HW 1.4

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6.

a) $\exists x N(x)$
There exists a student in my school that has visited North Dakota.

b) $\forall x N(x)$
All students in my school have visited North Dakota.

c) $\neg\exists x N(x)$
No students in my school have visited North Dakota.

d) $\exists x \neg N(x)$
There exists a student in my school that has not visited North Dakota.

e) $\neg\forall x N(x)$
Not all of the students in my school have visited North Dakota.

f) $\forall x \neg N(x)$
None of the students in my school have visited North Dakota.

8.

$R(x)$: x is a rabbit
$H(x)$: x hops

a) $\forall x(R(x) \rightarrow H(x))$
If the animal is a rabbit then it hops.

b) $\forall x(R(x) \wedge H(x))$
All animals are rabbits and they hop.

c) $\exists x(R(x) \rightarrow H(x))$
There exists an animal that if it is a rabbit then it hops.

d) $\exists x(R(x) \wedge H(x))$
There exists an animal that is a rabbit and it hops.

10.
$C(x)$: x has a cat
$D(x)$: x has a dog
$F(x)$: x has a ferret

a) A student in your class has a cat, a dog, and a ferret.
$\exists x(C(x) \wedge D(x) \wedge F(x))$

b) All student in your class have a cat, a dog, or a ferret.
$\forall x((C(x) \vee D(x) \vee F(x))$

c) Some student in your class has a cat and a ferret, but not a dog.
$\exists x(C(x) \wedge F(x) \wedge \neg D(x))$

d) No student in your class has a cat, a dog, and a ferret.
$\neg\forall x(C(x) \wedge D(x) \wedge F(x))$ (orignal answer)
$\neg\exists x(C(x) \wedge D(x) \wedge F(x))$ (corrected answer)

e) For each of the three animals, cats, dogs, and ferrets, there is a student in your class who has this animal as a pet.
$\exists x(C(x) \vee D(x) \vee F(x))$ (orignal answer)
$\exists x C(x) \wedge \exists x D(x) \wedge \exists x F(x)$ (corrected answer)

12.
$Q(x)$: $x + 1 > 2x$

a) $Q(0)$: True
b) $Q(-1)$: True
c) $Q(1)$: False
d) $\exists x Q(x)$: True
e) $\forall x Q(x)$: False
f) $\exists x \neg Q(x)$: True
g) $\forall x \neg Q(x)$: False

16.
a) $\exists x(x^2 = 2)$: True
b) $\exists x(x^2 = -1)$: False

c) $\forall x(x^2 + 2 \leq 1)$: True
d) $\forall x(x^2 \neq x)$: False

24.

a) Everyone in your class has a cellular phone.
$S(x)$: x is in my class; C(x): x has a cellphone
1. $\forall x C(x)$
2. $\forall x(S(x) \rightarrow C(x))$

b) Somebody in your class has seen a foreign movie.
$S(x)$: x is in my class; $M(x)$: x has seen a foreign movie
1. $\exists x M(x)$
2. $\exists x(S(x) \wedge M(x))$

c) There is a person in your class who cannot swim.
$S(x)$: x is in my class; $C(x)$: x can swim
1. $\exists x \neg C(x)$
2. $\exists x(S(x) \wedge \neg C(x))$

d) All students in your class can solve quadratic equations.
$S(x)$: x is in my class; $Q(x)$: x can solve quadratic equations
1. $\forall x Q(x)$
2. $\forall x(S(x) \rightarrow Q(x)$

e) Some student in your class does not want to be rich.
$S(x)$: x is in my class; $R(x)$: x wants to be rich
1. $\exists x \neg R(x)$
2. $\exists x(S(x) \wedge \neg R(x))$