#0 Mu School Bowl
MAΘ National Convention 2011

$A = \lim_{x \to \infty} \left(2\tan^{-1} x \right)$

$B = \lim_{x \to 2} \frac{x^2 + 8x - 20}{x^3 - 8}$

$C = \lim_{x \to 0^+} x^x$

$D = \lim_{x \to \pi} \tan x$

Find the value of $A + B + C + D$.

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#1 Mu School Bowl
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For the displacement function $f(t)=2t^2-3t-2$, let:

$A=$ the average velocity over the interval $[1,2]$

$B=$ the instantaneous velocity at $t=1$

$C=$ the average velocity over the interval $[2,3]$

$D=$ the instantaneous velocity at $t=2$

Find the value of $\frac{A-B}{C-D}$.

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#2 Mu School Bowl
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$A=\lim_{x\to -1}\frac{x^3+x+2}{2x^4+3x+1}$

$B=f''(-3)$, where $f(x)=\frac{x-2}{x+1}$

$C=$ the maximum value of $f(x)=-7x^{3/2}+21x-18$

$D=-1+$ the number of points of inflection of $f(x)=x^2-2x+2x\ln x$

Find the value of $ABCD$.

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Find the value of $ABCD$.

#3 Mu School Bowl
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What is the minimum value of $2x+y$, given that $xy=n$ and x and y are both positive?

$A=$ the solution when $n=50$
$B=$ the solution when $n=128$
$C=$ the solution when $n=162$
$D=$ the solution when $n=288$

Find the value of $\frac{\left(A^2+\sqrt{C}\right)D}{B}$.

#3 Mu School Bowl
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#4 Mu School Bowl
MAΘ National Convention 2011

For the function $f(x)=x^3-x^2-x+1$:

$A=$ the sum of the x-intercepts of f

$B=$ the sum of the x-coordinates of the relative extrema of f

$C=$ the sum of the x-coordinates of the inflection points of f

$D=$ the sum of the y-coordinates of all of the above points

Find the value of $(4A+3B+3C)\sqrt{D}$.

#4 Mu School Bowl
MAΘ National Convention 2011

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$A=$ the sum of the x-intercepts of f

$B=$ the sum of the x-coordinates of the relative extrema of f

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$D=$ the sum of the y-coordinates of all of the above points

Find the value of $(4A+3B+3C)\sqrt{D}$.

#5 Mu School Bowl
MAΘ National Convention 2011

A diver jumps from a diving board 32 feet above water, and his position in feet at time t is determined by the function $s(t) = -16t^2 + 24t + 32$.

$A =$ the time t the diver hit the water
$B =$ the time t the diver was at the peak of his dive
$C =$ the diver's velocity on impact with the water

Find the value of $\lfloor \lfloor A \rfloor B \rfloor \left(\frac{C}{8}\right)^2$, where $\lfloor x \rfloor$ represents the greatest integer n with $n \le x$.

#5 Mu School Bowl
MAΘ National Convention 2011

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#6 Mu School Bowl
MAΘ National Convention 2011

For the function $f(x)=\dfrac{\ln x}{x-1}$, let $L(x)$ be the linear approximation to the graph of f at $x=e$.

$A=$ the slope of $y=L(x)$

$B=$ the x-intercept of $y=L(x)$

$C=$ the y-intercept of $y=L(x)$

$D=L(1)$

Find the value of $\dfrac{A(B+e)}{CD}$.

#6 Mu School Bowl
MAΘ National Convention 2011

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$D=L(1)$

Find the value of $\dfrac{A(B+e)}{CD}$.

#7 Mu School Bowl
MAΘ National Convention 2011

$A=\int_1^3 \frac{x}{x^2+1}\, dx$

$B=\int_{-2}^1 \left(x^3-4x^2+2x-3\right) dx$

$C=\int_{-2}^2 \frac{\tan^{-1} x}{1+x^2}\, dx$

$D=\int_0^1 \left(\sum_{n=1}^{37} (n+1)x^n\right) dx$

Find the value of $\frac{Be^{2A}}{C+D}$.

#7 Mu School Bowl
MAΘ National Convention 2011

$A=\int_1^3 \frac{x}{x^2+1}\, dx$

$B=\int_{-2}^1 \left(x^3-4x^2+2x-3\right) dx$

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Find the value of $\frac{Be^{2A}}{C+D}$.

#8 Mu School Bowl
MAΘ National Convention 2011

Let $f(x)=\int_2^x \left(t^4+3t^3-2t^2+17t-14\right)dt$. Find the value of $f(2)+\sum_{n=1}^{\infty} f^{(n)}(2)$.

#8 Mu School Bowl
MAΘ National Convention 2011

Let $f(x)=\int_2^x \left(t^4+3t^3-2t^2+17t-14\right)dt$. Find the value of $f(2)+\sum_{n=1}^{\infty} f^{(n)}(2)$.

