# 1

1. Two propositions are logically equivalent if and only if they have identical truth values for each possible substitutions of propositions for their proposition variables.
2. A tautology is a proposition that is always true.
3. The negation of "if p then q" is “p and not q”.
4. "r is a sufficient condition for s" means if r, then s.
5. "a is a necessary condition for b" means if b, then a.

# 2

1. If I go to the beach or I go out dancing, then I am done with my work.
2. If I don’t go to the beach or I don’t go out dancing, then I am not done with my work.
3. If I am not done with my work, I neither go to the beach nor do I go out dancing.

# 3

1. P(a, b) means a likes b, and the universe of discourse for x, y, and z is the set of all people.
2. Universe of discourse: the n in the set of all integers Z

# 4

1. If you finish your salad, then you can have your ice cream.
2. If x is irrational, then is irrational.
3. If I get an A in my English class, then I get an A on the final.

# 5