MASSACHUSETTS MATHEMATICS LEAGUE
CONTEST 4 - JANUARY 2013
ROUND 7 TEAM QUESTIONS

ANSWERS

A) _____ D) (_____ , _____)

B) _____ E) _____

C) (___ , ____ , ____ , ____ , ___) F) _____

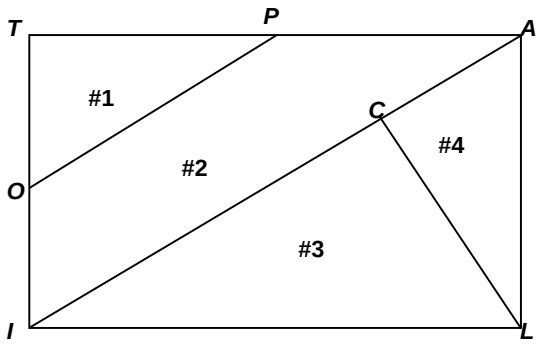
A) The set of points in the *xy*-plane equidistant from $F(2, 1)$ and the line $x + y = 0$ crosses one of the axes twice. Compute the coordinates of the points of intersection with that axis.

B) Compute <u>all</u> values of x for which $\left(\dfrac{1}{x+\dfrac{1}{x+\dfrac{1}{2}}}\right) \div \left(\dfrac{1}{2+\dfrac{1}{2+\dfrac{1}{x}}}\right) = -1.$

C) The curve represented by the parametric equations $\begin{cases} x = 5\cot(t) \\ y = 3\csc(t) \end{cases}$ may be expressed in the form $Ax^2 + Cy^2 + Dx + Ey + F = 0$, where A, C, D, E and F are integers and $A > 0$. Determine the ordered 5-tuple (A, C, D, E, F).

D) For exactly two irrational values of the constant B, the equation $(2x-3)(Bx-1) = 5$ has exactly one real root. Compute the ordered pair (P, Q), where $Q > 0$ and $\dfrac{P}{Q}$ is the reduced <u>rational</u> approximation of the <u>larger</u> value of B obtained by using the closest integer approximation for the simplified radical in the exact value of B.

E) Given: *LATI* is a rectangle, *O* and *P* are midpoints, $\overline{LC} \perp \overline{IA}$, $LI = 5$, $LA = 3$
Compute the ratio of the areas of the four regions, listed from <u>smallest to largest</u>.
Diagram is not necessarily drawn to scale.



F) A fastfood restaurant has 5-piece chicken nuggets and 8-piece chicken nuggets on their value menu. A customer can <u>not</u> order individual chicken nuggets, so, for example, an order for 12 chicken nuggets is not possible. What is the <u>largest</u> number of nuggets that can not be ordered?