#9 Mu School Bowl
MAΘ National Convention 2011

Given the system of parametric equations $\begin{cases} x = -t + \cos t \\ y = t^2 + \sin t \end{cases}$, find the value of $\left.\dfrac{dy}{dx}\right|_{t=\frac{\pi}{2}} + \left.\dfrac{d^2y}{dx^2}\right|_{t=\frac{\pi}{2}} + \left.\dfrac{d^3y}{dx^3}\right|_{t=\frac{\pi}{2}}$.

#9 Mu School Bowl
MAΘ National Convention 2011

Given the system of parametric equations $\begin{cases} x = -t + \cos t \\ y = t^2 + \sin t \end{cases}$, find the value of $\left.\dfrac{dy}{dx}\right|_{t=\frac{\pi}{2}} + \left.\dfrac{d^2y}{dx^2}\right|_{t=\frac{\pi}{2}} + \left.\dfrac{d^3y}{dx^3}\right|_{t=\frac{\pi}{2}}$.

#10 Mu School Bowl
MAΘ National Convention 2011

Let $f(x)=\frac{1}{4}x^2$ and $g(x)=2x-3$.

$A=$ the area bounded between f and g

$B=$ the volume obtained by rotating the region bounded by f and g about the x-axis

$C=$ the volume obtained by rotating the region bounded by f and g about the y-axis

Find the value of $\frac{AB}{C}$.

#10 Mu School Bowl
MAΘ National Convention 2011

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$A=$ the area bounded between f and g

$B=$ the volume obtained by rotating the region bounded by f and g about the x-axis

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Find the value of $\frac{AB}{C}$.

#11 Mu School Bowl
MAΘ National Convention 2011

Consider the differential equation $\frac{dy}{dx} = 2x - y$ with initial condition $y(0) = 1$. For each of the following, estimate the value of $y(0.4)$, using Euler's Method with given step size:

$A =$ solution with step size $\Delta x = 0.4$
$B =$ solution with step size $\Delta x = 0.2$
$C =$ solution with step size $\Delta x = 0.1$

Find the value of $A + B + C$, written as a decimal.

#11 Mu School Bowl
MAΘ National Convention 2011

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$C =$ solution with step size $\Delta x = 0.1$

Find the value of $A + B + C$, written as a decimal.

#12 Mu School Bowl
MAΘ National Convention 2011

List the letters of the series that converge.

$A: \sum_{n=1}^{\infty} \frac{n}{n^3+1}$

$B: \sum_{n=0}^{\infty} \frac{\cos(n\pi)}{n+1}$

$C: \sum_{n=1}^{\infty} \frac{(-3)^n}{(2n+1)!!}$

$D: \sum_{n=1}^{\infty} \left(\frac{\pi}{4}\right)^n$

$E: \sum_{n=1}^{\infty} (-1)^n e^{-n^2}$

$F: \sum_{n=2}^{\infty} \frac{1}{\ln n}$

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$F: \sum_{n=2}^{\infty} \frac{1}{\ln n}$

#13 Mu School Bowl
MAΘ National Convention 2011

Let $f(x)=\frac{\ln x}{x}$.

$A=f'(1)$

$B=\int_1^e f(t)\,dt$

$C=f'(e^2)$

$D=\int_1^{e^4} f(t)\,dt$

Find the value of $\frac{ABD}{C}$.

#13 Mu School Bowl
MAΘ National Convention 2011

Let $f(x)=\frac{\ln x}{x}$.

$A=f'(1)$

$B=\int_1^e f(t)\,dt$

$C=f'(e^2)$

$D=\int_1^{e^4} f(t)\,dt$

Find the value of $\frac{ABD}{C}$.

#14 Mu School Bowl
MAΘ National Convention 2011

Let $f(x) = e^{1-x}$.

$A = f'(2011)$

$B = f''(2011)$

$C = f'''(2011)$

$D = f^{(4)}(2011)$

Find the value of $\frac{A}{B} + \frac{A}{C} + \frac{A}{D} + \frac{B}{A} + \frac{B}{C} + \frac{B}{D} + \frac{C}{A} + \frac{C}{B} + \frac{C}{D} + \frac{D}{A} + \frac{D}{B} + \frac{D}{C}$.

#14 Mu School Bowl
MAΘ National Convention 2011

Let $f(x) = e^{1-x}$.

$A = f'(2011)$

$B = f''(2011)$

$C = f'''(2011)$

$D = f^{(4)}(2011)$

Find the value of $\frac{A}{B} + \frac{A}{C} + \frac{A}{D} + \frac{B}{A} + \frac{B}{C} + \frac{B}{D} + \frac{C}{A} + \frac{C}{B} + \frac{C}{D} + \frac{D}{A} + \frac{D}{B} + \frac{D}{C}$.