

#0 Mu CIPHERING
MAΘ National Convention 2026

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#1 Mu Cipheryng
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Legosi is riding a train, beginning from a stopped position. The train accelerates at a constant rate of 4 m/s^2 for 10 seconds. In those first 10 seconds, how far does the train travel, in meters?

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#3 Mu Ciphering

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An extendable ladder, initially 10 ft in length, is leaning up against a vertical wall such that the base of the ladder is on the horizontal ground, 6 ft from the base of the wall. At this moment, the base of the ladder starts slipping away from the wall at a rate of 2 ft/s, so the person on the ladder instantaneously starts extending the ladder at a rate of 1 ft/s, keeping the top of the ladder in contact with the wall. At this same moment, at what speed, in ft/s, is the top of the ladder moving down the wall? Note: since this is speed, your answer should be positive.

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#4 Mu Ciphery**MA@ National Convention 2026**

Compute the greatest x -coordinate among all points of the inflection of the function:

$$f(x) = e^{-\left(\frac{(x-1)^2}{4}\right)}$$

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Let R be the region bounded by the graphs of $y = 1 - x^2$ and $y = x^2 - 1$. If S is the solid whose base is R and whose cross-sections parallel to the x -axis are the largest possible isosceles right triangles with hypotenuse lying in R , find the volume of S .

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#6 Mu Ciphering
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Consider the limit $\lim_{x \rightarrow 0} \left(\frac{c}{1 - \cos x} - \frac{1}{x^2} \right)$, where c is a real number. There exists a unique value of c such that this limit is finite and nonzero. For this value of c , find the value of the limit.

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Find the maximum value of the function

$$f(x) = x^3(1 - x^2)^3 \text{ on the interval } 0 \leq x \leq 1.$$

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Let $L_a(x)$ be the tangent line approximation of the function $y = x^2$ at the point where $x = a$. If $L_a(4) = 15$, find the sum of all possible values of a .

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#10 Mu Ciphering
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Suppose $y = f(x)$ satisfies the equation

$$\frac{dy}{dx} = xy + x + y + 1 \text{ for all real } x. \text{ If } f(0) = 1,$$

find the value of $f(2)$.

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Given the Maclaurin series for $\sin x$ is written in order of ascending powers of x , use the first three nonzero terms of this Maclaurin series to approximate the value of $\int_0^1 (\sin x) dx$.

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The value of $\sum_{n=1}^{\infty} \left((-1)^{n-1} \cdot \frac{99}{n} \right)$ is in the interval $(a, a+1)$, where a is an integer. Find the value of a .

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