TRUTH TABLES

Is the following proposition a tautology, a contradiction, or neither?

$$(\neg p \wedge q) \wedge (p \vee \neg q)$$

Can you verify your answer without truth tables?

DISJUNCTIVE NORMAL FORM

p	q	r	S
T	T	T	T
T	T	F	F
T	F	T	T
T	F	F	F
F	T	T	T
F	T	F	F
F	F	T	T
F	F	F	T

Can you find some statement S with this truth table?

Hint: disjunctive normal form

Can you find a short statement S with this truth table?

Hint: use $\rightarrow$

DISJUNCTIVE NORMAL FORM

Is disjunctive normal form unique? In other words, is it possible to find different disjunctive normal forms that are equivalent?

BASIC LOGICAL EQUIVALENCES

Idempotence.	$p \vee p \equiv p$
	$p \wedge p \equiv p$
Commutativity	$p \vee q \equiv q \vee p$
	$p \wedge q \equiv q \wedge p$
Associativity	$p \vee (q \vee r) \equiv (p \vee q) \vee r$
	$p \wedge (q \wedge r) \equiv (p \wedge q) \wedge r$
Distributivity	$p \vee (q \wedge r) \equiv (p \vee q) \wedge (p \vee r)$
	$p \wedge (q \vee r) \equiv (p \wedge q) \vee (p \wedge r)$
Double negation.	$\neg(\neg p) \equiv p$
Domination.	$p \vee T \equiv T$
	$p \wedge F \equiv F$
DeMorgan's Laws.	$\neg(p \vee q) \equiv \neg p \wedge \neg q$
	$\neg(p \wedge q) \equiv \neg p \vee \neg q$
Implications.	$p \rightarrow q \equiv q \vee \neg p$

LOGICAL EQUIVALENCES

Show the following equivalences:

$$\neg(p \to q) \equiv p \wedge \neg q$$

$$(p \to q) \wedge (p \to r) \equiv p \to (q \wedge r)$$

$$\neg(p \vee (\neg p \wedge q)) \equiv \neg p \wedge \neg q$$

TAUTOLOGIES

Show that the following statements are tautologies.

1. $(p \wedge q) \longrightarrow (p \vee q)$

2. $\neg p \wedge (p \vee q) \longrightarrow q$

TAUTOLOGIES

Determine whether or not the following statements are tautologies.

$(\neg p \wedge (p \rightarrow q)) \rightarrow \neg q$

$(\neg q \wedge (p \rightarrow q)) \rightarrow \neg p$