#0 Mu Bowl
MAΘ National Convention 2015

For the curve with equation $y^2 + xy = 15$, find the sum of the slopes of the tangents to the curve at the points where $x = 2$ or $x = 14$.

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#1 Mu Bowl
MAΘ National Convention 2015

A = $\lim_{x \to 3^-} \dfrac{x^3 |2x - 6|}{x - 3}$ B = $\lim_{x \to 0} \left(\dfrac{3^x + 5^x}{2} \right)^{\frac{1}{x}}$

C = $\lim_{x \to \infty} \left(\dfrac{3^x + 5^x}{2} \right)^{\frac{1}{x}}$ D = $\lim_{x \to 1} \dfrac{x^x - x}{1 - x + \ln x}$

Find (AD+C)B.

#1 Mu Bowl
MAΘ National Convention 2015

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Find (AD+C)B.

#2 Mu Bowl
MAΘ National Convention 2015

A ball is tossed into the air from a bridge and its height, *y* (in feet), above the ground *t* seconds after it is thrown is given by:

$$y = f(t) = -16t^2 + 32t + A$$

A = How high above the ground is the bridge if it takes 2 seconds for the ball to pass the bridge on the way down and 4 total seconds to hit the ground?

B = What is the average velocity, in ft/sec, of the ball for the first second?

C = What is the ball's speed, in ft/sec, when it hits the ground?

D = What is the peak height of the ball?

Find $\dfrac{C}{D - A + B}$.

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MAΘ National Convention 2015

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#3 Mu Bowl
MAΘ National Convention 2015

A rectangle has one side on the positive *x*-axis, one side on the positive *y*-axis, one vertex at the origin and one vertex on the curve $y = e^{-2x}$.

A = Find the maximum area of the rectangle

B = Find the minimum perimeter of the rectangle

Find $A \times e^{B}$.

#3 Mu Bowl
MAΘ National Convention 2015

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B = Find the minimum perimeter of the rectangle

Find $A \times e^{B}$.

#4 Mu Bowl
MAΘ National Convention 2015

If $f(x)=x^3$ and $g(x)=x^{\frac{1}{3}}$

Let A be the area of the region between $f(x)$ and $g(x)$.

Let B be the volume of the solid obtained by rotating the region between $f(x)$ and $g(x)$ about the *x*-axis.

Let C be the volume of the solid obtained by rotating the area in the first quadrant between $f(x)$ and $g(x)$ about the line $y=1$.

Find $\frac{B}{C}+A$.

#4 Mu Bowl
MAΘ National Convention 2015

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Let A be the area of the region between $f(x)$ and $g(x)$.

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Find $\frac{B}{C}+A$.

#5 Mu Bowl
MAΘ National Convention 2015

A: $\sum_{n=1}^{\infty} \frac{(n-1)!}{4^n}$

B: $\sum_{n=1}^{\infty} \frac{\sin\left(\frac{\pi n}{2}\right)}{n}$

C: $\sum_{n=1}^{\infty} \frac{1}{(\ln n)^2}$

D: $\sum_{n=1}^{\infty} (-1)^n \frac{(n+1)^n}{n^n}$

If a series converges absolutely it is assigned a value of 1.
If a series converges conditionally it is assigned a value of 0.
If a series diverges it is assigned a value of -1.

Find $A+B+C+D$.

#5 Mu Bowl
MAΘ National Convention 2015

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Find $A+B+C+D$.

#6 Mu Bowl
MAΘ National Convention 2015

Given $f(x)=2x^3+4$,

A = The positive difference between the right and left-hand Riemann sums with equal subdivisions with n = 10 approximating $\int_{-1}^{1} f(x)\,dx$.

B = The right-hand Riemann sum with n = 4 with equal subdivisions approximating $\int_{-1}^{1} f(x)\,dx$.

C = The left-Riemann sum with n = 4 with equal subdivisions approximating $\int_{-1}^{1} f(x)\,dx$.

D = The trapezoidal Riemann sum with n = 4 with equal subdivisions approximating $\int_{-1}^{1} f(x)\,dx$.

Find $\frac{A}{D}+\frac{C}{B}$ (expressed as a single reduced improper fraction).

#6 Mu Bowl
MAΘ National Convention 2015

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Find $\frac{A}{D}+\frac{C}{B}$ (expressed as a single reduced improper fraction).

#7 Mu Bowl
MAΘ National Convention 2015

At time t, the position of a particle is $x(t)=4\sin(2t)$ and $y(t)=4\cos(2t)$, with $0\le t\le 2\pi$.

A = $\frac{dy}{dx}$ when $t=\frac{p}{8}$.

B = Displacement of the particle over the given interval.

C = Total distance traveled by the particle over the given interval.

D = Speed of the particle at time $t=p$.

Find the value of $\frac{\text{C}}{\text{D}}\left(\text{B}-\text{A}\right)$.

