Capítulo 2

Exercício 1

a) $\neg\exists x\forall y(y \in x) \equiv \forall x\exists y(y \notin x)$

b) $\exists! x\forall y(y \notin x)$

c) $\exists! y(y \in x)$

d) $\exists x\forall y((y \in x) \to y = \phi)$

e) r é subconjunto de $x \equiv \forall a((a \in r) \to (a \in x)) \equiv A$, então podemos escrever $\forall w([A]_r^w \to w \in y)$

Exercício 2

a) y

b) y

c) x

d) Não há variáveis livres.

e) x e y

Exercício 3

1. (a) $(\forall x(x = y)) \to (x \in y)$
   (b) $(\forall x(x = y))$
   (c) $(x = y)$
   (d) $(x \in y)$

2. (a) $\forall x((x = y) \to (x \in y))$
   (b) $(x = y) \to (x \in y)$
   (c) $(x = y)$
   (d) $(x \in y)$

3. (a) $\forall x(x = x) \to (\forall y\exists z(((x = y) \wedge (y = z)) \to \neg(x \in y)))$
   (b) $\forall x(x = x)$
   (c) $(x = y)$
   (d) $\forall z\exists y(((x = y) \wedge (y = z)) \to \neg(x \in y))$
   (e) $((x = y) \wedge (y = z))$
   (f) $(x = y)$
   (g) $(y = z)$

(h) $\neg(x \in y)$

(i) $(x \in y)$

4. (a) $(x = y) \to \exists y(x = y)$

   (b) $(x = y)$

   (c) $\exists y(x = y)$

   (d) $(x = y)$