MATH 306: Introduction to the History and Philosophy of Mathematics
Spring 2013
Thursday 7 March 2013
Midterm — Part I

NAME:______________________________

This part contains one question worth 24 points. It is closed-book, closed note. You should spend no more than 20 minutes on this section. When you have finished, turn in Part I and you will be given Part II. You have a total of 90 minutes for Part I and Part II together.

1. (3 points each) For each mathematician listed below, state about when they lived, about where they lived, and describe their most significant mathematical contributions (at least two).

   (a) Euclid (when: ____________) (where: ________________________)

   (b) Archimedes (when: ____________) (where: ________________________)

   (c) Apollonius (when: ____________) (where: ________________________)

(d) Diophantus (when: ____________) (where: ________________________)

(e) Liu Hui (when: ____________) (where: ________________________)

(f) Brahmagupta (when: ____________) (where: ________________________)

(g) Muhammad Al-Khwārizmī (when: ____________) (where: ________________________)

(h) 'Umar Al-Khāyammī (when: ____________) (where: ________________________)

MATH 306: Introduction to the History and Philosophy of Mathematics
Spring 2013
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Midterm — Part II

NAME:______________________________

This part contains six question worth 76 points.Plus one five point extra credit problem. It is open-book, open note.

1. (10 points) Problem 31 of the Rhind Papyrus states: A quantity and its $\frac{2}{3}$, its $\frac{1}{2}$, and its $\frac{1}{7}$ added together become 33. What is this quantity?
   Solve this using the method of false position.

2. (10 points) Find, in the Egyptian fashion, the quotient $47 \div 9$. [Note that while you may choose to reverse-engineer your answer, your official work and answer should look Egyptian.]

3. (12 points) (a) Explain why it would make sense for a Babylonian text to state that the reciprocal of 45 is 1,20.

   (b) Explain why in some Babylonian texts one finds sentences like "seven does not have an inverse."

4. (12 points)

(a) Show that one can solve the cubic equation $x^3+c = ax^2$ by intersecting the parabola $y^2+cx = ac$ and the hyperbola $xy = c$.

(b) Persian mathematician Sharaf al-Din, expanding on the work of al-Khayyami, described the conditions under which the cubic $x^3 + c = ax^2$ could have zero, one, or two solutions, thus implying that it could not have three solutions. Make reasonable assumptions about al-Din's view of the nature of a and c and what constitutes a valid solution. Use modern methods to show that, given his constraints, he was correct.

5. (12 points) Compare the mathematics of Euclid, Archimedes, and Diophantus.

6. (12 points) Ancient Babylonians, Brahmagupta, and Al-Khwarizmi all solved quadratic equations. Compare their different approaches including both ways in which they are similar and ways in which they are different.

(5 points) EXTRA CREDIT. Below is yet another Proof-by-Picture of the Pythagorean Theorem. This one is due to Islamic mathematician Thabit ibn Qurra (836-901AD). Provide all the details of this proof (in words). This should involve calculating the area of the figure below in two different ways. Furthermore, provide an argument that the picture drawn is correct. (That is, just because something LOOKS like a straight line doesn't mean it is....)