{x}{a} + \frac{y}{b} = 1$.

3. Learn the test for parallel and perpendicular lines. The book forgets the cases of vertical and horizontal lines.

4. Review quadratic functions and how to graph them. Practice the "completion of the square" technique and also memorize the quadratic formula well!

**About section 1.3.** Summary on page 23.

1. Review the types of functions: Polynomial, Rational, Exponential, Logarithmic.

2. Review how to compose known functions. Review how to do algebraic operations on functions, like addition, multiplication, division, exponentiation etc. Be aware that often the meaning of the resulting functions and computations of their domains and ranges is a sticky problem. We will study this as it comes up.

3. The correct definition of an algebraic function $y = f(x)$ is that there is a polynomial $H(x, y)$ such that $H(x, f(x)) = 0$. The book calls this the "general definition" of an implicitly defined function. It takes a lot of mathematical work to figure out why this may be called a "function" in the sense of the original definition. In the general case, both the domain and target have to become very complicated and the resulting theory leads to the concept of Riemann Surfaces.

# 2 Day 2. Sec. 1.4.

**Summary is on pages 30-31.**

1. Be sure to review the definition of trig. functions for any real angle, using the unit circle. The old definition with a right angle triangle is still useful, but no longer enough.

2. Memorize the basic identities for trig. functions. These include the fundamental $\sin^2(x) + \cos^2(x) = 1$ and **the addition formula.** Learn to derive the other identities (page 30), using these. In particular, learn how the table of values for special angles (page 27) can be derived if forgotten! Additional derivations will be shown in class.

3. Remember that in Calculus, we always want the angle in radians, whereas the application problems usually state the angles in degrees. Remember the conversion.

4. Practice how to sketch the graphs of trig. functions without depending on a calculator. Often, you just need to know the general shape and location of important points.

# 3 Day 3. Sec. 1.5,1.6.

**About section 1.5.** Summary on pages 40-41.

1. Practice composing two functions. Note that the domain of $f \circ g$ may need to be smaller than that of $g$. Learn the definition of an inverse function and remember that it may not exist!

2. **Memorize with understanding** the definition of a one to one function (also called "injective" by some.)

3. Practice finding the inverse of $f$, when it exists. Note that this is often the best way to check one to one property.

4. Often a function can be **made** one to one, by trimming its domain (to avoid duplication of values. For trig. functions, there are standard conventions to make them one to one on suitable domains. These domains must be memorized!

**About section 1.6.** Summary on page 50.

1. The book relies on calculator values and graph of an exponential function. A more precise definition will be discussed in class. However, for working with exponential and logarithmic ( or their inverse functions), it is best to memorize the various "laws". Look up the tables in the book (pages 44,46).

2. Recall that originally these functions were used as a "tool" for simplifying calculations. While calculators make that unnecessary, the functions do have important applications to mathematical modeling.

3. The hyperbolic functions are certain combinations of exponentials. They are useful in conceptual understanding of certain equations and their solutions.