MASSACHUSETTS MATHEMATICS LEAGUE
NOVEMBER 2003
ROUND 7: TEAM QUESTIONS

ANSWERS

A)_____ D)_____

B)_____ E)_____

C)_____ F)_____

A) Express the value of a + b in simple radical form when $9i^{14}(1+i)^3\left(\sqrt{2}-i\right)^{-2}$ is in standard a + bi form.

B) Cameron is thinking of a positive integer with the property that it is the average of a prime and a perfect cube where the cube is larger than the prime. How many integers less than 100, and which are primes satisfy Cameron's property?

C) A rectangle with integral sides is divided into four smaller rectangles by drawing a pair of perpendicular lines in its interior. If the areas of the four smaller rectangles are x, 2, 3, and 6; list all possible values of x.

D) The top and base of a fish tank are congruent rectangles whose lengths are 10 inches more than their widths. If the sum of the height and width of the tank is 50 inches, and the combined areas of the top and base is 400 square inches less than the total area of the four sides, what are the dimensions of the tank?

E) The pilot of an airplane calculates the angle of depression of an airport to be 30^0. The angle of depression to the airport from a second airplane 1000 feet directly above the first is 45^0. In simple radical form, what is the altitude of the first airplane?

F) The sides of a heptagon are extended to form a seven pointed star. What is the sum of the angles formed at the points of the star?