This activity is worth 20 points of course credit. See tentative calendar for due dates. Late activities are accepted at the discretion of your recitation instructor and a penalty may be imposed.

(1) Let $p$, $q$ and $r$ be propositions. Produce a truth table for each of the following compound propositions.

(a) (1 pts) $p \rightarrow q$

(b) (1 pts) $\neg p \lor q$

(c) (1 pts) $(p \rightarrow q) \land \neg r$

(d) (1 pts) $r \lor (p \land \neg q)$

(e) (1 pts) What can you conclude about propositions (a) and (b)? What about (c) and (d)?
(2) Determine whether each statement is true or false. Justify your answer (with complete and grammatically correct sentences).

(a) (1 pts) $\emptyset \in \emptyset$

(b) (1 pts) $\emptyset \subseteq \emptyset$

(c) (1 pts) $\emptyset \in \{\emptyset\}$

(d) (1 pts) $\forall x \in \mathbb{R}, \exists n \in \mathbb{Z}, n > x$.

(e) (1 pts) $\exists n \in \mathbb{Z}, \forall x \in \mathbb{R}, n > x$. 
(3) (5 pts) Let $p$ and $q$ be propositions. Using a truth table, show that $p$ is logically equivalent to $\neg p \rightarrow (q \land \neg q)$.

(4) (5 pts) Let $X = \{1, 2\}$ and $Y = \{2, 3, 4\}$. List the elements of the following sets: $X \setminus Y$, $X \times Y$ and $\mathcal{P}(X \cup Y)$ (the power set).