

1999 Mu Alpha Theta National  
ALPHA CIPHERING  
PRACTICE QUESTION

Find the sum of the coefficients of the first four terms of the expansion of  $(x + 2y)^{10}$ .

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QUESTION # 2

If  $f(x) = [x]$  where  $[x]$  means to take the greatest integer less than or equal to  $x$ , determine the value of the following:  $f(3 \cdot f(\frac{1}{2} \cdot f(\frac{1}{3} \cdot f(\frac{-2}{3}))))$

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QUESTION #4

Find the sum of the smallest three distinct positive integers such that their greatest common factor is 1 and their least common multiple is 391.

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QUESTION # 6

How many integral values is  $x$  satisfy the inequality  $|x + 3| > |5 - 2x|$ ?

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QUESTION # 8

If  $x_1 = 6 \left( \cos \frac{5\pi}{12} + i \sin \frac{5\pi}{12} \right)$  and  $x_2 = 3 \left( \cos \frac{\pi}{12} + i \sin \frac{\pi}{12} \right)$  find the ordered pair (a, b) where  $\frac{x_1}{x_2}$  is stated in  $a + bi$  form, where 'a' and 'b' are real numbers. 'a' and 'b' must be expressed in simplest form.

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QUESTION # 10

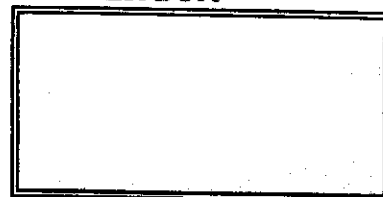
The lateral edge of a right circular cone is 26 centimeters. The base is 48 centimeters in diameter. A cross section intersects the lateral edge 13 centimeters from the vertex. If the upper cone were removed what would the remaining volume be, in cubic centimeters?

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QUESTION # 12

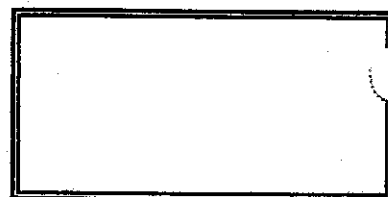
Solve for x if  $x^2 + ax + x + 3a - 6 = 0$

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QUESTION # 13

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QUESTION #1

Find the sum of the following to two decimal places:  $\log_2 8 + \log_4 8 + \log_8 8 + \log_{16} 8 + \log_{32} 8$

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QUESTION # 3

Given  $x$ ,  $y$ , and  $w$  are integers. For what value(s) of  $w$  is the following statement true?

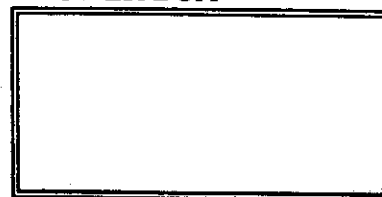
$$\frac{9^x \cdot 2^{y+1}}{3^{2x+1} \cdot 4^{\frac{y+2}{2}}} = 6^w$$

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QUESTION #5

Let  $f(x) = x^3 - 2x^2 + 10x$  and  $g(x) = \frac{-1}{4}x^2 + 3x + 3$ . Find all real values of  $x$  for which  
 $f(x) = 4g(x)$

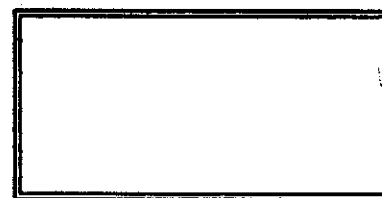
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QUESTION # 7

Find the sum of the values of  $x$  which satisfy  $\sin 3x = \cos 2x$  if  $0^\circ \leq x \leq 180^\circ$

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QUESTION # 9

Find the ordered pair(s) (a, b) is the following statement true?

$$\begin{bmatrix} 3 & a \\ 2 & b \end{bmatrix} \begin{bmatrix} -1 \\ 5 \end{bmatrix} = \begin{bmatrix} 4 & -1 \\ 3 & a \end{bmatrix} \begin{bmatrix} b \\ 2 \end{bmatrix}$$

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QUESTION # 11

Find the numerical value of q so that  $9x^2 - 54x + q = 0$  will have only one real number solution?

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