Math 303 Sample Exam Questions

1. What kind of numeral systems did the Egyptians (Chinese, Arabs, etc) use? What are the advantages and disadvantages of such a numeral system?

2. Multiply 22 by 57 using Egyptian numerals and the Egyptian algorithm. You may use Table 1 in 4.1 of Mathematical Ideas. (On the exam, I would provide the table for you.)

3. Multiply 22 by 57 using the Russian Peasant Algorithm.

4. Explain what an operation is. Give an example of an operation.

5. What does it mean for an operation to be commutative (or associative)? Give examples of an operation which is commutative (associative) and an operation which is not. Justify your answer.

6. What does it mean for an operation to have identity (or inverses)? Give examples of an operation which has identity (or inverses) and an operation which does not. Justify your answer.

7. What does it mean for an operation $\circ$ on a set S to be distributive with respect to the operation $*$ on S? Give an example of a pair of operations which are distributive. Give an example of a pair of operations which are not distributive.

8. Show how you use commutativity and associativity of addition and multiplication and distributivity of multiplication over addition to add (or multiply) 22 by 57 using the long hand algorithm.

9. State and prove Thales' theorem.

10. Who were the Pythagoreans and what significant role did they play in the history of mathematics?

11. What major result do we associate with Hippasus?

12. What does commensurability of two line segments mean? How does this relate to rational and irrational numbers?

13. Prove that $\sqrt{2}$ is an irrational number. How does this result allow you to conclude that 1 and $\sqrt{2}$ are not commensurable?

14. What major results did Hippocrates of Chios achieve in mathematics?

15. Given a rectangle $ABCD$, give a construction of a square of equal area using straightedge and compass only. Do the same for a triangle ABC. Why is quadrature an interesting geometric question?

16. What does quadrature of the lune mean? What is the math historical importance of the quadrature of the lune?

17. Discuss why ancient Greek mathematics was a major advance over Egyptian, Mesopotamian, and Babylonian mathematics. How does this affect modern mathematics?

Any of the homework exercises or an exercise similar to those could show up on the exam. I may ask you about any of the proofs and constructions presented in class too.