Truth values =>

if $1+1=3$ then dogs can fly — ~~false~~ $F \to F \equiv T$

if $2+2=4$ then today is Monday — $T \to F \equiv T$

if $2+4=6$ then $1+2=3$ — $T \to T \equiv T$

$2+2=5$ iff $3+3=5$ — $F \leftrightarrow F \equiv T$

dogs can fly iff $2+2=4$ — $F \leftrightarrow T \equiv F$

Equivalence	Name
$P \wedge T \equiv P$ $P \vee F \equiv P$	Identity law
$P \vee T \equiv T$ $P \vee F \equiv F$	Domination Law
$P \vee P \equiv P$ $P \wedge P \equiv P$	Idempotent laws
$\neg(\neg P) \equiv P$	Double negation law
$P \vee q \equiv q \vee P$ $P \vee q \equiv q \wedge P$	Commutative law
$(P \vee q) \vee r \equiv P \vee (q \vee r)$ $(P \wedge q) \wedge r \equiv P \wedge (q \vee r)$	Associate law

$p \vee (q \wedge r) \equiv (p \vee q) \wedge (p \vee r)$ $p \wedge (q \vee r) \equiv (p \wedge q) \vee (p \wedge r)$	Distributive law
$\neg(p \wedge q) \equiv \neg p \vee \neg q$ $\neg(p \vee q) \equiv \neg p \wedge \neg q$	De Morgans Law
$p \vee (p \wedge q) \equiv p$ $p \wedge (p \vee q) \equiv p$	Absorption Law
$p \vee \neg p \equiv T$ $p \wedge \neg p \equiv F$	Negation Law

① $p \rightarrow q \equiv \neg p \vee q$

② $p \leftrightarrow q \equiv p \rightarrow q \wedge q \rightarrow p$

Q① $p \rightarrow q$ and $p \wedge \neg q$

Sol. →

$\neg(p \rightarrow q)$

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

$\neg\neg p \wedge \neg q$ ∴ Demorgan law

$p \wedge \neg q$ ∴ Double Negation law.

proved

Q2 :→ $\neg(P \vee (\neg P \wedge q))$ and $\neg P \wedge \neg q$

Sol :→ L.H.S

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

$\equiv \neg P \wedge \neg(\neg P \wedge q))$ ∴ Demorgan law

$\equiv \neg P \wedge (\neg\neg P \vee \neg q)$ ∴ "

$\equiv \neg P \wedge (P \vee \neg q)$ Double negation

$\equiv (\neg P \wedge P) \vee (\neg P \wedge \neg q)$ ∴ Distribution

$\equiv F \vee (\neg P \wedge \neg q)$ ∴ Negation

$\equiv \neg P \wedge \neg P$ ∴ Identity.

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