Useful Tautologies

You need not memorize these, but you should study them to see what they are saying. The letter $C$ is used to represent a statement which is always FALSE. Such a statement is called a contradiction.

1. $(p \iff q) \iff [(p \implies q) \land (q \implies p)]$
2. $(p \iff q) \iff [(p \implies q) \land (\sim p \implies \sim q)]$
3. $(p \implies q) \iff (\sim q \implies \sim p)$
4. $p \lor \sim p$
5. $(p \land \sim p) \iff C$
6. $(\sim p \implies C) \iff p$
7. $[(p \land \sim q) \implies C] \iff (p \implies q)$
8. $[p \land (p \implies q)] \implies q$
9. $[\sim q \land (p \implies q)] \implies \sim p$
10. $[\sim p \land (p \lor q)] \implies q$
11. $p \land q \implies p$
12. $[(p \implies q) \land (q \implies r)] \implies (p \implies r)$
13. $[(p_1 \implies p_2) \land (p_2 \implies p_3) \land \cdots \land (p_{n-1} \implies p_n)] \implies (p_1 \implies p_n)$
14. $[(p \land q) \implies r] \iff [p \implies (q \implies r)]$
15. $[(p \implies q) \land (r \implies s) \land (p \lor r)] \implies (q \lor s)$
16. $[p \implies (q \lor r)] \iff [(p \land \sim q) \implies r]$
17. $[(p \implies r) \land (q \implies r)] \iff [(p \lor q) \implies r]$