

# Theta Ciphering

Mu Alpha Theta 2006 National Convention



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Question # P

Evaluate:

$$4\log_3 \frac{1}{3} + 2\log_{27} 9$$



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**Question # 1**

What is the largest real solution of the equation  
 $2x^2 - 5x - 12 = 0$  ?



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**Question # 2**

In how many different ways can the letters in the word COLORADO be arranged?



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**Question # 3**

Solve for  $x$  over the set of real numbers:

$$4^{2x-1} = 8^{3x+4}$$



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**Question # 4**

What is the area of the conic with the equation  
 $36x^2 + 25y^2 - 72x - 250y - 239 = 0$ ?



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**Question # 4**

What is the area of the conic with the equation  
 $36x^2 + 25y^2 - 72x - 250y - 239 = 0$ ?



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**Question # 4**

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**Question # 5**

There are 130 students enrolled at American High School, which offers 3 upper-level classes: Pre-calculus, AP Statistics, and Physics. Fifteen students take all 3 upper-level classes, 22 take both Pre-calculus and AP Statistics, 21 take both AP Statistics and Physics, 19 take Pre-calculus and Physics, 67 take Pre-calculus, 37 take AP Statistics, and 50 take Physics. How many students at American High School do not take any upper-level classes?



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Question # 6

$$\text{If } A = \begin{bmatrix} 3 & 1 & 0 \\ -2 & -4 & 1 \\ 2 & 5 & -2 \end{bmatrix},$$

find the value of  $\det A - \det A^T$ .



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**Question # 7**

What is the sum of the odd positive  
integral factors of 1008?



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**Question # 8**

How many different integers satisfy both

$$|3x - 5| \leq 11 \quad \text{and} \quad |2x + 1| > 5 ?$$



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**Question # 8**

How many different integers satisfy both

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Question # 9

$$\frac{2}{1+\sqrt{3}+\sqrt{5}} = \frac{A+B\sqrt{3}+C\sqrt{5}+D\sqrt{15}}{11},$$

where  $A$ ,  $B$ ,  $C$ , and  $D$  are integers.

Find  $AB + CD$ .



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Question # 10

Find the sum of the first 4 terms of the  
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Question # 11

Given the equation  $3x^4 - 5x^2 + C = 0$ .

What is the largest integral value of C for which the equation has at least 1 real root?



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**Question # 12**

Algebraland is a small town with only 5 restaurants. Verla and Beverly both decide to go to lunch in Algebraland on Monday at 1pm, but neither one talked to the other about lunch, so they were surprised to see each other at the same restaurant. If Verla and Beverly do not talk about meeting for lunch, and go every day at 1pm, what is the probability that they will meet each other on both Tuesday and Wednesday of the same week, provided that they do not eat at the same restaurant more than once during the week?



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