

**MASSACHUSETTS MATHEMATICS LEAGUE  
CONTEST 6 - MARCH 2008  
ROUND 7 TEAM QUESTIONS**

**ANSWERS**

A) \_\_\_\_\_ D) \_\_\_\_\_

B) \_\_\_\_\_ E) \_\_\_\_\_

C) \_\_\_\_\_ F) \_\_\_\_\_

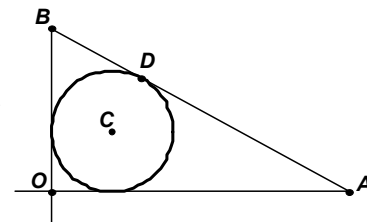
**\*\*\*\*\* NO CALCULATORS ON THIS ROUND \*\*\*\*\***

- A) In a magic square the sum in every column, in every row and along both diagonals is the same. Find the minimum value of  $x$  for which the following is a  $3 \times 3$  magic square of positive integers.

$x$	27	—
15	—	—
—	—	21

- B) Let  $P = \sqrt[3]{C} \cdot \sqrt[6]{C} \cdot \sqrt[12]{C} \cdot \sqrt[24]{C} \cdot \dots$ , where  $C$  and  $P$  are both integers.  
If  $C > 10^6$  and  $N = P - 10^4 > 10^3$ , determine the minimum value of  $N$ .
- C) Let  $P(x)$  denote the quadratic polynomial  $Ax^2 + Bx + C$  with integer coefficients and  $A > 0$ .  
When  $P(x)$  is divided by  $x - h$ , the remainder is  $k$ , but when  $P(x)$  is divided by  $x - k$ , the remainder is  $h$ . If  $h$  and  $k$  are positive primes and  $h + k = 9$ , determine the minimum value of  $C$ .
- D) Three clocks  $A$ ,  $B$  and  $C$  are in serious need of a technician, who unfortunately is on vacation.  
 $A$  has been ringing every 2 minutes and 30 seconds.  
 $B$  has been ringing every 3 minutes and 20 seconds.  
 $C$  has been ringing every 4 minutes and 10 seconds.  
If it's now 2:15 PM and all three clocks just rang simultaneously, how many times earlier today did all three clocks ring together?

- E) Right triangle  $ABO$  has circle  $C$  inscribed in it.  
 $A(24, 0)$ ,  $B(0, 18)$  and  $O(0, 0)$ . Circle  $C$  intersects the hypotenuse  $\overline{AB}$  at  $D$ .  
Find the coordinates of point  $D$ .



- F) In how many ways can you walk up a stairway that has 10 steps if you must take 1 or 2 steps at a time?