

Mu Alpha Theta National Convention: Seattle, 1997
Alpha Ciphering Test

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1. Evaluate $\sin^4 x + \cos^4 x$ given that $\cos 2x = \frac{3}{4}$.

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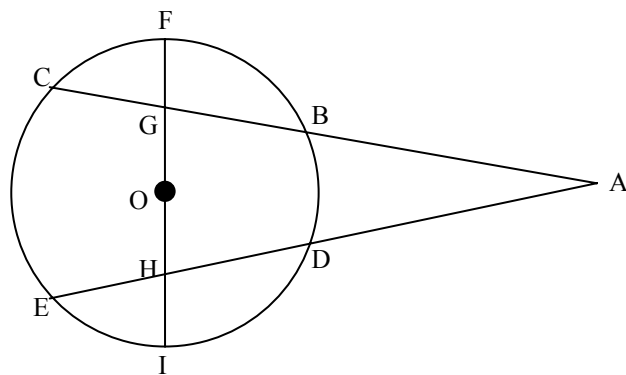
2. Express 211011201213_4 in base 16.

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3. Evaluate: $(\log_{a^2} b^3)(\log_{c^2} a^3)(\log_{b^2} c^3)$

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4. In circle O, AC and AE are secants to circle O which cut diameter IF at points G and H, each 2 units from the center. If the diameter of circle O is 8, $AB = HD = 2$, and $CG = 4$, determine the length of AD.



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5. Three dice are rolled. Given that their sum is not 11, what is the probability that at least one of the dice showed a 6?

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6. The sum of the first 30 terms of an arithmetic series is 835. The sum of terms 11 through 40 is 1235. What is the sum of the first term of the sequence and the common difference?

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7. Let $Z = a + bi$ where $a, b \in \mathfrak{R}$. If $|Z| = 2|a|$ and b is equal to the polar angle to Z as measured in radians ($0 \leq b < 2\pi$) from the x-axis, what is the sum of all possible values of Z ?

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8. Two people decide to play a game in which each player takes a turn by rolling a single die. If a person rolls a 6, that person wins. If a person rolls the number just rolled by their opponent, that person loses. If neither of these events occur, the other person takes a turn, and play continues in this manner until one of the players has won (or lost). What is the probability that the first person to take a turn ends up the loser?

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9. A number with 15 factors is indivisible by 10. What is the sum of the three smallest such numbers?

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10. Chickens A, B, and C are capable of laying 6 eggs in 4 days when they work together. Chickens B and C are capable of laying 4 eggs in 5 days when working together, and chicken B is capable of laying 3 eggs in 8 days. At what rate, in eggs per day, can chickens A and B lay eggs when working together?