

## CONTEST RULES

1. Contestants must be students in Math 489. Costumes are encouraged but not required.
2. As in the medieval format, each contestant should bring 3 cubic equations to be solved by all contestants, if s/he competes in the final public contest. The public contest will include at least one equation provided by each competitor.
3. Preliminary rounds for each division will be held to determine the finalists. Preliminary rounds will begin at 2:10 PM. The preliminary rounds will be private (class only) and everyone is encouraged to participate.
4. The top three contestants in each division will compete in the public contest. The public contest will begin at 2:45 PM. The general public is invited to attend.
5. There will be two divisions:
  - a) “non-program” division allows scientific calculators for numerical evaluation of cube and square roots and arithmetic and graphing of conic sections only. This division also allows notes of formulas and methods but not specific numerical examples. Work must be documented on paper.
  - b) “contestant-written program” allows the acceptable steps of the calculation to be programmed on the calculator or in computer software on a laptop. *The program must be written by the contestant alone. Use of another person’s program constitutes academic dishonesty.*
6. Each public contest will consist of solution of at least 6 (program) or 3 (non-program) cubic problems, submitted by the contestants and/or the moderator.
7. In the public contest, each contestant must be able to explain his/her method.
8. The winner of each public contest will be the contestant who solves the most problems correctly within the given time. If more than one contestant solves all problems correctly, the winner will be the fastest contestant who correctly solved all problems.
9. All contestants will receive food prizes.
10. All contestants who can satisfactorily solve at least one cubic will receive a one point extra credit prize. Any contestant in the public contest who solves all problems correctly within the allotted time will receive at least 5 extra credit points as a prize. Winners of each division will receive at least 10 points extra credit provided more than half of the problems are solved correctly.
11. The cubic equations will be presented in the format  $x^3 + px^2 + qx + r$ , e.g.,  $x^3 + (-1)x^2 = 0$ . A solution is defined as finding one real root (which may be negative).
12. The method of solution used must date to 1600 or earlier. Acceptable methods include Islamic methods using conic sections (see Umar al Khayyami for example), Cardano’s formulas, Viète’s method. To reduce the number of cases, any of these methods may be enhanced by allowing negative numbers, and/or a Viète’s reduction may be combined with another method. For example, the combined version of Cardano uses Viète’s reduction from  $x^3 + px^2 + qx + r$  to  $x^3 + ax + b$ , allows negative numbers and uses the formula 
$$\sqrt[3]{\frac{-b}{2} + \sqrt{\frac{b^2}{4} + \frac{a^3}{27}}} + \sqrt[3]{\frac{-b}{2} - \sqrt{\frac{b^2}{4} + \frac{a^3}{27}}} \quad (\text{cf. } CRC \text{ Handbook of Chemistry and Physics Mathematical Tables}).$$
 For al Khayyami’s method a calculator may be used to graph conic sections. For all methods a calculator may be used for extraction of cube and square roots and for arithmetic. The graph of the cubic itself may not be used as part of the solution. A “solve” command may not be used.
13. Use of modern technology is allowed only as described in these rules. Each contestant is solely responsible for the working condition of his/her equipment.
14. To register as a contestant, e-mail the moderator at [LHogben@iastate.edu](mailto:LHogben@iastate.edu) by 5 PM Monday, March 3.
15. The moderator, Prof. Leslie Hogben, will be the final judge of any and all disputes.