Boolean algebra exercises

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1. Use truth tables to check whether the following are correct.

   (a) $p \wedge (\neg p \vee q) = p \wedge q$;
   (b) $p \vee (\neg p \wedge q) = p \vee q$.

2. Are these formulae tautologies, contradictions, or neither?

   (a) $p \vee (q \vee \neg p)$;
   (b) $p \wedge \neg(q \vee \neg q)$;
   (c) $p \vee \neg(q \vee \neg q)$.

3. Use Boolean algebra to find simpler formulae equivalent to:

   (a) $\neg p \vee (p \wedge q)$;
   (b) $p \vee (q \wedge \neg p)$;
   (c) $r \vee (p \wedge \neg q \wedge \neg r)$;
   (d) $\neg(p \vee (q \wedge \neg r)) \wedge q$;
   (e) $\neg(\neg p \wedge \neg q)$;

   (f) $(p \wedge q) \vee (p \wedge \neg q)$;
   (g) $\neg(p \wedge \neg q) \vee (\neg p \wedge q)$;
   (h) $\neg(\neg p \vee q) \vee (p \wedge \neg r)$;
   (i) $\neg(\neg p \wedge q) \vee (p \wedge \neg r)$.

4. Find a formula using the connectives $\wedge$ and $\neg$ that is equivalent to $p \vee q$.

5. Find a formula involving the connectives $\wedge$, $\vee$, and $\neg$ that has the following truth table:

p	q	???
0	0	1
0	1	0
1	0	1
1	1	1

6. Find a formula involving the connectives $\wedge$, $\vee$, and $\neg$ that has the following truth table:

p	q	???
0	0	0
0	1	1
1	0	1
1	1	0