Answer on Question #63324 – Math – Discrete Mathematics

Question

Using laws of logics how to show that

$$(\sim p \land (\sim q \land r)) \lor (q \land r) \lor (p \land r) \leftrightarrow r.$$

Solution

$(\sim p \land (\sim q \land r)) \lor (q \land r) \lor (p \land r) \iff$	Associative Law of disjunction
$\iff (\sim p \land (\sim q \land r)) \lor ((q \land r) \lor (p \land r)) \iff$	Commutative Law of conjunction
$\iff (\sim p \land (\sim q \land r)) \lor ((r \land q) \lor (r \land p)) \iff$	
	Distributive Law of conjunction over disjunction
$\iff (\sim p \land (\sim q \land r)) \lor (r \land (q \lor p)) \iff$	Associative Law of conjunction
$\iff ((\sim p \land \sim q) \land r) \lor (r \land (q \lor p)) \iff$	Commutative Law of conjunction
$\iff ((\sim p \land \sim q) \land r) \lor ((q \lor p) \land r) \iff$	DeMorgan's Law
$\iff (\sim (p \lor q) \land r) \lor ((q \lor p) \land r) \iff$	Commutative Law of disjunction
$\iff (\sim (p \lor q) \land r) \lor ((p \lor q) \land r) \iff$	Commutative Law of conjunction
$\iff (r \land \sim (p \lor q)) \lor (r \land (p \lor q)) \iff$	
	Distributive Law of conjunction over disjunction
$\iff r \land (\sim (p \lor q) \lor (p \lor q)) \iff$	Law of excluded midle
$\iff r \land T \iff$	Redundance Law
$\iff r$	