Mu Alpha Theta National Convention: Denver, 2001

Calculator Programming Test

You will have two hours to complete this test. At the end of that time, you will turn in a single calculator and a single piece of paper, each labeled with your ID number, your name, your school number, and your school's name. The calculator should contain programs that are the solutions to the problems below. The piece of paper should contain instructions for executing each program. The programs should give all subsequent instructions. Programs will receive points for mathematical accuracy and ease of use. Mathematical accuracy will be worth 70 points for each program, and will be assessed by running a number of test cases (data sets) through a program and verifying that the program responds correctly. Ease of use is qualitative, but will be worth 30 points for each program, and involves the appearance, instructions, and information presented by a program. Speed and code design will be used in that order to break ties if necessary (speed may also be a factor in ease of use).

1. Create a calculator program which will take as input a single number, and will output "Yes" if that number is a triangular number, otherwise will output "No: *A*", where *A* is the smallest triangular number greater than the input number. For example, if the input were 5, the output would be "No: 6", but if the input were 10, the output would be "Yes". Assume that all triangular numbers are positive.

2. Create a calculator program which will take as input three points (x, y) in the two-dimensional Cartesian plane and will then output the center of the smallest circular disk containing the input points. For example, if the input points were (0, 2), (2, 0), and (0, -2), then the resulting output would be (0, 0).

3. Create a calculator program which will take as input a single number n ($6 < n < 1000$), and will output the three rightmost digits of $n!$, neglecting the terminal zeros. For example, if the input were 7, the output would be 504 because $7! = 5040$, and if the input were 12, the output would be 016 because $12! = 479{,}001{,}600$.