2. If polygon *ABCDE* is equiangular and equilateral, then it is a regular polygon.

3. Polygon *ABCDE* is not both equiangular and equilateral.

4. If polygon *ABCDE* is not a regular polygon, then it is not both equiangular and equilateral.

5. Polygon *ABCDE* is equiangular and equilateral if and only if it is a regular polygon.

TRUTH TABLES The **truth value** of a statement is either true (T) or false (F). You can determine the conditions under which a conditional statement is true by using a **truth table**. The truth table at the right shows the truth values for hypothesis p and conclusion q. The conditional $p \to q$ is only false when a true hypothesis produces a false conclusion.

Conditional		
p	q	$p \to q$
T	T	T
T	F	F
F	T	T
F	F	T

EXAMPLE 2 Make a truth table

Use the truth table above to make truth tables for the converse, inverse, and contrapositive of a conditional statement $p \to q$.

Solution

Converse			Inverse					Contrapositive				
p	q	$q \to p$	p	q	$\sim p$	$\sim q$	$\sim p \to \sim q$	p	q	$\sim q$	$\sim p$	$\sim q \to \sim p$
T	T	T	T	T	F	F	T	T	T	F	F	T
T	F	T	T	F	F	T	T	T	F	T	F	F
F	T	F	F	T	T	F	F	F	T	F	T	T
F	F	T	F	F	T	T	T	F	F	T	T	T

READ TRUTH TABLES A conditional statement and its contrapositive are *equivalent statements* because they have the same truth table. The same is true of the converse and the inverse.

PRACTICE

EXAMPLE 1 on p. 94 for Exs. 1–6

1. **WRITING** *Describe* how to use symbolic notation to represent the contrapositive of a conditional statement. $\sim q \to \sim p$

6. *Sample answer:* If $x + 5 = 12$, then $x = 7$; if $x = 7$, then $3x = 21$; if $x + 5 = 12$, then $3x = 21$; $p \to q$ and $q \to r$, so $p \to r$.

WRITING STATEMENTS **Use p and q to write the symbolic statement in words.** 2–5. See margin.

p: Polygon *ABCDE* is equiangular and equilateral.

q: Polygon *ABCDE* is a regular polygon.

2. $p \to q$ 3. $\sim p$ 4. $\sim q \to \sim p$ 5. $p \leftrightarrow q$

6. **LAW OF SYLLOGISM** Use the statements p, q, and r below to write a series of conditionals that would satisfy the Law of Syllogism. How could you write your reasoning using symbolic notation?

p: $x + 5 = 12$ q: $x = 7$ r: $3x = 21$

EXAMPLE 2 on p. 95 for Exs. 7–8

7. **WRITING** Is the truth value of a statement always true (T)? *Explain.*

7. No; it is false when the hypothesis is true while the conclusion is false.

8. **TRUTH TABLE** Use the statement "If an animal is a poodle, then it is a dog."

a. Identify the hypothesis p and the conclusion q in the conditional. **p: animal is a poodle; q: animal is a dog.**

b. Make a truth table for the converse. *Explain* what each row in the table means in terms of the original statement. **See margin.**

8b.

Converse			
p	q	$q \to p$	Statement
T	T	F	If an animal is a dog, then it is a poodle, which is false.
T	F	F	If an animal is not a dog, then it is a poodle, which is false.
F	T	F	If an animal is a dog, then it is not a poodle, which is false.
F	F	T	If an animal is not a dog, then it is not a poodle, which is true.