

# MU ALPHA THETA CONVENTION 1991

## THETA INDIVIDUAL CIPHERING

1. If  $\log(x) + \log(x-3) = \log(2) + \log(x-2)$ , what is the value of  $x$ ?
2. What is the numerical value of  $[(2+i)^2 - 2(2+i) + 1]^2$  ?
3. Simplify:  $1 + \frac{2}{1 + \frac{2}{1 + \frac{2}{\dots}}}$
4.  $AX+BY=C$  is the equation for the line  $L$  which is tangent to the circle  $x^2+y^2+4x-2y-20=0$  at the point  $(2, -2)$ . If  $a$  and  $b$  are the  $x$ - and  $y$ -intercepts of the graph of line  $L$ , find  $a+b$ .
5.  $A$  is a  $2 \times 2$  matrix such that  $A \begin{bmatrix} 1 & 2 \\ -2 & 3 \end{bmatrix} + \begin{bmatrix} 3 & -5 \\ 2 & 4 \end{bmatrix} = \begin{bmatrix} 1 & -2 \\ -1 & 3 \end{bmatrix}$ . Find the sum of the entries in  $A$ .
6. Find the area of the quadrilateral formed by connecting the endpoints of the major axis and the minor axis of the ellipse  $4x^2+25y^2-8x+100y+4=0$ .
7. A certain function  $f(x)$  is defined so that  $f(x) + 2f(6-x) = x$  for all  $x \in \mathbb{R}$ . Find  $f(1)$ .
8. Candidates  $A$ ,  $B$ , and  $C$  are running for president of  $MA\theta$ . The odds in favor of  $A$  winning are 1 to 4, and the odds in favor of  $B$  winning are 1 to 9. What are the odds in favor of  $C$  winning?
9. Alpha and Beta working together can do a given job in 20 days, Beta and Gamma together can do the job in 15 days, and Alpha and Gamma together can do it in 12 days. In how many days can Gamma do the job alone?
10. Express the following as the product of linear factors:  
 $3x^2 - xy - 7x + 2y + 2$
11. Solve for  $x$ :  $(2^{2x+4})(3^{2x-3}) = (27^{4x-21})(16^{3x-14})$
12. Find the value of:  $(15)(\sqrt{3})(\sqrt{5})(\sqrt[4]{15})(\sqrt[8]{3})(\sqrt[8]{5})(\sqrt[16]{15}) \dots$
13. How many integers satisfy the inequality  $|x-3| < 9 < |2x-3|$ ?

14. It is estimated that the cost of tuition at a certain university will increase 10% each year. What is the percentage increase, to the nearest percent, over the freshman year that a student at this university would expect to pay for the tuition during the senior year?