Format and topics
Exam 3, Math 108

General information. Exam 3 will be a timed test of 75 minutes, covering Chapters 16–21 of the Yellow Book and all of the proof notes. No books, notes, calculators, etc., are allowed. 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.

Types of questions. Exam 3 will feature the same types of questions as Exams 1 and 2.

Definitions. The most important definitions we have covered in the Yellow Book are:

Ch. 16	composite function	composition
	identity function	inverse
Proof notes 18	inverse	invertible
Ch. 17	image	
Ch. 18	base case	induction step
	induction hypothesis	recursive definition
	$\sum_{k=1}^{n} a_k$ (recursive)	$\prod_{k=1}^{n} a_k$ (recursive)
PS08	$\bigcap_{i=1}^{n} A_i$ (recursive)	$\bigcup_{i=1}^{n} A_i$ (recursive)
Ch. 19	sequence	term
	bounded above	bounded below
	bounded	upper bound
	lower bound	inf
	sup	increasing
	decreasing	strictly increasing
	strictly decreasing	
Ch. 20	converges	limit
	diverges	
Ch. 21	equivalence (of sets)	same cardinality
	equipotent	equinumerous
	finite	infinite
	restriction (of a function)	

Examples. You will also need to be familiar with the key properties of the main examples we have discussed. The most important examples we have seen are:

Ch. 16 Examples 16.1, 16.2.
Ch. 18 Example 18.2; Exercise 18.5; Example 18.8.
Ch. 19 Exercise 19.8; Example 19.10.
Ch. 20 Examples 20.2, 20.3; bounded does not imply convergent (make your own example).
Ch. 21 Strange examples of sets with the same cardinality (Thm. 21.5, etc.).

You should also be familiar with all of the examples from the Exercises from Ch. 16–21, and you should be familiar with the examples from PS07–09.

Theorems, results, algorithms, axioms. The most important theorems, results, algorithms, and axioms 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).

Ch. 16 Facts about inverses (Thm. 16.4); $(g \circ f)^{-1} = f^{-1} \circ g^{-1}$; Composition of one-to-one, onto, and converse (Thms. 16.7, 16.8).

Proof notes 18 The inverse theorem. (Compare Thm. 16.10 of the text.)

Ch. 17 Properties of images (Thms. 17.5 and 17.7(1)–(4)).

Ch. 18 Principle of mathematical induction. Strong induction (Thm. 18.9).

Ch. 20 Limits are unique (Thm. 20.7); Convergent implies bounded (Thm. 20.8); Combination theorems (Thm. 20.9).

Ch. 21 Equivalence/"same cardinality" is an equivalence relation (Thm. 21.1); subset of finite is finite (Cor. 21.10); finite union of finite is finite (Thm. 21.11); finite product of finite is finite (Cor. 21.14).

Other. Please be familiar with the "techniques of proof" in the proof notes, Sects. 1–23. (Sect. 23.1 is particularly relevant to the material on limits.)

Not on exam. (Ch. 17) inverse image. (Ch. 18) factorial, convex, triangular number, binomial coefficient. (Ch. 19) Fibonacci sequence, Fibonacci numbers. (Ch. 20) lim sup, lim inf, diverge to infinity, monotone, Cauchy sequence, subsequence.

Good luck.