(1) Let p and q be the statements.
p: I bought a lottery ticket this week.
q: I won the million dollar jackpot.
Express each of these statements as an English sentence.

(a) $\neg p$
(b) $p \vee q$
(c) $p \to q$
(d) $p \wedge q$
(e) $p \leftrightarrow q$
(f) $\neg p \to \neg q$
(g) $\neg p \wedge \neg q$
(h) $\neg p \vee (p \wedge q)$

(2) Let p, q, and r be the propositions.
p: You get an A on the final exam.
q: You do every exercise in this book.
r: You get an A in this class.

Write these statements using p, q, and r and logical connectives (including negations).

(a) You get an A in this class, but you do not do every exercise in this book.
(b) You get an A on the final, you do every exercise in this book, and you get an A in this class.
(c) To get an A in this class, it is necessary for you to get an A on the final.
(d) You get an A on the final, but you don't do every exercise in this book; nevertheless, you get an A in this class.
(e) Getting an A on the final and doing every exercise in this book is sufficient for getting an A in this class.
(f) You will get an A in this class if and only if you either do every exercise in this book or you get an A on the final.

(3) Determine whether each of these conditional statements is true or false.
(a) If $1 + 1 = 2$, then $2 + 2 = 5$.
(b) If $1 + 1 = 3$, then $2 + 2 = 4$.
(c) If $1 + 1 = 3$, then $2 + 2 = 5$.
(d) If monkeys can fly, then $1 + 1 = 3$.

(4) Determine whether these biconditionals are true or false.
(a) $2 + 2 = 4$ if and only if $1 + 1 = 2$.
(b) $1 + 1 = 2$ if and only if $2 + 3 = 4$.
(c) $1 + 1 = 3$ if and only if monkeys can fly.
(d) $0 > 1$ if and only if $2 > 1$

(5) State the converse, contrapositive, and inverse of each of these conditional statements.
(a) If it snows today, I will ski tomorrow.
(b) I come to class whenever there is going to be a quiz.
(c) A positive integer is a prime only if it has no divisors other than 1 and itself.

(6) Construct a truth table for each of these compound statements.

(a) $p \wedge \neg p$
(b) $p \vee \neg p$
(c) $(p \vee \neg q) \to q$
(d) $(p \vee q) \to (p \wedge q)$
(e) $(p \to q) \leftrightarrow (\neg q \to \neg p)$
(f) $(p \to q) \to (q \to p)$