MATH 51 Homework #3

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Section 1.4

10.

Let $C(x)$ be the statement "x has a cat"
Let $D(x)$ be the statement "x has a dog"
Let $F(x)$ be the statement "x has a ferret"

a $\exists! x, (C(x) \wedge D(x) \wedge F(x))$

b $\forall x, (C(x) \vee D(x) \vee F(x))$

c $\exists x, (C(x) \wedge F(x) \wedge \neg D(x))$

d $\forall x, \neg(C(x) \wedge D(x) \wedge F(x))$

e $(\exists x, C(x)) \wedge (\exists x, D(x)) \wedge (\exists x, F(x))$

18.

a $P(-2) \vee P(-1) \vee P(0) \vee P(1) \vee P(2)$

b $P(-2) \wedge P(-1) \wedge P(0) \wedge P(1) \wedge P(2)$

c $\neg P(-2) \vee \neg P(-1) \vee \neg P(0) \vee \neg P(1) \vee \neg P(2)$

d $\neg P(-2) \wedge \neg P(-1) \wedge \neg P(0) \wedge \neg P(1) \wedge \neg P(2)$

e $\neg(P(-2) \vee P(-1) \vee P(0) \vee P(1) \vee P(2))$

f $\neg(P(-2) \wedge P(-1) \wedge P(0) \wedge P(1) \wedge P(2))$

32.

a Domain: D all dogs. $F(D) =$ "D has fleas". $\forall D, F(D)$.

Negation: $\exists D, \neg F(D)$. There is a dog that doesn't have fleas.

b Domain: H all horses. $A(H) =$ "H can add". $\exists H, A(H)$.

Negation: $\forall H, \neg A(H)$. All horses can't add.

c Domain: K all koalas. $C(K) =$ "K can climb". $\forall K, C(K)$.

Negation: $\exists K, \neg C(K)$. There exists a koala that can't climb.

d Domain: M all monkeys. $F(M) =$ "M can speak French. $\forall M, \neg F(M)$.

Negation: $\exists M, F(M)$. There is a monkey that can speak French.

e Domain: P all pigs. $S(P) =$ "P can swim." $F(P) =$ "P can catch fish". $\exists P, (S(P) \wedge F(P))$

Negation: $\forall P, (\neg S(P) \vee \neg F(P)$. All pigs can't swim or can't catch fish.

36.

a $\exists x, (-2 \geq x \geq 3)$

b $\exists x, (0 > x \geq 5)$

c $\forall x, (-4 > x > 1)$

d $\forall x, (-5 \geq x \geq -1)$

46.

These are not logically equivalent. The reasoning comes from when you choose your x. With $\forall x, (...)$, you choose a single x that is input into both $P(x)$ and $Q(x)$. On the other hand, with $\forall x, P(x) \leftrightarrow \forall x, Q(X)$ you are stating that for all x you choose for $P(x)$ works for any other all x for $Q(x)$. Because of this difference, the outputs for $P(x)$ or $Q(x)$ can be different.