Proof Skills Identified by UBC Faculty

The following abilities were identified during my faculty interviews as being essential to constructing and following mathematical proofs. Faculty interviewed include past instructors of Math 220 - "Mathematical Proof" and subsequent 300-level courses, including MATH 308, MATH 312, MATH 320, MATH 322 and MATH 342.

*This list is not complete, since interviews are still in progress.

1. Identify theorems and lemmas that may be useful for the proof.

2. Identify or give corollaries (consequences) of a theorem or statement.

3. Find counterexamples to show a statement is not true.

4. Identify/give/recall relevant definitions.

5. Convert statements to equivalent statements using logic.

6. Determine the set of objects the theorem or statement is about (ex. Real numbers, integers, continuous functions, symmetries of a polygon, etc.).

7. Determine if something is a proof or not (ie. Does it prove the statement?).
    1. Use logic to determine when statements are true or false (especially conditional statements)

8. Make educated guesses whether or not a statement is true (ie. "intuition").
    1. Remember similar results/problems
    2. do some simple tests/counterexamples ("simple" can be domain specific)

9. Rank various methods of proof by (expected) usefulness for a problem.
    1. Choose an approach
    2. recall indicators for what methods may be most fruitful (ex. Type of quantifiers, mathematical domain (analysis vs. algebra vs. number theory), remember proofs of similar statements, others?)

10. Identify the assumptions in a theorem/statement.

11. Identify the conclusion in a theorem/statement.

12. Convert statements to equivalent statements using definitions

13. Draw a conceptual picture of the theorem/statement.

14. Give an example that illustrates the theorem/statement.

15. Recognize what assumptions were used in proving a theorem and which were not:
    1. explain why the assumptions are required/recognize what part of the conclusion does not hold if an assumption is removed or relaxed

2. give an example illustrating how the conclusion is false if an assumption is not satisfied.

16. Remove unnecessary assumptions in a theorem/statement.

17. Remove/combine unnecessary steps in a proof using properties, lemmas and theorems.