Format and topics for exam 2
Math 131a

General information. Exam 2 will cover 3.1–3.5 and 3.7 of the text. The exam will be cumulative only to the extent that 3.1–3.5 and 3.7 rely on previous material; for example, you should still know what the supremum of a subset of $\mathbb{R}$ is. However, there will not be any questions on the exam that only cover old material; for example, you will not be asked to define the supremum of a subset of $\mathbb{R}$.

As before, most of the exam will rely on understanding the problem sets and the definitions and theorems that lie behind them. If you can do all of the homework, and you know and understand all of the definitions and the statements of all of the theorems we've studied, you should be in good shape. You should not spend time memorizing proofs of theorems from the book, though understanding those proofs does help you understand the theorems. On the other hand, you should defintely spend time memorizing the *statements* of the important theorems in the text.

Exam 2 will follow the same ground rules as exam 1 did. In particular, no books, notes, or calculators are allowed, and there will be the same four types of questions: computations, statements of definitions and theorems, proofs, and true/false with justification.

Definitions. The most important definitions we have covered are:

3.1	sequence of real numbers	sequence in $\mathbb{R}$
	term, element	$\lim(x_n)$
	$x_n \to x$	inductively defined
	constant sequence	converge
	limit	convergent
	divergent	m-tail
3.2	bounded (sequence)	sum of sequences $X + Y$
	difference of sequences $X - Y$	product of sequences XY
	multiple cX	quotient X/Z
3.3	increasing (sequence)	decreasing (sequence)
	monotone (sequence)	
3.4	subsequence	
3.5	Cauchy sequence	
3.7	infinite series generated by (x_n)	terms of a series
	partial sums of a series	convergent series
	sum of a series	divergent series
	geometric series	p-series
	harmonic series	alternating harmonic series

Examples. You will also need to be familiar with the key properties of the main examples we have discussed. Most of the important examples we have encountered have appeared in the assigned problems. In addition, you should also know:

3.1: Constant sequence, $\left(\frac{1}{n}\right)$, $(0, 2, 0, 2, \dots)$; if $0 \leq b < 1$, $\lim(b^n) = 0$. Examples of ϵ-$K(\epsilon)$ procedure (Examples 3.1.6, 3.1.11).

3.2: Examples (from text and homework) of using Combo Theorems, Squeeze Theorem, Ratio test for sequences (Example 3.2.8).

3.3: $\left(\frac{1}{1} + \cdots + \frac{1}{n}\right)$. Calculating square roots, Euler's Number e.

3.4: $(\sin n)$, other examples of convergent/divergent series. Using convergent sequences to show their subsequences converge. Convergent and divergent subsequences of bounded sequences. Unbounded sequences with/without convergent subsequences.

3.5: Examples of Cauchy/non-Cauchy sequences.

3.7: Geometric series, harmonic series, p-series, alternating harmonic series. Using definition of sum of a series to prove convergence/divergence (HW).

Theorems, results, algorithms. The most important theorems, results, and algorithms we have covered are listed below. You should understand all of these results, and you should be able to state any theorem clearly and precisely. You don't have to memorize theorems by number or page number; however, you should be able to state a theorem, given a reasonable identification of the theorem (either a name or a vague description).

3.1: Uniqueness of Limits. Equivalent conditions for existence of a limit. The Tails Theorem (Thm. 3.1.9).
3.2: Convergent implies bounded. Combination Theorems (sums, products, etc., of convergent series converge). Nonnegative converges to nonnegative; Comparison Theorem for convergent sequences; Squeeze Theorem. Convergence of absolute values, square roots; Ratio Test for Sequences (Thm. 3.2.11).
3.3: Monotone Convergence Theorem.
3.4: All subsequences of convergent sequences converge; converse (Thm. 3.4.9). Divergence Criteria. Monotone Subsequence Theorem. Bolzano-Weierstrass Theorem.
3.5: Cauchy Convergence Criterion.
3.7: nth Term Test (3.7.3). Cauchy Criterion for Series (3.7.4). Convergence of bounded positive series (Thm. 3.7.5) Comparison Test (3.7.7); Limit Comparison Test (3.7.8).

Not on exam. (3.5) Contractive sequences.
Good luck.