

The Dog Sentences

Translate the English sentences into FOL, and the FOL sentences into English, using the dictionary provided. Sample answers will also be posted.

Dog(x) – x is a dog

Cat(x) – x is a cat

Large(x) – x is large

Happy(x) – x is happy

Larger(x, y) – x is larger than y

Bit(x, y) – x bit y

felix – the name in FOL of the cat Felix.

rover – the name in FOL of the dog Rover

mother(x) – the mother of x

1. The dog is happy.
2. The large dog is happy.
3. $\exists x(\text{Dog}(x) \wedge \text{Happy}(x) \wedge \forall y((\text{Dog}(y) \wedge \text{Happy}(y)) \rightarrow x=y) \wedge \text{Large}(x))$
4. $\exists x(\text{Dog}(x) \wedge \forall y(\text{Dog}(y) \rightarrow x=y) \wedge \text{Large}(x) \wedge \text{Happy}(x))$
5. The largest dog is happy
6. The largest dog that bit Felix is happy. (I.e. the largest of all the dogs that bit Felix is happy.)
7. The largest dog, which bit Felix, is happy.
8. The largest dog bit all of the cats.
9. There are at least three cats.
10. $\exists x \exists y (\text{Cat}(x) \wedge \text{Cat}(y) \wedge x \neq y \wedge x \neq \text{felix} \wedge y \neq \text{felix})$
11. $\forall x \forall y \forall z ((\text{Cat}(x) \wedge \text{Cat}(y) \wedge \text{Cat}(z) \wedge x \neq y \wedge x \neq z \wedge y \neq z) \rightarrow \neg(\text{Happy}(x) \wedge \text{Happy}(y) \wedge \text{Happy}(z)))$
12. $\exists x \exists y [\text{Dog}(x) \wedge \text{Dog}(y) \wedge \text{Larger}(x, y) \wedge \forall z (\text{Cat}(z) \rightarrow \text{Larger}(y, z)) \wedge \forall w ((\text{Dog}(w) \wedge \forall z (\text{Cat}(z) \rightarrow \text{Larger}(w, z))) \rightarrow (w=x \vee w=y))]$
13. Felix is the only cat that bit Rover.
14. Other than Felix's mother, the only cat that bit Rover is Felix.
15. The dogs that bit Felix are the same ones as those that are larger than Rover.