The contrapositive of our original statement is *If there is not a cloud in the sky, then it is not raining.*

The inverse of our original statement is *If it is not raining, then there is not a cloud in the sky.*

NOTE: Of the three new conditional statements, the only one that is guaranteed to be logically equivalent to the original statement is the contrapositive. For this reason, we sometimes use the contrapositive to rewrite a conditional statement if it is to our benefit.

The truth table values for the conditional statement "If P, then Q" are as follows:

P	**Q**	**If P, then Q**
1	1	1
1	0	0
0	1	1
0	0	1

NOTE: The only situation in which our result is false is when our hypothesis is true and our conclusion is false. If it's true that it's raining and false that it's cloudy, you better run for cover!

Biconditional Statements

Biconditional statements are stated as "P if and only if Q". We denote this in numerous ways such as $P \leftrightarrow Q, P\ iff\ Q$, etc. Biconditional statements have the same truth table values as "(If P, then Q) AND (If Q, then P)". In other words, we are using the original statement and its converse. The truth table values for a biconditional statement are as follows:

P	**Q**	**P↔Q**
1	1	1
1	0	0
0	1	0
0	0	1

Example: *You can win the lottery if and only if you purchase a lottery ticket and you have the winning numbers.*

Note that this statement is logically true in the case where both P and Q are true (you purchased a lottery ticket and you have the winning numbers and won the lottery) and in the case where both P and Q are false (you didn't purchase a lottery ticket with the winning numbers which is the same as saying you didn't win the lottery).

Another way to express "P if and only if Q" is "P is necessary and sufficient for Q". Using the example above:

If you win the lottery then you purchased a lottery ticket and you have the winning numbers indicates the sufficiency of P.