Student Information

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Answer 1

a)

p	q	$\neg q$	$p \rightarrow q$	$p \wedge \neg q$	$p \rightarrow q \oplus p \wedge \neg q$
T	T	F	T	F	T
T	F	T	F	T	T
F	T	F	T	F	T
F	F	T	T	F	T

b)

$$\begin{aligned}
p \rightarrow ((q \vee \neg p) \rightarrow r) &\equiv \neg p \vee ((q \vee \neg p) \rightarrow r) && table\ 7, Equivalence\ 1 \\
&\equiv \neg p \vee (\neg(q \vee \neg p) \vee r) && table\ 7, Equivalence\ 1 \\
&\equiv \neg p \vee ((\neg q \wedge \neg\neg p) \vee r) && table\ 6, De\ Morgan's\ Second\ Law \\
&\equiv \neg p \vee ((\neg q \wedge p) \vee r) && table\ 6, Double\ Negation\ Law \\
&\equiv (\neg p \vee (\neg q \wedge p)) \vee r && table\ 6, Associative\ Law \\
&\equiv ((\neg p \vee \neg q) \wedge (\neg p \vee p)) \vee r && table\ 6, Distributive\ Law \\
&\equiv ((\neg p \vee \neg q) \wedge (T)) \vee r && table\ 6, Negation\ First\ Law \\
&\equiv (\neg p \vee \neg q) \vee r && table\ 6, Identity\ First\ Law \\
&\equiv \neg(p \wedge q) \vee r && table\ 6, De\ Morgan's\ Second\ Law \\
&\equiv (p \wedge q) \rightarrow r && table\ 7, Equivalence\ 3
\end{aligned}$$

c)

1. F
2. F
3. F
4. T
5. T

Answer 2

a) $\exists x(P(Can, x) \wedge T(x, L))$
b) $\forall x(T(x, S) \rightarrow \exists y(N(y, Turkish) \wedge P(y, x)))$
c) $\forall x(T(x, S) \rightarrow \exists y(R(x, y) \wedge T(y, S) \wedge \forall z((R(x, z) \wedge T(z, S)) \rightarrow (y = z))))$
d) $\forall y(W(M, y) \rightarrow \neg\exists z(P(z, y) \wedge N(z, English)))$
e) $\exists x\exists y((x \neq y) \wedge N(x, Turkish) \wedge N(y, Turkish) \wedge P(x, G) \wedge P(y, G) \wedge \forall z((N(z, Turkish) \wedge P(z, G)) \rightarrow (z = x \vee z = y)))$
f) $\exists x\exists y\exists z(T(x, y) \wedge T(x, z) \wedge (y \neq z))$

Answer 3

	$p \rightarrow q, (r \wedge s) \rightarrow p, (r \wedge \neg q) \vdash \neg s$	
1.	$p \rightarrow q$	*premise*
2.	$(r \wedge s) \rightarrow p$	*premise*
3.	$(r \wedge \neg q)$	*premise*
4.	r	$\wedge e, 3$
5.	$\neg q$	$\wedge e, 3$
6.	$r \wedge s$	*assumption*
7.	p	$\rightarrow$e $2, 6$
8.	q	$\rightarrow$e $1, 7$
9.	$\perp$	$\neg$e $5, 8$
10.	$\neg(r \wedge s)$	$\neg$i $6 - 9$
11.	s	*assumption*
12.	$r \wedge s$	$\wedge$i $4, 11$
13.	$\perp$	$\neg$e $10, 12$
14.	$\neg s$	$\neg$i $11 - 13$

Answer 4

a)

- $(First\ premise)$ $\exists x(P(x) \rightarrow S(x))$
- $(Second\ premise)$ $\forall x(P(x))$
- $(Claim)$ $\exists y S(y)$

b)

$\exists x(P(x) \to S(x)), \forall x(P(x)) \vdash \exists y S(y)$

1.	$\exists x(P(x) \to S(x))$	*premise*
2.	$\forall x(P(x))$	*premise*
3.	$P(c) \to S(c)$	*assumption*
4.	$P(c)$	$\forall$e 2
5.	$S(c)$	$\to$e 3, 4
6.	$\exists y S(y)$	$\exists$i 5
7.	$\exists y S(y)$	$\exists$e 3 − 6