TERMS YOU SHOULD KNOW: *propositions, truth values, negations, conjunctions, disjunctions, DeMorgan's Laws, logical equivalence.*

1. Which of the following are propositions? What is the truth value for each that is a proposition?
   (a) Pizza is good.
   (b) Today is Tuesday.
   (c) Pizza is good or today is Tuesday.
   (d) For each number x, there is some number y such that $x + y = 0$.

2. Negate each of the following compound propositions.
   (a) $1 + 1 = 3$ or $x \geq 5$.
   (b) $1 + 1 = 3$ and $x \geq 5$.

3. Assume both p and r are true propositions and that q is a false proposition. Find the truth value of each of the following propositions:
   (a) $(\sim p) \vee q$.
   (b) $p \wedge (q \vee (\sim r))$.
   (c) $x \vee (\sim x)$, where x is any of p, q, or r.
   (d) $x \wedge (\sim x)$, where x is any of p, q, or r.

4. Let p, q, and r be the following propositions:

   p : You have the mumps.
   q : You miss the final.
   r : You pass the course.

   Write "$(p \wedge q) \vee ((\sim q) \wedge r)$" as an English sentence.

5. Let p and q be propositions. Use truth tables to show that $\sim (p \vee (\sim q))$ is logically equivalent to $(\sim p) \wedge q$.

6. Let p, q, and r be propositions. Use DeMorgan's Laws a bunch of times to rewrite $\sim [(p \wedge q) \vee ((\sim q) \wedge r)]$ so that the only negated expressions are (possibly) p, q, and r.

1a. This is not a proposition; it's an opinion.
1b. This is a proposition that is true if and only if you read it on Tuesday.
1c. This is not a proposition since the first part isn't.
1d. This is a true proposition; $y = -x$ works every time.

2a. $1 + 1 \neq 3$ and $x < 5$.
2b. $1 + 1 \neq 3$ or $x < 5$.

3a. $F \vee F$, which is F.
3b. $T \wedge (F \vee F)$, which is F.
3c. $T \vee F$ or $F \vee T$, which is always T.
3d. $T \wedge F$ or $F \wedge T$, which is always F.

4. You have the mumps and you miss the final, or you make it to the final and you pass the course.

5.

p	q	$\sim p$	$\sim q$	$p \vee (\sim q)$	$\sim (p \vee (\sim q))$	$(\sim p) \wedge q$
T	T	F	F	T	F	F
T	F	F	T	T	F	F
F	T	T	F	F	T	T
F	F	T	T	T	F	F

6. $((\sim p) \vee (\sim q)) \wedge (q \vee (\sim r))$