1. Fully parenthesize each of the following propositional formulas. That is, add parentheses so that the structure is determined by the parentheses without the need for rules of precedence.
	1. $P ˄ Q ˅ R$
	2. $P˄ Q \rightarrow R ˄ S$
	3. $P \rightarrow Q \rightarrow R$
2. How many rows are in the truth table of propositional formula $P \rightarrow (Q \rightarrow \left(¬R \rightarrow S\right))$?
3. Construct a truth table of $P \rightarrow (Q ˄ P)$.
4. Using a truth table, show that $P \rightarrow (Q \rightarrow P)$ is a tautology.
5. Suppose that the domain of discourse is the set of all integers. Say whether each of the following is true or false.
	1. $∀n∃m(n^{2}<m)$
	2. $∃n∀m(n^{2}<m)$
	3. $∃n∃m(n^{2}+ m^{2}=5)$
	4. $∃n∃m(n^{2}+ m^{2}=6)$
	5. $∀n∀m∃r\left(m+n=2r\right)$
6. Are first-order formulas $∃xP\left(x\right) ˄ ∃xQ\left(x\right) $and $∃x\left(P\left(x\right)˄ Q\left(x\right)\right)$ logically equivalent? (That is, is

$$∃xP\left(x\right) ˄ ∃xQ\left(x\right) ≡ ∃x(P\left(x\right)˄ Q\left(x\right))$$

valid?) If so, explain why. If not, give definitions of $P(x)$ and $Q(x)$ where they are different.