

Math 311  
Exam 1 Review Sheet

### **Propositional Equivalences, Rules of Inference and 2-column proofs**

- Memorize the list of standard logical equivalences (see handout).
- Be able to prove two propositions are logically equivalent using a 2-column proof and logical equivalences.
- Understand the definition of a *counterexample* and how to use them to show that a statement is false.
- Know the definition of an argument and how to use a truth table to determine whether a given argument form is valid.
- Memorize the standard rules of inference for arguments with statements involving propositions (see handout).
- Memorize the standard rules of inference for arguments with statements involving predicates and quantifiers (see handout).
- Be able to translate arguments from English into symbolic form.
- Memorize the two standard logical fallacies and be able to identify them.
- Be able to recognize from the basic form of a short argument whether it is a known valid argument form or a known fallacy.
- Be able to prove whether or not a given argument is valid by constructing a 2-column proof.
- Be able to find valid conclusions from a list of premises by applying one or more rules of inference.

### **Introduction to Proofs**

- Understand the basic terminology for paragraph proofs (see handout)
- Understand the differences between formal and informal proofs.
- Be able to write short proofs making use of: Direct proof, Contraposition, and Proof by Contradiction.
- Given a proof, be able to determine which method was used in the proof.
- Be able to find errors in false proofs.
- Understand what vacuous and trivial proofs are and be able to recognize them, including begging the question.
- Understand the definition of odd numbers, even numbers, and rational numbers.

### **Proof Methods and Strategy**

- Understand and be able to utilize Proof by Cases (the Method of Exhaustion).
- Understand how to rule out unnecessary cases (without loss of generality statements).
- Understand and be able to carry out an existence proof (in both constructive and non-constructive forms).
- Understand and be able to carry out a uniqueness proof.
- Understand the role of counterexamples in disproving statements.
- Understand how to form conjectures and know the difference between a conjecture and a theorem.
- Understand how to prove results using “backwards reasoning”

### **Sets and Functions**

- Understand the definition of the set operations: union, intersection, complementation, and set difference.
- Be able to prove that a set is a subset of another set using a paragraph proof (using a general element argument).
- Be able to prove that two sets are equal using a paragraph proof (using general element arguments).
- Know the definition of one-to-one and onto, and be able to prove whether or not a given function satisfies these definitions.