1.

¬[( ¬p ∧ ¬q) ∨ (p ∨ ¬q)]

≡ ¬( ¬p ∧ ¬q) ∧ ¬ (p ∨ ¬q) ∵ De Morgan’s Law

≡ ¬[ ¬(p ∨ q)] ∧ ¬ (p ∨ ¬q) ∵ De Morgan’s Law

≡ (p ∨ q) ∧ ¬ (p ∨ ¬q) ∵ Double Negation Law

≡ (p ∨ q) ∧ [¬p ∧ ¬(¬q)] ∵ De Morgan’s Law

≡ (p ∨ q) ∧ (¬p ∧ q) ∵ Double Negation Law

≡ [(p ∨ q) ∧ q] ∧ ¬p ∵ Associative Law

≡ q ∧ ¬p ∵ Absorption Law

≡ ¬p ∧ q ∵ Commutative Law

2.

(p ∨ r) → [(q ∧ ¬r) → p]

≡ ¬(p ∨ r) ∨ [(q ∧ ¬r) → p] ∵ Implication Law

≡ ¬(p ∨ r) ∨ [¬(q ∧ ¬r) ∨ p] ∵ Implication Law

≡ ¬(p ∨ r) ∨ {[¬q ∨ ¬ (¬r)] ∨ p} ∵ De Morgan’s Law

≡ ¬(p ∨ r) ∨ [(¬q ∨ r) ∨ p] ∵ Double Negation Law

≡ ¬(p ∨ r) ∨ ¬q ∨ (r ∨ p) ∵ Associative Law

≡ [¬ (p ∨ r) ∨ (r ∨ p)] ∨ ¬q ∵ Associative Law

≡ [¬ (p ∨ r) ∨ (p ∨ r)] ∨ ¬q ∵ Commutative Law

≡ [T] ∨ ¬q ∵ Negation Law

≡ T ∵ Domination Law

3.

(p ∨ q) ∧ (p → r) ∧ ¬(q ∨ r)

≡ (p ∨ q) ∧ (¬p ∨ r) ∧ ¬(q ∨ r) ∵ Implication Law

≡ (p ∨ q) ∧ (¬p ∨ r) ∧ (¬q ∧ ¬r) ∵ De Morgan’s Law

≡ (p ∨ q) ∧ ¬q ∧ (¬p ∨ r) ∧ ¬r ∵ Commutative Law

≡ [(p ∨ q) ∧ ¬q] ∧ [(¬p ∨ r) ∧ ¬r] ∵ Associative Law

≡ [(p ∧ ¬q) ∨ (q ∧ ¬q)] ∧ [(¬p ∧ ¬r) ∨ (r ∧ ¬r)] ∵ Distributive Law

≡ [(p ∧ ¬q) ∨ F] ∧ [(¬p ∧ ¬r) ∨ F] ∵ Negation Law

≡ (p ∧ ¬q) ∧ (¬p ∧ ¬r) ∵ Identity Law

≡ (p ∧ ¬p) ∧ (¬q ∧ ¬r) ∵ Commutative Law

≡ F ∧ (¬q ∧ ¬r) ∵ Negation Law

≡ F ∵ Domination Law