

# Student Mathematics League

## Questions for Week of Oct. 8

Student Name: \_\_\_\_\_ Math Instructor: \_\_\_\_\_

CWID#: \_\_\_\_\_ Phone #: \_\_\_\_\_

Submit your entries to Bobby Jackson in Alexander 210. **Deadline for submissions is 1 p.m.**

**Friday, October 12.** One randomly selected student from the highest scoring submissions will receive a cash prize of \$25. Score will be determined as follows:

- +2 points for each correct response
- 1/2 point for each incorrect response
- 0 points for no response

Clearly circle your answer in each case.

1. If  $\log_{36}9 + \log_{36}24 = x$ , what is the value of  $x$ ?  
A. 1                      B. 1.5                      C. 2                      D. 2.5                      E. 3
2. Casey runs  $y$  yards on a circular track of radius  $r$  yards. Kelly runs the same distance on a larger circular track of radius  $R$  yards. If  $c$  and  $k$  are the angles in degrees formed by the centers of the tracks and Casey's and Kelly's runs, respectively, what is the ratio of  $c$  to  $k$ ?  
A.  $R - r$                       B.  $\frac{r}{R}$                       C.  $\frac{R}{r}$                       D.  $\frac{r^2}{R^2}$                       E.  $\frac{R^2}{r^2}$
3. Suppose  $x$  and  $y$  are integers. Let  $k$  be the smallest positive integer for which  $36x + 21y = k$  has solutions. What is the smallest positive value of  $y$  among all such solutions?  
A. 1                      B. 3                      C. 5                      D. 7                      E. 9
4. The matrix  $M = \begin{bmatrix} s & t \\ u & v \end{bmatrix}$  has the property that  $M^2 = \begin{bmatrix} 0 & 0 \\ 0 & 0 \end{bmatrix}$ . If  $t = 2$  and  $u = -4$ , find  $|s - v|$ .  
A. 0                      B. 4                      C.  $4\sqrt{2}$                       D. 8                      E.  $8\sqrt{2}$
5. Let  $f(x) = |x + 0.5| - |x - 0.5|$  and  $h(x) = \frac{|x|}{x}$ . If  $g(x) = f(f(f(x)))$ , what is the length of the interval on which  $g(x) - h(x) \neq 0$ .  
A.  $\frac{1}{8}$                       B.  $\frac{1}{4}$                       C. 1                      D. 4                      E.  $\infty$