

The final is cumulative. Prepare by reviewing your previous study materials, old exams, assignments (graded and ungraded), and notes in conjunction with the list below. Solutions to HW and exams are on the bulletin board outside my office; exam solutions are also online.

**Non-Proof Tasks: Logic** (Work hard on these, in light of Exam #3!)

1. For conditional statements written using the phrasings if-then, “trailing” if, only if (including “split” only if), necessary, sufficient, implies, or as universal-conditional:
  - (a) Identify hypothesis, conclusion as a stand-alone sentence; don’t keep conditional words.
  - (b) Write its converse, inverse, contrapositive using my choice of phrasing for your answer.
  - (c) Write its negation (which is NEVER also conditional).
  - (d) Answer in verbal vs. symbolic style to match the original, and in simplest logical form.
2. Negate given statements that contain: conditional, if and only if (iff), and, or, for all/each/every/any, there exists/is, inequalities, positive/negative,  $\in$ ,  $\subseteq$ , divides, “at least/at most (number).”
  - (a) Answer in verbal vs. symbolic style to match the original, and in simplest logical form.
  - (b) Identify, avoid incorrect interval or inequality notation, such as  $[1, -2)$ ,  $[4]$ , or  $5 > x \leq 6$ .
3. Rewrite compound inequalities ( $\geq$ ,  $\leq$ , “3-way”) as conjunctions, dysjunctions of simpler statements. (Recall what the words “conjunction,” “dysjunction” mean from Discrete Math.)

**Non-Proof Tasks: Sets**

1. Given a set defined using set-builder notation, write in words how to read the notation aloud.
2. Be familiar with the notations  $\mathbf{Z}$ ,  $\mathbf{Z}^+$ ,  $\mathbf{Z}^-$ , and similar variations for  $\mathbf{Q}$  and  $\mathbf{R}$ .
3. Given set-builder or listed sets, find union, intersection, set difference, Cartesian product.
  - (a) Given the notation  $A \cup B$ ,  $A \cap B$ ,  $A \setminus B$ ,  $A \times B$ , give the name of the operation represented.
4. Predict how many subsets a set has, how many elements a power set or Cartesian product has.
5. Use/understand correct notation for power sets, for the empty set:  $\{\emptyset\}$  is NOT the empty set!
6. Answer true/false, fill-in-the-blank, or short-answers questions about  $\in$ ,  $\subset$ . (2B #2 on p. 57 and 2J #2 on p. 59 are examples of short-answer.) Some may seem tricky, so study well!
7. Find union, intersection of sets in a given indexed family (listed or interval notation).
  - (a) Write intervals correctly, and DON’T use the infinity symbol like a number.

**Non-Proof Tasks: Formal Statements**

1. Formally state Division Algorithm, FTA, definitions of rational,  $\subseteq$ ,  $\not\subseteq$ ,  $\cup$ ,  $\cap$ ,  $A \setminus B$ ,  $\times$ , divides.
2. FORMAL statements require YOU to give all necessary hypotheses or background too.

**Non-Proof Tasks: Proof Formats** (Work hard on these, in light of Exam #3!)

1. Master the OUTLINES for proof styles: direct, proof by cases, ctp, contradiction, there exists/is, for all,  $\subseteq$ ,  $\not\subseteq$ , set equality, identities, iff, onto, one-to-one, equal functions, induction, etc.
2. USE outlines to answer general questions about how to prove certain types of claims.
  - (a) Example: “How do you prove that two sets are equal?” Answer: “Show that each is a subset of the other.”
  - (b) Example: “How do you prove a ‘there exists’ statement?” Answer: “Give a candidate, then show that it meets all conditions.”
3. Given a SPECIFIC statement, tell what you’d assume/NTS to prove it, possibly by my choice of proof style.
  - (a) Example: “To prove ‘if  $6|x$  then  $3|x$ ’ by contradiction, what would you assume, and what would you need to show?”
  - (b) Example: “To prove that  $f(x) = \int_0^x \sin(e^t)dt$  is one-to-one, what would you assume, and what would you need to show?”

- (c) Since you won't actually have to write a full proof, the statements might be about ANY math topic, not just ones we've covered in this course.
- (d) 'Iff' questions may be like 4K #1 and #2 on pp.189-190 or may be variations where I ask about the "if" versus "only if" directions, as on Exam #3.

#### **Non-Proof Tasks: Functions**

1. Identify given ordered pairs, arrow diagram, or formula, as function, onto, one-to-one, or NOT.
2. Given  $f, g$  as ordered pairs, arrow diagrams, formulas, find  $f+g, f-g, fg, f/g, f \circ g$ , as possible.

#### **Proof Tasks:**

1. Write complete proofs of the various styles we've studied in this course: direct, proof by cases, ctp, contradiction, there exists/is, for all,  $\subseteq$ ,  $\not\subseteq$ , set equality, identities, iff, onto, one-to-one, equal functions, induction, etc.
2. For set identities or "iff" proofs, the choice to use a chain-style proof will be YOURS.
3. DISPROOF will NOT appear on the Final Exam. Everything I ask you to prove will be true.
4. Complete proofs will be on a variety of topics:
  - (a) Ones we've seen in this course: sets, closure, rational vs. irrational, even/odd/parity, divides or Division Algorithm (remainders), intersections of graphs, largest/smallest numbers, etc.
  - (b) Or they may be on other FAMILIAR math topics from your prerequisite courses: algebra (be-ware exponents and factoring!), formulas for lines/circles/parabolas, intervals, prime numbers (1 isn't!), basic derivatives, etc.
5. Prove results by Mathematical Induction: equalities, divisibility, or inequalities.
6. Prove that two functions given by formulas or as sets of ordered pairs are equal.
7. Prove that a function given by a specific formula is onto, is one-to-one.

#### **End-of-Course Information:**

- The Final Exam is worth 150 points out of 550 total points for the course.
- Roughly 50% to 65% of the points on the Final will be for proof tasks.
- I don't expect to have the finals graded any earlier than Sunday, May 8, at best.
- Please don't email for your grade - that only slows me down.
- Please don't ask afterwards for extra credit or "is there any way I can make up/re-do...?" - I don't do that once the final is over, **EVER**, and certainly not for just one student!
- However, if you think there's an \*error\* calculating your score, I will definitely look into that ASAP.
- I'll TRY to post your course scores on D2L so that you can see your grades before they're submitted Tuesday afternoon, May 10, but can't promise anything.
- Remember that D2L grades for any course are NOT OFFICIAL per SRU rules - only the grade reported by your professor on MySRU/Banner is official.