MATH 220 List of Possible Topics **Section 9<u>70</u>**

1. Pick's Theorem and the Farey Series

2. Transcendental Numbers

3. Bernoulli Numbers

4. Fractal patterns

5. Fibonacci Numbers and Golden Ratio

6. Pascal's Triangle and Fibonacci Numbers

7. Error-correcting codes, especially linear or matrix codes

8. Two Principles of Counting (The Pigeonhole Principle and The Inclusion-Exclusion Principle)

9. The Tower of Hanoi

10. Euler Characteristic

11. Exploring Graph Theory: The Five Color Problem. (Remark: All planar graphs can be colored using at most Five colors so that no two countries with a common borderline have the same color. Actually four colors are enough but that is beyond this course.)

12. Exploring Graph Theory: The Königsberg Bridge Problem. .

13. Sphere packing problem (Kepler's conjecture).

14. Latin Squares (note: Latin squares were first used in agricultural experiments)

15. Infinity (Hilbert's discussion of the "Grand Hotel" is a good starting point for this topic)

16. Ciphers or cryptography (secret codes)

17. Game theory and the Prisoner's Dilemma

18. Platonic solids

19. Crystal structures and symmetry

20. Tilings (e.g., the chess problem of the knights)

21. Knots and Braids

22. Little Fermat's theorem and RSA codes

23. Democratic elections and Arrow theorem

24. Finite Automata (including the Game of Life)

25. Göedel Incompleteness Theorem

26. Fermat's Last Theorem

27. The Riemann Hypothesis)

28. The axiom of choice.

29. Proofs of Impossibility (Classical Greek problems)

30. The P versus NP problem