

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

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1. What are the foci of the graph of $4x^2 - 48x - y^2 + 22y = 233$?

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2. Evaluate: $\int_{-1}^1 \left((3 + 5x^2 + 7x^4)^4 (11x + 13x^3 + 17x^5)^5 + 19x^{\frac{4}{3}} + 23 \right) dx$

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3. Simplify: $\int t^2 \sin t \, dt$

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4. What is the smallest natural number B for which B! is divisible by 16128?

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5. Two dice are rolled, and at least one of them shows a 5 or 6. What is the probability that the sum of the dice is 11?

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6. If the probability of choosing the natural number N is $\frac{1}{2^N}$, what is the probability that a number chosen in this manner is divisible by 3 or 4?

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7. If 70% of the US population has brown eyes, 75% have dark hair, 85% are tall, and 90% weigh over 45 kg, what is the minimum percentage of the population that must share all 4 traits?

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8. A triangle has a vertex at the origin and is isosceles with its other two vertices on the graph of $y = 16 - x^4$. If the triangle lies entirely above the x-axis, what is its maximum area?

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9. Evaluate: $1 + \frac{3}{3} + \frac{7}{9} + \frac{15}{27} + \frac{31}{81} + \dots$

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10. Triangle ABC is inscribed in circle O with radius 4. Determine the area of triangle ABC if angle $AOB = 90^\circ$, angle $BOC = 120^\circ$, and angle $COA = 150^\circ$.