9. Let $P(x)$ be the statement "x can speak Russian" and let $Q(x)$ 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) There is a student at your school who can speak Russian and who knows C++.

    b) There is a student at your school who can speak Russian but who doesn't know C++.

    c) Every student at your school either can speak Russian or knows C++.

    d) No student at your school can speak Russian or knows C++.

13. Determine the truth value of each of these statements if the domain consists of all integers.

    a) $\forall n(n+1 > n)$ **b)** $\exists n(2n = 3n)$

    c) $\exists n(n = -n)$ **d)** $\forall n(3n \leq 4n)$

35. Express the negation of each of these statements in terms of quantifiers without using the negation symbol.

    a) $\forall x(x > 1)$
    b) $\forall x(x \leq 2)$
    c) $\exists x(x \geq 4)$
    d) $\exists x(x < 0)$
    e) $\forall x((x < -1) \vee (x > 2))$
    f) $\exists x((x < 4) \vee (x > 7))$

41. Translate these specifications into English, where $F(p)$ is "Printer p is out of service," $B(p)$ is "Printer p is busy," $L(j)$ is "Print job j is lost," and $Q(j)$ is "Print job j is queued."

    a) $\exists p(F(p) \wedge B(p)) \rightarrow \exists j L(j)$
    b) $\forall p B(p) \rightarrow \exists j Q(j)$
    c) $\exists j(Q(j) \wedge L(j)) \rightarrow \exists p F(p)$
    d) $(\forall p B(p) \wedge \forall j Q(j)) \rightarrow \exists j L(j)$

61. Let $P(x)$, $Q(x)$, and $R(x)$ be the statements "x is a professor," "x is ignorant," and "x is vain," respectively. Express each of these statements using quantifiers; logical connectives; and $P(x)$, $Q(x)$, and $R(x)$, where the domain consists of all people.

    a) No professors are ignorant.

    b) All ignorant people are vain.

    c) No professors are vain.

    d) Does (c) follow from (a) and (b)?

63. Let $P(x)$, $Q(x)$, $R(x)$, and $S(x)$ be the statements "x is a baby," "x is logical," "x is able to manage a crocodile," and "x is despised," respectively. Suppose that the domain consists of all people. Express each of these statements using quantifiers; logical connectives; and $P(x)$, $Q(x)$, $R(x)$, and $S(x)$.

a) Babies are illogical.

b) Nobody is despised who can manage a crocodile.

c) Illogical persons are despised.

d) Babies cannot manage crocodiles.

*e) Does (d) follow from (a), (b), and (c)? If not, is there a correct conclusion?