

## MATH 220 List of Possible Topics **Section 903**

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