Exercises

1. (5 a, d) Let $P(x)$ be the statement “$x$ spends more than five hours every weekday in class,” where the domain for $x$ consists of all students. Express each of the quantifications in English.
   
   (a) $\exists x P(x)$
   
   (b) $\forall x \neg P(x)$

2. (7 a, d) Translate these statements into English, where $C(x)$ is “$x$ is a comedian” and $F(x)$ is “$x$ is funny” and the domain consists of all people.
   
   (a) $\forall x (C(x) \rightarrow F(x))$
   
   (b) $\exists x (C(x) \land F(x))$

3. (9 a, d) Let $P(x)$ be the statement “$x$ can speak Russian” and $Q(x)$ be the statement “$x$ knows the computer language C++.” Express each of these sentences in terms of $P(x)$, $Q(x)$, quantifiers, and logical connectives. The domain for quantifiers consists of all students at your school.
   
   (a) The is a student at your school who can speak Russian and who knows C++.
   
   (b) No student at your school can speak Russian or knows C++.

4. (28 b, c) Translate each of these statements into logical expressions using predicates, quantifiers, and logical connectives.
   
   (a) All tools are in the correct place and are in excellent condition.
   
   (b) Everything is in the correct place and in excellent condition.

5. (33 a, b) Express each of these statements using quantifiers. Then form the negation of the statement so that no negation is to the left of a quantifier. Next, express the negation in simple English. (Do not simply use the words “It is not the case that.”)
   
   (a) Some old dogs can learn new tricks.
   
   (b) No rabbit knows calculus.