#0 Theta Ciphering
MAΘ National Convention 2011

Two tangents to a circle form an angle of measure 72°. Find the degree measure of the larger of the two intercepted arcs.

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A circle is inscribed in an ellipse such that the centers of both shapes coincide. The circle divides the interior of the ellipse into three regions which have equal areas. What is the eccentricity of the ellipse?

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Find the smallest value of x such that $x^{\log x} = 100x$.

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#3 Theta Ciphering
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Find the x-coordinate of the point on the line $y = 2x - 1$ that is equidistant from the points $(1,-1)$ and $(9,7)$.

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Let $\bar{z}$ be the conjugate of complex number $z = a + bi$. Find all complex numbers z such that $2z + 5\bar{z} = 14 - 9i$.

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Find the coefficient of x^4y^3 in the expansion of $\left(x^2+2y\right)^5$.

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Simplify: $\dfrac{50!-49!}{51!-2(49!)}$

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#7 Theta Ciphering
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The domain of function f is [0,2], and function g is defined by $g(x)=f(10-x)$. If the domain of function g is $[a,b]$, find the value of $a+b$.

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#8 Theta Ciphering
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Find the area of the region defined by the solution to the system $\begin{cases} 21x^2+21y^2 \le 336 \\ 16x^2+9y^2 \ge 144 \end{cases}$.

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#9 Theta Ciphering
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Find all real values of x such that
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#10 Theta Ciphering
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Jerry wrote six checks, addressed six envelopes for the corresponding six different bills, and then randomly put exactly one check into each envelope. What is the probability that exactly half the envelopes contain the correct check?

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#11 Theta Ciphering
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A parallelogram has sides of length 8 and 13 and an interior angle of 60°. Find the length of the longer diagonal of the parallelogram.

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#12 Theta Ciphering
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A sphere of volume 288π is to be coated uniformly with paint. How thick must the paint be so that the surface of the exposed paint is three times that of the original sphere?

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#13 Theta Ciphering
MAΘ National Convention 2011

An armadillo starts at the point $(0,4)$ and walks 4 units in one direction along the line $y=3x+4$ in the first quadrant before stopping. What is the *y*-coordinate of the point where the armadillo stops?

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#14 Theta Ciphering
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Compute: $\dfrac{(8000000)^{\frac{2}{3}}\sqrt{0.0009}}{(20)^2}$

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