#7 Mu Bowl
MAΘ National Convention 2015

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Find the value of $\frac{\text{C}}{\text{D}}\left(\text{B}-\text{A}\right)$.

#8 Mu Bowl
MAΘ National Convention 2015

For the function $f(x) = x^3 + 4x^2 + 5x + 20$,

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 the *y*-intercepts of f, f', and f''.

Find $\left(\frac{B}{C}\right)^{(D+8A)}$.

#8 Mu Bowl
MAΘ National Convention 2015

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C = the sum of the *x*-coordinates of the inflection points of *f*.

D = the sum of the *y*-coordinates of the *y*-intercepts of f, f', and f''.

Find $\left(\frac{B}{C}\right)^{(D+8A)}$.

#9 Mu Bowl
MAΘ National Convention 2015

Given $y = f(x)$ and the equation $x^4 - 5x^2y^2 + 4y^4 = 0$, let $g(x)$ be the tangent line to the graph of $f(x)$.

A = $f'(2)$, given that f(2)=1.

B = y-intercept of $g(x)$ at tangency point $x = 2, y = 1$

C = $f'(-2)$, given that f(-2)=-2

D = y-intercept of $g(x)$ at tangency point $x = -2, y = -2$

Find $\sqrt{2A} + B\sqrt{3} - \sqrt{C} - D\sqrt{7}$.

#9 Mu Bowl
MAΘ National Convention 2015

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B = y-intercept of $g(x)$ at tangency point $x = 2, y = 1$

C = $f'(-2)$, given that f(-2)=-2

D = y-intercept of $g(x)$ at tangency point $x = -2, y = -2$

Find $\sqrt{2A} + B\sqrt{3} - \sqrt{C} - D\sqrt{7}$.

#10 Mu Bowl
MAΘ National Convention 2015

A = $\int_{-4}^{4}(x^3+3x^2-16x-48)dx$

B = $\int_{-4}^{4}\left|x^3+3x^2-16x-48\right|dx$

Find $4A+4B$.

#10 Mu Bowl
MAΘ National Convention 2015

A = $\int_{-4}^{4}(x^3+3x^2-16x-48)dx$

B = $\int_{-4}^{4}\left|x^3+3x^2-16x-48\right|dx$

Find $4A+4B$.

#11 Mu Bowl
MAΘ National Convention 2015

Given an initial value of $y(0)=1000$ and the following equation:

$$\frac{dy}{dx}=0.5x$$

Use Euler's method to solve the following:

A = $y(2)$ using 2 equal steps (use decimal answers and round to the nearest thousandths)

B = $y(2)$ using 3 equal steps (use decimal answers and round to the nearest thousandths)

C = $y(2)$ using 4 equal steps (use decimal answers and round to the nearest thousandths)

Find the sum of A, B, and C.

#11 Mu Bowl
MAΘ National Convention 2015

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Use Euler's method to solve the following:

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C = $y(2)$ using 4 equal steps (use decimal answers and round to the nearest thousandths)

Find the sum of A, B, and C.

#12 Mu Bowl
MAΘ National Convention 2015

Find $y'(1)$ given that $y=\dfrac{(2x+7)^2(x+2)^3}{(1+2x)^4}$.

#12 Mu Bowl
MAΘ National Convention 2015

Find $y'(1)$ given that $y=\dfrac{(2x+7)^2(x+2)^3}{(1+2x)^4}$.

#13 Mu Bowl
MAΘ National Convention 2015

x	1	2	3	4
$f(x)$	2	1	4	3
$f'(x)$	4	2	3	1
$g(x)$	3	2	1	4
$g'(x)$	1	4	2	3

Given the table above, find the following:

A = $h'(4)$ if $h(x) = f(g(g(x)))$
B = $h'(4)$ if $h(x) = e^{f(x)\times g(x)}$
C = $h'(4)$ if $h(x) = \ln\left(f(x) + g(x)\right)$
D = $h'(4)$ if $h(x) = \frac{f(x)}{2g(x)}$

Find $\frac{B}{-32D + 14C} + A$.

#13 Mu Bowl
MAΘ National Convention 2015

x	1	2	3	4
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Given the table above, find the following:

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D = $h'(4)$ if $h(x) = \frac{f(x)}{2g(x)}$

Find $\frac{B}{-32D + 14C} + A$.

#14 Mu Bowl
MAΘ National Convention 2015

Sand falling at a rate of $4\ \text{ft}^3/\text{s}$ forms a conical pile whose radius is always twice its height as it continues to accumulate sand.

A = rate of change, in ft/s, of the height when the cone has a volume of $\frac{4p}{3}$.

B = rate of change of the height when the cone has a volume of $36p$.

Find $\frac{B}{A}$.

#14 Mu Bowl
MAΘ National Convention 2015

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A = rate of change, in ft/s, of the height when the cone has a volume of $\frac{4p}{3}$.

B = rate of change of the height when the cone has a volume of $36p$.

Find $\frac{B}{A}$.