MONT 107Q – Thinking About Mathematics
Information for Midterm Exam
March 23, 2017

*General Information*

The midterm exam will be given in class on Friday, March 31, as announced in the course syllabus. It will cover the mathematical and historical material we have studied since the start of the semester. It *will not cover* the CHQ common readings of *All the Pretty Horses* and the *Metamorphoses* of Ovid.

Like the exams last semester, this one will be roughly 60% mathematical questions about the questions related to the history we have discussed, together with 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, of course!)
  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 Jens Hoyrup
- 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 $\sqrt{2}$, the way this fact was proved, and the way the Greeks dealt with the fact that these magnitudes exist
  b. Euclid's "geometric algebra" from Book II of the *Elements*; in particular know the proof of Proposition 4 (the geometric form of the identity $(a+b)^2 = a^2+2ab+b^2$)
  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.
- The *Hisab al-jabar w'al muqabalah* of Al-Khwarizmi. Know the technique for solving quadratic equations of the "squares plus roots equals numbers case, be able to work out specific examples, and also know either one of the geometric demonstrations that Al-Khwarizmi gives to establish the correctness of his method.

*Essay*

The essay question will be one of the following:

1) “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 *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* (emphasis added by JL!) 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? What is Joseph getting at? Does this criticism seem to be apt for Diophantus' *Arithmetica*? Then, which side of this debate do you come down on personally? Should all the mathematics we learn and do have practical usefulness or significance?

*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.