MONTGOMERY COUNTY MATHEMATICS LEAGUE

Individual for Contest # 2 **(No Calculators)** **2015-2016**

Time: 10 minutes

1. If $|x-a| = |x-b|, and\ if\ a \neq b,$ find the value of x in terms of a and b.

2. Let P(x) = $x^3 + 6x^2 + 7x + 2$. Find the real number c such that P(x +c) has no x^2 term.

MONTGOMERY COUNTY MATHEMATICS LEAGUE

Individual for Contest # 2 (No Calculators) 2015-2016

Time: 10 minutes

3. For all values of x and y, the function satisfies the equation: $f(xy) = f(x) + f(y)$. If $f(2) = a, and\ f(3) = b,$ find the value of $f(72)$ explicitly in terms of a and b.

4. If a square and a regular hexagon have equal areas, then the ratio of their respective perimeters is: $\sqrt[4]{k}:1$. Find k.

MONTGOMERY COUNTY MATHEMATICS LEAGUE

Team for Contest # 2 (Calculators NOT Permitted) 2015-2016

Time: 20 minutes

1.A right circular cone of *diameter* k and height 12 rests on the bottom base of a right circular cylinder of *radius* k (their bases lie in the same plane) and is contained within the cylinder. The cylinder is filled with water to a height of 12. If the cone is then removed, compute the height to which the water will fall.

2. Two rays begin at point A and form an angle of $43°$ with one another. Lines $l, m, and\ n$, no two of which are parallel, each form an isosceles triangle with the original rays. Compute the largest angle of the triangle formed by lines $l, m, and\ n$.

3. Compute this "cross-number puzzle" by putting the proper digit into each box. All answers to clues are 3-digit numbers (thus no answer begins with a zero).

$$\begin{vmatrix} a & b & c \\ d & e & f \\ g & \boldsymbol{h} & i \end{vmatrix}$$

Across	Down
1. A prime	1. An integral power of 5
2. A composite	2. An integral power of 2
3. A square	3. An integral power of 3

4. A square and an equilateral triangle share a common side but lie in perpendicular planes. The center of the square is A and the centroid of the triangle is B; segment AB is drawn. If a new equilateral triangle ABC is drawn, compute the ratio of the area of triangle ABC to the area of the original equilateral triangle.

5. In triangle ABC, $(b\ sinC)(\boldsymbol{b}\ cosC + c\ cosB) = 42$. Compute the area of triangle ABC.