1. Let $P =$"I am happy", $Q =$"I am watching a movie", and $R =$"I am studying for Math300".
   (a) Translate the following symbolic statements into correct and complete English sentences:
      i. not $(P$ or $Q)$
      ii. $Q \Rightarrow$ not R
      iii. (not P and $R)$ or Q
   (b) Translate the following English statements into equivalent symbolic statements:
      i. I am neither studying for Math 300, nor watching a movie.
      ii. I am happy when I study for Math 300.
      iii. I dont study for Math 300 if I am watching a movie.
   (c) If P and R are true, but Q is false, what are the truth values of the six statements from parts a) and b)?

2. Let P and Q be statements. Use truth tables to prove the following three statements are equivalent.
   - $P \Rightarrow Q$
   - $(P$ or $Q) \Leftrightarrow Q$
   - $(P$ and $Q) \Leftrightarrow P$

3. Prove this lemma: If is n an odd positive integer, then it can be written as $n = 2k + 1$ for some integer k. (Recall: An odd integer was defined as an integer which is not even, i.e. it is not divisible by 2) Bonus: Prove the lemma for any odd integer , positive or negative.

4. Prove that if n is an integer then $n^2 + n$ is even. (Recall: an integer m is even iff there exists an integer k such that $m = 2k$.)

5. Let x and y be non-negative real numbers. Prove that $\frac{x+y}{2} \geq \sqrt{xy}$. In your proof, explicitly point out where you need the assumption that x and y are non-negative.

6. Prove the following two theorems.
   (a) The sum of two odd integers is even.
   (b) The product of two odd integers is odd.

What you can assume known in your proofs:

1. The regular operations on the real numbers (see Properties 2.3.1 pages 18-19)
2. The order axioms on the real numbers (see Axioms 3.1.2)
3. Any definition or result proved in class, in a previous chapter of the textbook, or in the homework.
4. All the usual functions studied in pre-calculus and calculus (including absolute value). Anything else probably needs to be proved in order to be used, at least at the beginning of the term.
   (If unsure, ask me.)