Student Information

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Answer 1

a)

p	q	(p$\wedge q$)	($\neg p \wedge \neg q$)	(p$\wedge q$) $\iff$ ($\neg p \wedge \neg q$)
T	T	T	F	F
T	F	F	T	F
F	T	F	T	F
F	F	F	T	F

Contradiction

b)

$p \implies ((q \vee \neg q) \implies (p \wedge q)) \iff (\neg p \vee q)$	
$p \implies (T \implies (p \wedge q))$	Negation Laws
$p \implies (\neg T \vee (p \wedge q))$	Table 7, Line 1
$p \implies (F \vee (p \wedge q))$	-
$p \implies (p \wedge q)$	Identity Laws
$(p \implies p) \wedge (p \implies q)$	Table 7, Line 6
$T \wedge (p \implies q)$	-
$p \implies q$	Identity Laws
$\neg p \vee q$	Table 7, Line 1

Answer 2

a) $\forall x \exists y \, W(x, y)$

b) $\neg \forall y \exists x \, F(x, y)$

c) $\forall$ x (W(x,P) $\implies$ $A(Ali, x)$)

d) $\exists x (W(Büsra, x) \wedge F(TUBITAK, x))$

e) $\exists x \exists y \exists z (S(x, y) \wedge S(x, z) \wedge y \neq z)$

f) $\forall x \forall y (W(x, z) \wedge W(y, z) \implies x = y)$

g) $\exists x \exists y \exists z \forall c ((W(x, z) \wedge W(y, z) \wedge (x \neq y)) \wedge ((x \neq c \wedge y \neq c \wedge x \neq y) \implies \neg W(c, z))$

Answer 3

1	$p \implies Q$	
2	$(q \wedge \neg r) \implies s$	
3	$\neg s$	
4	$\quad p$	
5	$\quad q$	$\Rightarrow$E, 1, 4
6	$\quad\quad q \wedge \neg r$	
7	$\quad\quad q$	R
8	$\quad\quad\quad \neg r$	
9	$\quad\quad\quad s$	$\Rightarrow$E, 2, 6–8
10	$\quad\quad\quad \bot$	$\neg$E, 3, 9
11	$\quad\quad \neg\neg r$	$\neg$I, 8–10
12	$\quad\quad r$	$\neg\neg$E, 11
13	$\quad r$	$\wedge$E, 2, 6–12
14	$p \implies r$	$\Rightarrow$I, 4, 13

Answer 4

1	p	
2	$p \implies (q \wedge r))$	
3	$r \implies s$	
4	$q \wedge r$	$\Rightarrow$E, 1, 2
5	q	$\wedge$E, 4
6	r	$\wedge$E, 4
7	s	$\Rightarrow$E, 3
8	$\quad s \implies \neg q$	
9	$\quad s$	$\Rightarrow$E, 8
10	$\quad \neg q$	$\Rightarrow$E, 8
11	$\quad \bot$	$\neg$E, 5, 10
12	$\neg(s \implies \neg q)$	$\neg$I, 8–11

Answer 5

1	$\forall x(P(x) \implies (Q(x) \implies R(x)))$	
2	$\exists x P(x)$	
3	$\forall x(\neg R(x))$	
4	$\quad c$	
5	$\quad P(c)$	
6	$\quad P(c) \implies (Q(c) \implies R(c))$	$\forall$E, 1
7	$\quad Q(c) \implies R(c)$	$\Rightarrow$E, 6
8	$\quad\quad Q(c)$	
9	$\quad\quad R(c)$	$\Rightarrow$E, 7, 8
10	$\quad\quad \neg R(c)$	$\forall$E, 3
11	$\quad\quad \bot$	$\neg$E, 9, 10
12	$\quad \neg Q(c)$	$\neg$I, 8–11
13	$\quad \exists x(\neg Q(x))$	$\exists$I, 11
14	$\exists x(\neg Q(x))0$	$\exists$E, 2, 4–13