

Name: \_\_\_\_\_

Please show all work.

1. Prove by induction that  $n! \geq 2^n$  for all natural numbers  $n \geq 4$ .
2. Prove that  $(p \rightarrow (q \wedge \neg q)) \rightarrow \neg p$  is a tautology.
3. Negate the statement  $(\exists y)[p(y) \wedge (\forall x)[\neg q(x) \rightarrow r(x)]]$ . Simplify.
4. Prove that any interval in  $\mathbf{R}$  is a set. You may assume  $\mathbf{R}$  is a set.  
Hint: you may need to look at some cases.
5. Prove or disprove  $(\forall A)[B \in \mathcal{P}(A)] \Rightarrow B = \emptyset$ .
6. Prove or disprove  $(A \cup C) \times (B \cup D) \subseteq (A \times B) \cup (C \times D)$ .

1	2	3	4	5	6	total (60)	%

Prelim. course grade: %