In each of 1, 2, 3, and 4 represent the common form of each argument using letters to stand for component sentences, and fill in the blanks so that the argument in part (b) has the same logical form as the argument in part (a).

3. a. This number is even or this number is odd.

This number is not even.

Therefore, this number is odd.

b. ____ or logic is confusing.

My mind is not shot.

Therefore, ____ .

Answer

Common form: $p \vee q$.

$\sim p$.

Therefore, q.

My mind is shot. Logic is confusing.

Write the statements in 6, 7, 8, and 9 in symbolic form using the symbols $\sim$, $\vee$, and $\wedge$ and the indicated letters to represent component statements.

8. Let $h =$ "John is healthy," $w =$ "John is wealthy," and $s =$ "John is wise."

a. John is healthy and wealthy but not wise.

Answer

$(h \wedge w) \wedge \sim s$

b. John is not wealthy but he is healthy and wise.

c. John is neither healthy, wealthy, nor wise.

d. John is neither wealthy nor wise, but he is healthy.

Answer

$(\sim w \wedge \sim s) \wedge h$

Write truth tables for the statement forms in 12, 13, 14, and 15.

12. $\sim p \wedge q$

Answer

p	q	$\sim p$	$\sim p \wedge q$
T	T	F	F
T	F	F	F
F	T	T	T
F	F	T	F

14. $p \wedge (q \wedge r)$

Answer

p	q	r	$q \wedge r$	$p \wedge (q \wedge r)$
T	T	T	T	T
T	T	F	F	F
T	F	T	F	F
T	F	F	F	F
F	T	T	T	F
F	T	F	F	F
F	F	T	F	F
F	F	F	F	F

Assume x is a particular real number and use De Morgan's laws to write negations for the statements in 32, 33, 34, 35, 36, and 37.

32. $-2 < x < 7$

Answer

$-2 \geq x$ or $x \geq 7$

In 48 and 49 below, a logical equivalence is derived from Theorem 2.1.1. Supply a reason for each step.

48.

$$\begin{aligned} (p \wedge \sim q) \vee (p \wedge q) &\equiv p \wedge (\sim q \vee q) && \text{by (a)} \\ &\equiv p \wedge (q \vee \sim q) && \text{by (b)} \\ &\equiv p \wedge \mathbf{t} && \text{by (c)} \\ &\equiv p && \text{by (d)} \end{aligned}$$

Therefore, $(p \wedge \sim q) \vee (p \wedge q) \equiv p$.

Answer

a. The distributive law

b. The commutative law for $\vee$

c. The negation law for $\vee$

d. The identity law for $\wedge$