Exercises

1. Classify each of the sentences below as an atomic statement, and molecular statement, or not a statement at all. If the statement is molecular, say what kind it is (conjuction, disjunction, conditional, biconditional, negation).

(a) The sum of the first 100 odd positive integers.

(b) Everybody needs somebody sometime.

(c) The Broncos will win the Super Bowl or I'll eat my hat.

(d) We can have donuts for dinner, but only if it rains.

(e) Every natural number greater than 1 is either prime or composite.

(f) This sentence is false.

2. Suppose P and Q are the statements: P: Jack passed math. Q: Jill passed math.

(a) Translate "Jack and Jill both passed math" into symbols.

(b) Translate "If Jack passed math, then Jill did not" into symbols.

(c) Translate "$P \vee Q$" into English.

(d) Translate "$\neg(P \wedge Q) \rightarrow Q$" into English.

(e) Suppose you know that if Jack passed math, then so did Jill. What can you conclude if you know that:

i. Jill passed math?

ii. Jill did not pass math?

3. Geoff Poshingten is out at a fancy pizza joint, and decides to order a calzone. When the waiter asks what he would like in it, he replies, "I want either pepperoni or sausage. Also, if I have sausage, then I must also include quail. Oh, and if I have pepperoni or quail then I must also have ricotta cheese."

(a) Translate Geoff's order into logical symbols.

(b) The waiter knows that Geoff is either a liar or a truth-teller (so either everything he says is false, or everything is true). Which is it?

(c) What, if anything, can the waiter conclude about the ingredients in Geoff's desired calzone?

4. Consider the statement "If Oscar eats Chinese food, then he drinks milk."

(a) Write the converse of the statement.

(b) Write the contrapositive of the statement.

(c) Is it possible for the contrapositive to be false? If it was, what would that tell you?