MATH 304 EXAMINATION, TUESDAY, MARCH 30, 2010

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You may use modern notation in your work; but Problems 2 and 3 should involve diagrams.

Problem 1. A straight line is cut into equal and unequal segments. What is the relationship between the square on the half and the rectangle contained by the unequal segments?

Problem 2. A square is equal to three roots and twenty-eight dirhams. What is the root? Give a geometrical justification of your answer (as Muḥammad ibn Mūsā al-Khwārizmī or Thābit ibn Qurra did).

Problem 3. Suppose a cube and nine sides are equal to ten. Find the side by taking the intersection of two conic sections (as Omar Khayyām did). It is preferable if one of those sections is a circle.

Problem 4. Again, a cube and nine sides are equal to ten.

(a). Find the side numerically, as the difference of the cube roots of a *binomium* and an *apotome,* by Cardano's method (really Tartaglia's method); your steps should be clearly justifiable.

(b). The side is in fact a whole number; which one?

Problem 5. A square-square, twelve squares, and thirty-six are equal to seventy-two sides. In finding the side by Cardano's method (really Ferrari's method), you first solve a cubic equation.

(a). Obtain that cubic equation.
(b). Convert that cubic equation to an equation of the form "cube equal to roots and number".
(c). The cubic equation in (a) should have 6 as a root. Use this to find the side in the original fourth-degree equation.