MAT 200: HOMEWORK 1
DUE TU, JUNE 7

1. Write the truth table for each of the following formulas. Are they equivalent (i.e., do they always give the same value)?
  (a) $(A \text{ AND } B) \text{ OR} (A \text{ AND } C)$
  (b) $A \text{ AND} (B \text{ OR } C)$.

2. Let us consider a new logical operation, called NAND, which is defined by the following truth table:

A	B	A NAND B
T	T	F
T	F	T
F	T	T
F	F	T

  (a) Show that A NAND B is equivalent to NOT$(A \text{ AND } B)$ (this explains the name: NAND is short for "not and").
  (b) Show that A NAND A is equivalent to NOT A.
  (c) Write the truth table for $(A \text{ NAND } B) \text{ NAND} (A \text{ NAND } B)$.
  (d) Write the truth table for $(A \text{ NAND } A) \text{ NAND} (B \text{ NAND } B)$.
  (e) Show that any logical formula which can be written using AND, OR, NOT can also be written using only NAND.

3. By using truth tables, show that the following statements are equivalent: $P \text{ OR } Q$ and $(\text{NOT } P) \implies Q$

4. Prove that if an integer n is divisible by 3, then n^2 is also divisible by 3. Is the converse statement true?

5. Prove that if a, b are negative real numbers, then $a < b \implies a^2 > b^2$

  In problem 6, you need to a)write the obvious conclusion from given statements; and b)justify the conclusion, by writing a chain of arguments which leads to it. It may help to write the given statements and conclusion by logical formulas (denoting the statements which are used by letters $A, B, \ldots$ connected by logical operations OR, AND, $\implies, \ldots$).

6. If today is Thursday, then Jane's class has library day. If Jane's class has library day, then Jane will bring home new library books. Jane brought no new library books. Therefore,...