

## 1.4

10.

- a)  $\exists x D(x) \wedge F(x) \wedge C(x)$
- b)  $\forall x D(x) \vee F(x) \vee C(x)$
- c)  $\exists x \neg D(x) \wedge F(x) \wedge C(x)$
- d)  $\neg \exists x D(x) \wedge F(x) \wedge C(x)$
- e)  $\exists x D(x) \wedge F(x) \wedge C(x)$  **not sure**

18.

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

34.

- a)  $\forall x P(x)$ , All drivers obey the speed limit
- b)  $\exists x \neg Q(x)$ , There exists a Swedish movie that is not serious
- c)  $\exists x K(x)$ , There exists a person who can keep a secret
- d)  $\forall x G(x)$ , Every person in this class has a good attitude

44. Are  $\forall x (P(x) \leftrightarrow Q(x))$  and  $\forall x P(x) \leftrightarrow \forall x Q(x)$  equivalent? **not sure**

48. b) There exists some  $x$  such that something implies  $P(x)$ , **not sure**

## 1.5

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

b)  $\forall y F(\text{Evelyn}, y)$

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

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

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

d)  $\neg \exists x F(x, \text{Fred}) \wedge F(x, \text{Jerry})$

g)  $\exists x \exists y F(\text{Nancy}, x) \wedge F(\text{Nancy}, y) \wedge \neg(x=y)$  **not sure**

24. a) There exists some  $x$  such that a number added to  $x$  is equal to itself

b) For every pair of numbers  $(x, y)$ , if  $x$  is greater than or equal to zero and  $y$  is less than zero, then  $x - y$  must be greater than 0.

c) There exists some pair  $(x, y)$  such that  $x$  is less than or equal to zero and  $y$  is less than or equal to zero and  $x - y$  is greater than zero

d) For every pair of numbers  $(x, y)$ , if and only if  $x$  and  $y$  are not equal to zero does the product  $xy$  not equal zero and vice versa.

32. a)  $\forall z \exists y \exists x \neg T(x,y,z)$

b)  $\forall x \forall y \neg P(x,y) \vee \exists x \exists y \neg Q(x,y)$

c)  $\forall x \forall y (Q(x,y) \oplus Q(y,x))$

d)  $\exists y \forall x \forall z (\neg T(x,y,z) \wedge \neg Q(x,y))$

40. a) counterexample: when x is equal to 0

b) Counterexample: x is equal to -200, or any value less than or equal to -100

c) Counterexample: x = 1000, y=100

46. a) false

b) true

c) true