

# Predicates and Quantifiers

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## Exercises

- (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.
  - $\exists x P(x)$
  - $\forall x \neg P(x)$
- (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.
  - $\forall x (C(x) \rightarrow F(x))$
  - $\exists x (C(x) \wedge F(x))$
- (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.
  - There is a student at your school who can speak Russian and who knows C++.
  - No student at your school can speak Russian or knows C++.
- (28 b, c) Translate each of these statements into logical expressions using predicates, quantifiers, and logical connectives.
  - All tools are in the correct place and are in excellent condition.
  - Everything is in the correct place and in excellent condition.
- (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.”)
  - Some old dogs can learn new tricks.
  - No rabbit knows calculus.