Student Information

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Answer 1

p	q	r	p→q	q→r	p→r	(p→q)∧(q→r)	((p→q)∧(q→r))→(p→r)
T	T	T	T	T	T	T	T
T	T	F	T	F	F	F	T
T	F	T	F	T	T	F	T
T	F	F	F	T	F	F	T
F	T	T	T	T	T	T	T
F	T	F	T	F	T	F	T
F	F	T	T	T	T	T	T
F	F	F	T	T	T	T	T

Since for all possible p,q & r truth values ((p→q)∧(q→r))→(p→r) evaluates to True; it is a ***tautology****.*

p	q	¬p	p∨q	¬p∧(p∨q)	(¬p∧(p∨q))→q	¬((¬p∧(p∨q))→q)
T	T	F	T	F	T	F
T	F	F	T	F	T	F
F	T	T	T	T	T	F
F	F	T	F	F	T	F

Since for all possible p & q truth values ¬((¬p∧(p∨q))→q) evaluates to False; it is a ***contradiction****.*

Answer 2

1	$(p \to q) \land (p \to r)$	
2	$\equiv (\neg p \lor q) \land (\neg p \lor r)$	Equivalence 1 at Table 7
3	$\equiv \neg p \lor (q \land r)$	Distributive Law at Table 6
4	$\equiv (q \land r) \lor \neg p$	Commutative Law at Table 6
5	$\equiv \neg(q \land r) \to \neg p$	Equivalence 1 at Table 7
6	$\equiv (\neg q \lor \neg r) \to \neg p$	De Morgan's Law at Table 6

Hence (¬q∨¬r)→¬p ≡ (p→q)∧(p→r).

Answer 3

a)
a) $\exists x(F(x) \wedge \forall y D(x,y))$
b) $\forall y \exists x(D(x,y) \rightarrow F(x))$
c) $\exists y \forall x(D(x,y) \rightarrow \neg F(x))$
d) $\exists y \exists x \exists z((D(x,y) \wedge D(z,y)) \rightarrow (x=z))$
e) $\exists y \forall x(D(x,y) \rightarrow F(x))$

b)
a) teacher(Ahmet Metin)$\rightarrow \forall y \neg$ teaches(Ahmet Metin,y)
b) $\exists x \forall y$((teacher(x) $\wedge$ enjoys(x,y))$\rightarrow$teaches(x,y))
c) $\exists x$(teacher(x)$\wedge \exists y \neg$ teacher(x,y))
d) $\forall x \forall y$(takes(x,y)$\rightarrow$ student(x))
e) $\forall x$(teacher(x)$\rightarrow \exists y \exists z \exists w$((teaches(x,y)$\wedge$ teaches(x,z)$\wedge$ teacher(x,w)) $\rightarrow$ (($w \neq y$) $\wedge$ (($w=z$)$\vee$ ($y=z$)))))

Answer 4

1	p	
2	$p \rightarrow (r \rightarrow q)$	
3	$r \rightarrow q$	$\Rightarrow$E, 1, 2
4	$\quad \neg q$	
5	$\quad\quad r$	
6	$\quad\quad q$	$\Rightarrow$E, 5, 3
7	$\quad\quad \bot$	$\neg$E, 6, 4
8	$\quad \neg r$	$\neg$I, 5–7
9	$\neg q \rightarrow \neg r$	$\Rightarrow$I, 4–8

Answer 5

1	$\exists x.(p(x) \to q(a))$		
2	d | $p(d) \to q(a)$		
3	| | $\forall y.p(y)$		
4	| | $p(d)$		$\forall$E, 3
5	| | $q(a)$		$\Rightarrow$E, 4, 2
6	| $\forall y.p(y) \to q(a)$		$\Rightarrow$I, 3–5
7	$\forall y.p(y) \to q(a)$		$\exists$E, 1, 2–6