

Problem-1 use truth table

- a) Show that $(p \wedge \neg q) \wedge (\neg p \vee q)$ is a contradiction
- b) Show that $(p \rightarrow q) \leftrightarrow (\neg q \rightarrow \neg p)$ is tautology
- c) Verify the Absorption and Distributive law

Problem-2 Use De Morgan's laws to find the negation of each of the following statements.

- a) Jan is rich and happy.
- b) Carlos will bicycle or run tomorrow.
- c) The fan is slow or it is very hot.

Problem-3 Prove the following equivalences by using laws of logic:

- a) $(p \wedge (\neg (\neg p \vee q))) \vee (p \wedge q) \equiv p$
- b) $\neg (p \leftrightarrow q) \equiv (p \leftrightarrow \neg q)$
- c) $\neg p \leftrightarrow q \equiv p \leftrightarrow \neg q$
- d) $(p \wedge q) \rightarrow (p \rightarrow q) \equiv T$
- e) $\neg (p \vee \neg (p \wedge q)) \equiv F$

Problem-4 write inverse, converse and contrapositive of the following

If my car is in repair shop, then I can't get to class

Problem-5 Use symbols to write logical form of argument and use truth table to test the argument for validity

If Maxwell is not on team A , then David is on team B

IF David is not on team B , then Maxwell is on team A

Therefore Maxwell is not on team A or David is not on team B

Problem-6 show that the following argument is valid

$$p \vee (q \vee r)$$

$$\neg r$$

$$\therefore p \vee q$$