Solution 5

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April 26, 2022

1.5

10. a) $\forall x F(x, Fred)$

b) $\forall x F(Evelyn, x)$

c) $\forall x \exists y F(x, y)$

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

e) $\exists x \forall y F(x, y)$

f) $\neg \exists x (F(x, Fred) \wedge F(x, Jerry))$

g) $\exists x \exists y (F(Nancy, x) \wedge F(Nancy, y) \wedge \forall z F(Nancy, z) \rightarrow (z = x \vee z = y) \wedge x \neq y)$

h) $\exists x (\forall y F(y, x) \wedge \forall y (\forall z F(z, y) \rightarrow y = x))$

i) $\neg \exists x F(x, x)$

j) $\exists x \exists y (F(x, y) \wedge x \neq y \wedge \forall z ((F(x, z) \wedge x \neq z) \rightarrow z = y))$

28. a) $true \quad (y = x^2)$

b) $false \quad (x < 0)$

c) $true \quad (x \equiv 0)$

d) $false$

e) $true \quad (y = \frac{1}{x})$

f) $flase \quad (only \quad y = \frac{1}{x})$

g) $true \quad (y = 1 - x)$

h) $false \quad (x + 2y = 2 \wedge x + 2y = 2.5)$

i) $false \quad (only(2 - x = 2x - 1 \rightarrow x = 1)$

j) $true \quad (z = (x + y)/2)$

34. a) $x = 0 \quad y = 1 \quad z = 1$

b) $x = y = 0 \quad z = 1$

46. a) $false \qquad$ let $y = \frac{\sqrt{x}}{3}$ then $x = 9y^2 > y^2$

b) $true \qquad$ let $x < 0 \ \forall y (y^2 >= 0)$

c) *true*   let $x < 0$ $\forall y(y^2 >= 0)$

50.   a) $\exists x(P(x) \lor Q(x) \lor A)$

      b) $\exists x \exists y \neg(P(x) \lor Q(y))$

      c) $\forall x \exists y(\neg P(x) \lor Q(y))$

(1.)

Step	Reason
1.$p \to (q \to r)$	Premise #1
2.p	Premise #2
3.$q \to r$	Modus ponens using 1,2
4.q	Premise #3
5.r	Modus ponens using 3,4
6.$r \lor s$	Addition of 5

(2.)

Step	Reason
1.$\neg(q \land r)$	Premise #2
2.$\neg q \lor \neg r$	De Morgan's laws of 1
3.r	Premise #3
4.$\neg q$	Disjunctive syllogism using 2,3
5.$p \to q$	Premise #1
6.$\neg p$	Modus tollens using 4,5