Topics for Exam 2
Math 10, Spring 2003

General information. Exam 2 will be a timed test of 50 minutes, covering section 2.4, 2.6–2.7, 3.1–3.3, 4.1, and 4.3 of the text. Most of the exam will be based on the homework assigned for those sections. If you can do all of that homework, and you know and understand all of the ideas behind it, you should be in good shape.

You are allowed to use a calculator and notes on **ONE** 3×5 note card (both sides).

As mentioned above, your first priority should be to understand the homework and quizzes and the ideas behind them. Besides the list of things you should know, below, you should also be familiar with everything specially emphasized in the text. If time permits, try to do some of the mindscapes that have answers in the back of the book.

Section 2.4. Basic rules and ideas of mod n arithmetic. Clocks, months, days of the week. How UPC's work. Connection between mod n arithmetic and remainders (questions II.1 and II.2).

Section 2.6. Definitions: natural numbers, integers, rational numbers, irrational numbers. $\sqrt{2}$ is irrational; details of explanation of why $\sqrt{2}$ is irrational; generalization to $\sqrt{3}$, $\sqrt{7}$, etc.

Section 2.7. Definitions: real numbers, decimal expansion. How to tell if a number is rational from its decimal expansion (finite vs. infinite with infinitely repeating pattern vs. infinite no repeating pattern). Expressing infinitely repeating decimal as quotient of two integers. No next real number. $0.9999\ldots = 1$. Most real numbers are irrational.

Section 3.1. What is 2? One-to-one correspondence.

Section 3.2. Definition of cardinality. Examples of sets with the same cardinality as the natural numbers: Natural numbers without 1, integers, rational numbers, $2\times$ natural numbers, integer points in the plane. Hotel Cardinality questions.

Section 3.3. Cantor's Theorem (There are more real numbers than natural numbers): idea of theorem (different cardinalities), outline of proof (suppose we had a one-to-correspondence), details of proof (Dodgeball and the missing number).

Section 4.1. The Pythagorean Theorem: what it says, proofs.

Section 4.3. Definitions: Golden Ratio $\phi = (1+\sqrt{5})/2$, Golden Rectangle. Properties: self-similar rectangle, logarithmic spiral. Constructing a Golden Rectangle.

Not on exam. Section 2.4: Checks, ISBN's. Section 2.6: irrational power, π. Section 2.7: Base 2, $0.123\ldots$ is irrational. Section 3.2: Ping-pong ball conundrum.