Section 1.3, Problem 50: In this exercise we will show that $\{\downarrow\}$, is a functionally complete set of operators. Recall that $\downarrow$ has the truth table

p	q	$p \downarrow q$
T	T	F
T	F	F
F	T	F
F	F	T

, and that a set of operator is functionally complete if every compound proposition is equivalent to a compound proposition involving only operators in the set.

a. Show that $p \downarrow p \equiv \neg p$.

b. Show that $(p \downarrow q) \downarrow (p \downarrow q) \equiv p \vee q$

c. Show that $p \wedge q$ can be written as a compound proposition using only p, q, and $\downarrow$. Conclude that $\{\downarrow\}$ is functionally complete.

Section 1.4, Problem 36: Find a counterexample, if possible, to these universally quantified statements, where the domain for all variables consists of all real numbers.

a. $\forall x\, (x^2 \neq x)$

b. $\forall x\, (x^2 \neq 2)$

c. $\forall x\, (|x| > 0)$