Will May MA HW

2.1

2.) a.) false; if $x=1$ $x+x=1$

$1+1 \neq 2$ ✗

b.) true; if $x=-1$ $-1+2=1$ ✓

c.) true; if $x=1$ $1^2-1 \neq 1$ ✓

d.) false; if $x=1$ $1^2-1=0$ ✗

4.) a.) true because all values of P(x) are true

b.) true because at least one value of P(x) is true

c.) false because Q(b), Q(c), and Q(d) are false; they must all be true in order to be fully true.

d.) true because Q(a) is true

2.2

2.) a.) $\exists x (E(x) \wedge T(x))$

b.) $\forall x (E(x) \wedge T(x))$

c.) $\forall x (T(x) \rightarrow E(x))$

d.) $\exists x (E(x) \rightarrow \neg T(x))$

4.) a) $\exists x (S(x))$

b.) $\forall x (\neg S(x) \wedge W(x))$

c.) $\forall x (S(x) \rightarrow \neg W(x))$

d) $\exists x (S(x) \wedge W(x))$

2.2

8.) a.) proposition : false
"There is someone who had migraines and was given the medication."

b.) proposition : true
"There is someone who had migraines and there is someone who was given the medication."

c) Not a proposition

d.) Proposition : false
"Everyone had fainting spells or migraines."

10.) a.) false : Hillary, Bernie, Donald, and Carly are all false

b.) true : everyone that is not Jeb is true

c.) true : everyone is true

d.) true : Hillary is true

2.3

1.) a.) $\neg \exists x P(x) = \forall x \neg P(x)$

b.) $\neg \exists x (P(x) \vee Q(x)) = \forall x (\neg P(x) \wedge \neg Q(x))$

c.) $\neg \forall x (P(x) \wedge Q(x)) = \exists x (\neg P(x) \vee \neg Q(x))$

d.) $\neg \forall x (P(x) \wedge (Q(x) \vee R(x))) = \exists x (\neg P(x) \vee \neg (Q(x) \wedge R(x)))$

2.) a.)
- $\forall x D(x)$
- $\neg \forall x D(x)$
- $\exists x D(x)$
- Some patient was not given the medication

b.)
- $\forall x (D(x) \vee P(x))$
- $\neg \forall x (D(x) \vee P(x))$
- $\exists x (\neg D(x) \wedge \neg P(x))$
- Some patient was not given the medication and not given the placebo

c.)
- $\exists x (D(x) \wedge M(x))$
- $\neg \exists x (D(x) \wedge M(x))$
- $\forall x (\neg D(x) \vee (\neg M(x))$
- Every patient did not take the medication or did not have migraines or both.

d.)
- $\forall x (P(x) \rightarrow M(x))$
- $\neg \forall x (P(x) \rightarrow M(x))$
- $\exists x (\neg P(x) \vee M(x))$
- Some patient did not take the placebo or had migraines

2.3

4.) a.) $\neg \forall x (P(x) \wedge \neg Q(x))$
$\exists x \neg (P(x) \wedge \neg Q(x))$
$\exists x (\neg P(x) \vee \neg \neg Q(x))$
$\exists x (\neg P(x) \vee Q(x))$

b.) $\neg \forall x (\neg P(x) \rightarrow Q(x))$
$\exists x \neg (\neg P(x) \rightarrow \neg Q(x))$
$\exists x (\neg P(x) \wedge \neg Q(x))$

c.) $\neg \exists x (\neg P(x) \vee (Q(x) \wedge \neg R(x)))$
$\forall x \neg (\neg P(x) \vee \neg (Q(x) \wedge \neg R(x)))$
$\forall x (P(x) \wedge (\neg Q(x) \vee R(x)))$

2.4

1.) a.) Not a proposition
b.) Not a proposition
c.) Proposition; true
d.) Proposition; true

3.) a.) true
b.) true
c.) true
d.) false

5.) a.) $\forall x \forall y F(x,y)$
$\neg \forall x \forall y F(x,y)$
$\exists x \exists y \neg F(x,y)$
Someone is not a friend of someone.

b.) $\exists x \exists y F(x,y)$
$\neg \exists x \exists y F(x,y)$
$\forall x \forall y \neg F(x,y)$
Everyone is not a friend of everyone

c.) $\exists x \forall y F(x,y)$
$\neg \exists x \forall y F(x,y)$
$\forall x \exists y \neg F(x,y)$
Everyone is not a friend of someone

d.) $\forall x \exists y F(x,y)$
$\neg \forall x \exists y F(x,y)$
$\exists x \forall y \neg F(x,y)$
Someone is not a friend of everyone

2.5

1.) a.) false; every value is not true
b.) true; every value besides $x=y$ is true
c.) true
d.) false

4.) a.) $\exists x \exists y M(x/y < 1)$
b.) $\forall x M(x-1 > 0)$
c.) $\exists x \exists y M(x+y = xy)$
d.) $\forall x \forall y (x/y > 0)$