Solution to 1.2 problem 20

a) "If it snows tonight then I will stay at home.” This is a simple if...then.. statement, so the converse and contrapositive are easy:

- **Converse:** “If I stay at home then it snows tonight.” (Or: “If I stay at home then it will have snowed tonight.” Or: “If I stay at home tonight then it will snow.”)
- **Contrapositive:** “If I don’t stay at home tonight then it won’t be snowing.”

b) “I go to the beach whenever it is a sunny summer day.” We can rewrite this in simpler if...then.. language as “If it is a sunny summer day then I go to the beach.” (Convince yourself that this is the correct rewrite by considering possible truth values.) Now it is easy:

- **Converse:** “Whenever I go to the beach it is a sunny summer day.”
  Or: “If I go to the beach then it is a sunny summer day.”
- **Contrapositive:** “If I don’t go to the beach then it is not a sunny summer day.”

c) “When I stay up late, it is necessary that I sleep until noon.” This is equivalent to “If I stay up late, then I need to sleep until noon.”

- **Converse:** “If I need to sleep until noon, then I stay(ed) up late.”
- **Contrapositive:** “If I don’t need to sleep until noon, then I didn’t stay up late.”