Mu School Bowl Question #1 2010 MAΘ National Convention

Let $A = \lim_{x\to 1} \frac{|x| - x}{x - 1}$ Let $B = \lim_{x\to 0} \frac{\cos x - 1}{x}$ Let $C = \lim_{x\to 3} \frac{(1/x) - (1/3)}{x - 3}$

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

Mu School Bowl Question #2 2010 MAΘ National Convention

If $f(3) = 5$, $f'(3) = 1.1$, $g(3) = -4$ and $g'(3) = 0.7$, then let $A = (f \cdot g)'(3)$

If $f(-2) = 1$, $f'(-2) = -5$, $g(-2) = 0$ and $g'(-2) = 5$, then let $B = (g/f)'(-2)$

Find the value of $A + B$.

Mu School Bowl Question #3 2010 MAΘ National Convention

Let $A =$ the x-coordinate of the absolute minimum of $f(x)$ if $f(x) = x^3 - x^2 - x + 1$ on $[-2, 2]$.

Let $B =$ the x-coordinate(s) of the relative extrema of $f'''(x)$ if $f(x) = \frac{1}{5}x^5 - \frac{1}{24}x^4$.

Find the value of $A + B$.

Mu School Bowl Question #4 2010 MAΘ National Convention

Let R = the region bounded by $y = \sin x$, $x = 0$, $x = \pi$, and $y = 0$.

$A =$ the volume of the solid found by revolving the region R about the $x-$axis.

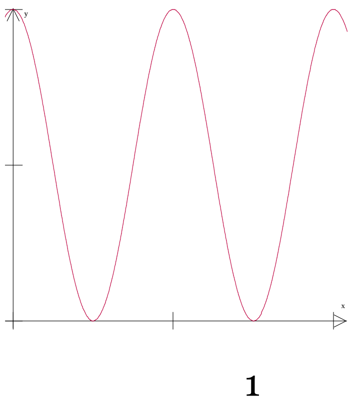
$B =$ the volume of the solid by revolving the region R about the $y-$axis.

Find the value of $A + B$.

Mu School Bowl Question #5 2010 MAΘ National Convention

Using the graph of $f(x)$ below, list the following quantities from smallest to largest using the letters as designated. The graph is periodic with a period of 1 and the maximum value is at (1, 1).

$A = \int_0^2 f(x)dx$ $\qquad$ $B = \int_0^2 \sqrt{f(x)}dx$ $\qquad$ $C = \int_0^2 f^2(x)dx$ $\qquad$ $D = \int_0^2 f'(x)dx$



Mu School Bowl Question #6 2010 MAΘ National Convention

The position of a particle moving along a horizontal line at any time t is given by $s(t) = 3t^2 - 2t - 8$. Let $A =$ the value(s) of t for which the particle is NOT moving.

The position of a particle moving along a horizontal line at any time t is given by $s(t) = (2t-3)^3$. Let $B =$ the number of times that the particle changes direction.

Find the value of $A + B$.

Mu School Bowl Question #7 2010 MAΘ National Convention

Start with S = 0 and for each series below, add 3 to S if the series converges and subtract 5 from S if the series diverges. Using this rule, what is the value of S?

$\sum_{n=1}^{\infty} \frac{5^n}{3n^2+1}$ $\qquad$ $\sum_{n=1}^{\infty} \frac{1}{n(\ln n)^2}$ $\qquad$ $\sum_{n=1}^{\infty} \frac{\sin n}{3^n}$ $\qquad$ $\sum_{n=1}^{\infty} \frac{n \cdot 3^n}{n!}$

Mu School Bowl Question #8 2010 MAΘ National Convention

A balloon rises straight up at 10 ft/sec. An observer is 40 ft. away from the spot where the balloon left the ground. Let $A=$the rate of change (in radians/sec) of the balloon's angle of elevation when the balloon is 30 ft. off the ground.

A point moves along the curve $y=x^2+1$ such that its $x-$coordinate is increasing at the rate of 1.5 units/sec. Let $B=$the rate (in units/sec) at which the point's distance from the origin is changing when the point is at (1, 2).

Find the value of $A+B$. (ignore all units when summing)

Mu School Bowl Question #9 2010 MAΘ National Convention

Let $A=\lim_{x\to\infty}(e^{-x}\sqrt{x})$ Let $B=\lim_{x\to\infty}(x-1)^{\frac{1}{x}}$

Find the value of $A+B$.

Mu School Bowl Question #10 2010 MAΘ National Convention

If $f(x)=\dfrac{e^x-e^{\frac{x}{2}}}{2}$, then let $A=f^{//}(0)$.

If $x=t^3-1$ and $y=t^2$, then let $B=\dfrac{d^2y}{dx^2}$ at $t=1$.

Find the value of $A+B$.

Mu School Bowl Question #11 2010 MAΘ National Convention

Let $A=$the approximation of $\int_0^6 (x^2-2x+2)dx$ using a lower Riemann sum with 3 inscribed rectangles of equal width on the $x-$axis.

Let $B=$ the approximation of $\int_0^4 (x^2-6x+9)dx$ using 4 inscribed rectangles of equal width on the $x-$axis.

Find the value of $A+B$.

Mu School Bowl Question #12 2010 MAΘ National Convention

A curve is given parametrically by the equations $x = 3 - 4\sin t$ and $y = 4 + 3\cos t$ for $0 \le t \le 2\pi$. Let $A =$ all $x-$coordinates at which the curve has a vertical tangent.

Let $B =$ all $x-$coordinates on the curve $x^2 - y^2 + x = 2$ where the tangent line is vertical.

Find the value of $A + B$.

Mu School Bowl Question #13 2010 MAΘ National Convention

If f is a continuous function on the interval $[a,b]$, which of the following statement(s) is/are **NOT** necessarily true?

I. f has a minimum on $[a,b]$
II. f has a maximum on $[a,b]$
III. $f'(c) = 0$ for some number c, $a < c < b$

Mu School Bowl Question #14 2010 MAΘ National Convention

The Taylor Series of a function about $x = 3$ is given by

$$f(x) = 1 + \frac{3(x-3)}{1!} + \frac{5(x-3)^2}{2!} + \frac{7(x-3)^3}{3!} + \ldots + \frac{(2n+1)(x-3)^n}{n!} + \ldots$$

Let $A =$ the value of $f'''(3)$, the 3rd derivative of f at $x = 3$.

The Maclaurin Series for a function is given by $\sum_{n=0}^{\infty} \frac{x^n}{2n}$.

Let $B =$ the value of $f^{(4)}(0)$, the 4th derivative of f at $x = 0$.

Find the value of $A + B$.