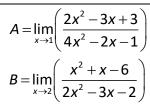
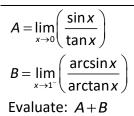
$$A = \lim_{x \to 1} \left(\frac{2x^2 - 3x + 3}{4x^2 - 2x - 1} \right)$$
$$B = \lim_{x \to 2} \left(\frac{x^2 + x - 6}{2x^2 - 3x - 2} \right)$$

Evaluate: A+B

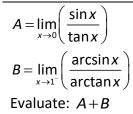
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Evaluate: A+B



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#2 Mu Bowl MA© National Convention 2018

The tangent to $y = e^x$ at the point (a, e^a) has slope a+1. The y-intercept of this tangent is (0, b), the x-intercept of this tangent is (c, 0), and the slope of a line perpendicular to this tangent has slope d. Find the value of |a|+|b|+|c|+|d|.

#2 Mu Bowl MA© National Convention 2018

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#3 Mu Bowl MA© National Convention 2018

Consider the function $f(x) = x^3 + 6x^2 - 36x + 40$. Find all values of x, written in interval notation, such that f is simultaneously positive, decreasing, and concave downward.

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#4 Mu Bowl MA© National Convention 2018

A rectangle is to be drawn so that two of its vertices lie on the x-axis while the other two vertices are above the x-axis on the parabola $y = 36 - 2x^2$. If the side length of the rectangle on the x-axis must have length from 2 to 8, inclusive, find the value of A - B, where A is the maximum area enclosed by such a rectangle and B is the minimum area enclosed by such a rectangle.

#4 Mu Bowl MA© National Convention 2018

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#5 Mu Bowl MA© National Convention 2018

Two people start walking from the same point at the same time. One walks east at 3 miles per hour while the other walks northeast at 2 miles per hour (thus the angle between their paths is 45°). If the rate of change of the distance between the people, in miles per hour, at the moment when they have been walking for 15 minutes is written in the form $\sqrt{A-B\sqrt{C}}$, where *A*, *B*, and *C* are positive integers, and *C* is not divisible by the square of any integer greater than 1, find the value of $A \cdot B + C$. (HINT: You will need to use the Law of Cosines.)

#5 Mu Bowl MA© National Convention 2018

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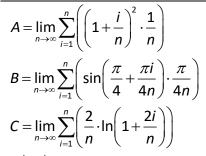
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#6 Mu Bowl MA© National Convention 2018

$$A = \lim_{n \to \infty} \sum_{i=1}^{n} \left(\left(1 + \frac{i}{n} \right)^2 \cdot \frac{1}{n} \right)$$
$$B = \lim_{n \to \infty} \sum_{i=1}^{n} \left(\sin\left(\frac{\pi}{4} + \frac{\pi i}{4n}\right) \cdot \frac{\pi}{4n} \right)$$
$$C = \lim_{n \to \infty} \sum_{i=1}^{n} \left(\frac{2}{n} \cdot \ln\left(1 + \frac{2i}{n}\right) \right)$$

If $\lfloor x \rfloor$ represents the greatest integer less than or equal to x, and if $\lceil x \rceil$ represents the least integer greater than or equal to x, find the value of $\lfloor A \rfloor + \lceil B \rceil + \lceil C \rceil$.

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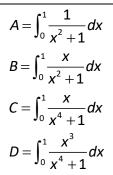
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#7 Mu Bowl MA© National Convention 2018

$$A = \int_0^1 \frac{1}{x^2 + 1} dx$$
$$B = \int_0^1 \frac{x}{x^2 + 1} dx$$
$$C = \int_0^1 \frac{x}{x^4 + 1} dx$$
$$D = \int_0^1 \frac{x^3}{x^4 + 1} dx$$

List the letters A, B, C, and D in increasing numerical order.

#7 Mu Bowl MA© National Convention 2018



List the letters A, B, C, and D in increasing numerical order.

$$A = \int_0^{4\sqrt{6}} \sin\left(\arctan\frac{x}{2}\right) dx$$
$$B\sqrt{C} + \ln\left(D + \sqrt{E}\right) = \int_0^4 \sqrt{1 + \frac{1}{2x}} dx$$

Given that *B*, *C*, *D*, and *E* are positive integers such that *C* is not divisible by the square of any integer greater than 1, find the value of $\frac{B \cdot C + D \cdot E}{A}$.

#8 Mu Bowl MA© National Convention 2018

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#9 Mu Bowl MA© National Convention 2018

Let $f(x) = \left(1 + \frac{1}{x}\right)^x$ and $g(x) = (\log 5) 10^{\log_5 x}$. $A = \lim_{x \to \infty} f(x)$ $B = \lim_{x \to \infty} f'(x)$ $g'(x) = C^{\log_5 x}$ Find the value of $C \cdot (A + B)$.

#9 Mu Bowl MA© National Convention 2018

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Find the value of $C \cdot (A+B)$.

#10 Mu Bowl MA© National Convention 2018

A sequence $\{a_n\}_{n=1}^{\infty}$ is defined recursively in the following way: $a_1 = 5$, and for integers $n \ge 2$, $a_n = 3a_{n-1} - 2$. If A is added to each term in this sequence, the sequence becomes geometric with common ratio B.

A sequence $\{b_n\}_{n=1}^{\infty}$ is defined recursively in the following way: $b_1 = 5$, $b_2 = 13$, and for integers $n \ge 3$, $b_n = 3b_{n-1} - 2b_{n-2}$. If *C* is added to each term in this sequence, the sequence becomes geometric with common ratio *D*.

Find the value of $(A+B)^{C+D}$.

#10 Mu Bowl MA© National Convention 2018

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Find the value of $(A+B)^{C+D}$.

#11 Mu Bowl MA© National Convention 2018

The function $f(x) = x^4 + 4x^3 - 48x^2 + Ax + B$ has two inflection points: one at x = C and one at x = D. If these two inflection points have the same y-value E, find the value of $A + B - C \cdot D - E$.

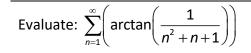
#11 Mu Bowl MA© National Convention 2018

The function $f(x) = x^4 + 4x^3 - 48x^2 + Ax + B$ has two inflection points: one at x = C and one at x = D. If these two inflection points have the same *y*-value *E*, find the value of $A + B - C \cdot D - E$.

#12 Mu Bowl MA© National Convention 2018

Evaluate:
$$\sum_{n=1}^{\infty} \left(\arctan\left(\frac{1}{n^2 + n + 1}\right) \right)$$

#12 Mu Bowl MA© National Convention 2018



#13 Mu Bowl	
MA© National Convention 2018	
Find the area enclosed by the graph of the polar equation $r + \frac{163}{r} = 16\cos\theta + 20\sin\theta$.	

#13 Mu Bowl MA© National Convention 2018

Find the area enclosed by the graph of the polar equation $r + \frac{163}{r} = 16\cos\theta + 20\sin\theta$.

 $A = \int_{\frac{\pi}{6}}^{\frac{\pi}{2}} \left(\csc x - x \csc x \cot x \right) dx$

Using the second-degree Maclaurin polynomial for $\cos(\sqrt{x})$, let *B* be the approximation of $\int_{0}^{2} \cos(\sqrt{x}) dx$.

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

#14 Mu Bowl MA© National Convention 2018

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