Name: _  Score: / 50’

Note: each problem worth 5 points, except each with "double" worth 10 points.

§1.5. 10(e) 10(f) 20(c) 26(f) 30(c)

Hints:

§1.5. 10(e) \( \forall x \exists y F(y, x) \)
10(f) \( \neg \exists x (F(x, Fred) \land F(x, Jerry)) \)
20(c) \( \exists n \exists m (n < 0 \land m < 0 \land -(n - m < 0)) \)
26(f) Basically \( \forall x \exists y Q(x, y) \) is translated as “for any integer \( x \), there exists an integer \( y \) so that \( x + y = x - y \). This statement is TRUE because it is TRUE that ”for any integer \( x \), there exists \( y = 0 \) so that \( x + 0 = x - 0 \)."
30(c) \( \neg \exists y (Q(y) \land \exists x \neg R(x, y)) \equiv \forall y (\neg Q(y) \lor \exists x R(x, y)) \)

§1.6. 10(d) Let the domain be all people. Then,
1: \( \forall s (s \text{ is a student } \rightarrow s \text{ has an Internet account}) \) ....... Premise
2: Homer does not have an Internet account .......Premise
3: Homer is not a student .......Universal Modus tollens on 1, 2
This is the conclusion we can draw. The statement that “Maggie has an Internet account” does not lead to any other conclusion. Note: we can also use Universal intantiation on 1 to obtain “Homer is a student \( \rightarrow \) Homer has an Internet account”. Then, combine this with 2 and use Modus tollens to arrive at the same conclusion 3.
20(a) Not valid. “p \( \rightarrow \) q” and “q \( \rightarrow \) p” have no logic connection.
28. Here is one way to show it.
1: \( \forall x ((\neg P(x) \land Q(x)) \rightarrow R(x)) \) .......Premise
2: \( \forall x (\neg(P(x) \land Q(x)) \lor R(x)) \) .......Logic equivalence of 1
3: \( \forall x (P(x) \lor \neg Q(x) \lor R(x)) \) .......De Morgan’s Law and associative law on 2
4: \( \forall x (P(x) \lor Q(x)) \) .......Premise
5: \( \forall x (P(x) \lor R(x) \lor P(x)) \) .......Resolution on 3, 4
6: \( \forall x (R(x) \lor P(x)) \) .......Logic equivalence of 5
7: \( \forall x (\neg R(x) \rightarrow P(x)) \) .......Logic equivalence of 6