Worksheet 1b

1. Know the definition of the following:

   I encourage you to keep all the definitions in one place. Throughout this course, a lot of definitions will come up and it is easier to find and review if you have them all in one place. This is very IMPORTANT for a proof-based class (especially for upper-division proof-based classes). You should start building up a good habit NOW!

   a. Statement
   b. Negation
   c. Converse
   d. Inverse
   e. Contrapositive
   f. Implication
   g. Biconditional
   h. Logical Equivalence
   i. DeMorgan's Law

2. Know how to construct a truth table
   a. Use truth table to prove logically equivalent statements
3. Know how to negate a statement
   a. Negate implication statement
   b. Negate quantified statement
   c. Negate multiple-quantified statement
4. Know how to write the converse, inverse, contrapositive of an implication statement
5. Determine the truth value of a statement

More practices:

1. Construct a truth table for $(P \wedge (P \Rightarrow Q)) \Rightarrow Q$

2. Determine the truth value of the following sentence:
   a. If $5 = 8$, then $3 + 5 = 8$
   b. If squares have four sides, then the earth is flat
3. Let the universe be the real numbers $\mathbb{R}$. Determine the truth value for each proposition.
   a. $\forall x, x^2 + 1 \geq 0$
   b. $\forall x, |x| > 0$
   c. $\exists x, |x| > 0$
   d. $\exists x, 4x + 5 = 7x - 4$
4. Negate the following statements:
   a. All even numbers are divisible by four
   b. Some natural numbers are greater than 1000
   c. $\forall x \in \mathbb{R}, \exists y \in \mathbb{R}, x > y$ (Also, what is the truth value of this statement)
   d. $\exists y \in \mathbb{R}, \forall x \in \mathbb{R}, x > y$ (Also, what is the truth value of this statement)

5. Write the following English sentences in formulaic expression and write its negation.

   a. Every rational number is fraction of two integers.

      i. Formulaic expression:

      ii. Negation:

   b. For every integer n, $n(n+1)$ is even.

      i. Formulaic expression:

      ii. Negation:

   c. For every integer n, if n is even, then $2n-3$ is odd.

      i. Formulaic expression:

      ii. Negation: