

MATH 110 - 02  
Information for Midterm Exam  
October 9, 2019

*General Information*

The midterm exam will be given in class on Friday, October 25, as announced in the course syllabus. It will cover the mathematical and historical material we have studied since the start of the semester.

This exam will contain about 30% on mathematical questions related, about 30% on short answer questions related to the history we have discussed, and a 1- or 2-page essay on an assigned topic (see below).

*Mathematical/Historical Topics*

- From our study of Old Babylonian mathematics:
  - a. Know the approximate historical period represented by the Old Babylonian mathematical texts.
  - b. Know the base-60 number system and number symbols and be able to read “the real thing” and convert to base-10 form (given information about where the fractional part of the number starts).
  - c. Know and understand what the tablets YBC 6967 and YBC 7289 contain
  - d. The role of addition, multiplication, reciprocal,  $n^3 + n$ , ... tables in Babylonian arithmetic
  - e. Know the different interpretations of the Babylonian “quadratic algebra” problem texts like YBC 6967 given by Otto Neugebauer and more recent historians like Jens Hoyrup and Eleanor Robson.
- From our study of the Greek algebra and number theory:
  - a. Know the approximate historical periods of Euclid and Diophantus.
  - b. The meaning of incommensurability of magnitudes, the discovery of incommensurable magnitudes like  $\sqrt{2}$ , know the way that the diagonal of a square was proved to be incommensurable with the side of the square (see class materials for September 27 for the proof from “Book X, Proposition 117” in Euclid). Know the way the Greeks dealt with the fact that these incommensurable magnitudes exist.
  - b. Euclid’s “geometric algebra” from Book II of the *Elements*; Know the proof of Proposition 5 (the geometric form of the identity  $ab + ((a + b)/2 - b)^2 = ((a + b)/2)^2$ .) See pages 7 and 8 of the class materials for September 25.
  - c. Diophantus’ *Arithmetica*. In particular, know the algebraic symbolism Diophantus introduced and be able to “decode” the proof/example for Proposition 4 from Book I (translate his notation into modern algebra, carry out his steps and solve the problem).
  - d. How know Proposition 8 from Book II of the *Arithmetica* led to “Fermat’s Last Theorem” and when by whom that was finally established.

## *Essay*

The essay question will be one of the following. I could also be persuaded to give *you* the choice which one to answer if you would prefer that. We can discuss this in class.

- 1) A certain older history of mathematics says, flatly, that “the distinguishing feature of Babylonian mathematics is its algebraic character.” Of the historians we have mentioned, who would agree with this claim and who would disagree? Explain using the the interpretations your historians would give for the YBC 6967 problem of (what we would phrase as) solving the equation  $x = 60/x + 7$ .
- 2) George G. Joseph, the author of another book on the non-European roots of modern mathematics called *The Crest of the Peacock*, offers this overall evaluation of the ultimate impact of Greek geometry: “There is no denying that the Greek approach to mathematics produced remarkable results, but it also *hampered* the subsequent development of the subject. ... Great minds such as Pythagoras, Euclid, and Apollonius spent much of their time creating what were essentially abstract idealized constructs; how they arrived at a conclusion was in some way more important than any practical significance.” First, what does the last sentence mean? Would this criticism seem to be apt for Diophantos’ *Arithmetica* as well? Is it necessary for all the mathematics we learn and do to have practical usefulness or significance? (Note: this last question is calling for a personal opinion and there’s no right or wrong answer there. The idea would be for you to state a clear position and defend it using what you know and have learned in this course so far.)

## *Miscellaneous Groundrules*

No use of cell phones, pagers, I-pods, or any other electronic devices beyond a calculator will be allowed during the exam – turn them off and stow them in your backpack.