Name: _____ **PID:** _____

Math 109
Midterm Exam 1
October 23, 2009

Turn off and put away your cell phone.
No calculators or any other electronic devices are allowed during this exam.
You may use one page of notes, but no books or other assistance on this exam.
Read each question carefully, answer each question completely, and show all of your work.
Write your solutions clearly and legibly; no credit will be given for illegible solutions.
If any question is not clear, ask for clarification.

#	Points	Score
1	6	
2	6	
3	6	
4	6	
Σ	24	

1. (6 points) Let $f : \mathbb{R} \to \mathbb{R}$ be a function. Consider the following statement:

   - f is differentiable is a sufficient condition for f to be continuous.

   (a) Write the contrapositive of the statement.

   (b) Write the converse of the statement.

   (c) Write the negation of the statement.

2. (6 points) Let n be an integer. Prove by contradiction that if 3 divides n^2, then 3 divides n.

3. (6 points) Let A, B and C be sets. Prove that

$$A \cup (B \cap C) = (A \cup B) \cap (A \cup C)\,.$$

(Note: neither a truth table nor a Venn diagram meets the requirements of this problem and so will not earn any credit.)

4. (6 points) Prove by induction that $5^n + 7$ is divisible by 4 for every positive integer n.