Assignment #11-key

1.

(a) No one except Anghard loves Bryn.
For all x, if x is not Angharad, then x doesn't love Bryn.
For all x, if ¬x = a, then ¬Lxb.
$\forall x(\neg x = a \supset \neg Lxb)$

(b) Some Welsh speaker loves a girl other than Angharad.
There exists an x such that, x is a Welsh speaker, and x loves a girl other than Angharad.
There exists an x such that, Fx and $\exists y((Gy \wedge Lxy) \wedge \neg y = a)$.
$\exists x(Fx \wedge \exists y((Gy \wedge Lxy) \wedge \neg y = a))$

(c) Exactly one girl loves Bryn.
$(\forall x\forall y((((Gx \wedge Lxb) \wedge Gy) \wedge Lyb) \supset x = y) \wedge \exists x(Gx \wedge Lxb))$
OR
$\exists x((Gx \wedge Lxb) \wedge \forall y((Gy \wedge Lyb) \supset y = x))$
OR
$\exists x\forall y((Gy \wedge Lyb) \equiv y = x)$

(d) Exactly two girls love Bryn.
$\exists x\exists y(((((Gx \wedge Lxb) \wedge Gy) \wedge Lyb) \wedge \neg x = y) \wedge \forall z((Gz \wedge Lzb) \supset (z = x \vee z = y)))$

(e) At most one Welsh speaker loves Bryn.
$\forall x\forall y(((Fx \wedge Lxb) \wedge (Fy \wedge Lyb)) \supset x = y)$

2.

(a) Any two successors of a positive whole number are equal (or, a positive whole number has at most one successor).
(b) There are no positive whole numbers that precede zero.
(c) Any positive whole number plus zero equals itself.
(d) Every positive whole number has a succesor.
(e) There is exactly one positive whole number such that, when added to itself equals itself (namely, zero).