6-2 *Inverses and Contrapositives*

You have already studied the converse of an if-then statement. Now we consider two other related conditionals called the *inverse* and the *contrapositive*.

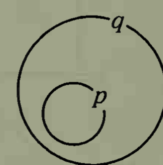
Statement:	If p, then q.
Inverse:	If not p, then not q.
Contrapositive:	If not q, then not p.

Example Write (a) the inverse and (b) the contrapositive of the true conditional: If two lines are not coplanar, then they do not intersect.

Solution
a. Inverse: If two lines are coplanar, then they intersect. (False)
b. Contrapositive: If two lines intersect, then they are coplanar. (True)

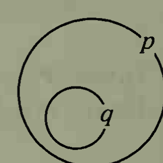
As you can see, the inverse of a true conditional is *not* necessarily true.

You can use a **Venn diagram** to represent a conditional. Since any point inside circle p is also inside circle q, this diagram represents "If p, then q." Similarly, if a point is *not* inside circle q, then it *can't* be inside circle p. Therefore, the same diagram also represents "If not q, then not p." Since the same diagram represents both a conditional and its contrapositive, these statements are either both true or both false. They are called **logically equivalent** statements.



Since a conditional and its contrapositive are logically equivalent, you may prove a conditional by proving its contrapositive. Sometimes this is easier, as you will see in Written Exercises 21 and 22.

The Venn diagram at the right represents both the converse "If q, then p" and the inverse "If not p, then not q." Therefore, the converse and the inverse of a conditional are also logically equivalent statements.



Summary of Related If-Then Statements

Given statement:	If p, then q.
Contrapositive:	If not q, then not p.
Converse:	If q, then p.
Inverse:	If not p, then not q.

A statement and its contrapositive are logically equivalent.
A statement is *not* logically equivalent to its converse or to its inverse.