

#1 Calculus - Hustle
MA@ National Convention 2016

Evaluate:

$$\lim_{x \rightarrow 0} x \cot 5x$$

Answer : _____

Round 1 2 3 4 5

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#2 Calculus - Hustle
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Evaluate the following indefinite integral:

$$\int x \sec^2 x^2 dx$$

Answer : _____

Round 1 2 3 4 5

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#3 Calculus - Hustle**MA© National Convention 2016**

Find the value of ab for a, b such that the following piece-wise function is continuous and differentiable on \mathbb{R} .

$$f(x) = \begin{cases} e^{-x^2} & x \leq 1 \\ ax + b & x > 1 \end{cases}$$

Answer : _____

Round 1 2 3 4 5

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#4 Calculus - Hustle
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Evaluate:

$$\lim_{x \rightarrow 0} \frac{2 - \ln(x + e^2)}{2x}$$

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#5 Calculus - Hustle
MA \odot National Convention 2016

Use the Trapezoidal Rule with 4 uniform subdivisions to approximate the following integral:

$$\int_0^2 (2x^2 + 1)dx$$

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Round 1 2 3 4 5

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#6 Calculus - Hustle

MA \odot National Convention 2016

For some odd function $f(x)$, we know

$\int_0^4 f(x)dx = 10$ and $\int_{-2}^0 f(x)dx = -4$. Find the value of $\int_{-4}^{-2} f(x)dx$.

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#7 Calculus - Hustle

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The position of some particle in the coordinate plane at time t is given by $x(t) = \ln(t)$ and $y(t) = e^{t^2}$. Find the particle's tangential velocity at $t = 2$.

Answer : _____

Round 1 2 3 4 5

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#8 Calculus - Hustle
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Let $h(x) = \frac{f(g(x))}{f(x)}$ where f and g are defined below. Find $h'(1)$.

x	1	2	3
$f(x)$	3	0	1
$g(x)$	2	2	0
$f'(x)$	1	1	2
$g'(x)$	2	3	1

Answer : _____

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#9 Calculus - Hustle

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Use the linear approximation of $f(x) = \sqrt[4]{x}$ at $x = 81$ to approximate the value of $\sqrt[4]{75}$.

Answer : _____

Round 1 2 3 4 5

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Round 1 2 3 4 5

#10 Calculus – Hustle
MA[©] National Convention 2016

I pull apart opposite edges of a cube so that the length of its diagonal increases at a rate of 3cm/s. At what rate, in cm/s, does its surface area increase when the diagonal has length 3? (Assume that the solid maintains its cube shape).

Answer : _____

Round 1 2 3 4 5

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#11 Calculus – Hustle
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Find the value(s) guaranteed by the Mean Value Theorem for derivatives for the function $f(x) = x^3 - x$ on the interval $[0, 2]$.

Answer : _____

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Answer : _____

Round 1 2 3 4 5

#12 Calculus – Hustle
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Evaluate:

$$\lim_{x \rightarrow -\infty} \frac{\sqrt{x^2 + 4x + 4}}{2x + 4}$$

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#13 Calculus - Hustle
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Find the value of $f'(2)$ given that $f(x) = x^{x^2}$

Answer : _____

Round 1 2 3 4 5

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#14 Calculus – Hustle
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The growth of a population P is governed by the differential equation $\frac{dP}{dt} = kP(2000 - 5P)$. Find the value of $\lim_{t \rightarrow \infty} P(t)$.

Answer : _____

Round 1 2 3 4 5

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#15 Calculus - Hustle
MA@ National Convention 2016

$f(x) = x^3 - 3x^2 + x + 1$. Find the derivative of $f^{-1}(x)$ at the point $(4, f^{-1}(4))$.

Answer : _____

Round 1 2 3 4 5

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#16 Calculus – Hustle
MA@ National Convention 2016

Solve the integral:

$$\int_0^1 \frac{x^2}{1+x^2} dx$$

Answer : _____

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#17 Calculus – Hustle
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A curve in the coordinate plane is described parametrically by $x(t) = t^3 + 1$ and $y(t) = 2t^2$. Find the length of the curve between $(1, 0)$ and $(2, 2)$.

Answer : _____

Round 1 2 3 4 5

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#18 Calculus - Hustle
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Find $f'(2)$ given

$$f(x) = \frac{(x+3)^2(x+1)}{(x-3)^2(x-1)}$$

Answer : _____

Round 1 2 3 4 5

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Round 1 2 3 4 5

#19 Calculus – Hustle
MA@ National Convention 2016

Find the area enclosed by the curves $f(x) = x$
and $g(x) = x^5$.

Answer : _____

Round 1 2 3 4 5

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#20 Calculus - Hustle
MA@ National Convention 2016

Find $\lim_{x \rightarrow \infty} f'(x)$ where

$$f(x) = \left(1 + \frac{1}{x}\right)^x$$

Answer : _____

Round 1 2 3 4 5

#20 Calculus - Hustle
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#21 Calculus – Hustle
MA[©] National Convention 2016

A radioactive substance decays at a rate directly proportional to the amount of the substance present. Initially there are 10g and there are 7.5g after an hour. What is the substance's half-life (in hours)?

Answer : _____

Round 1 2 3 4 5

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Answer : _____

Round 1 2 3 4 5

#22 Calculus – Hustle
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Find the volume for the solid formed by rotating the first-quadrant portion of $f(x) = e^{-x}$ around the x axis.

Answer : _____

Round 1 2 3 4 5

#22 Calculus – Hustle
MA@ National Convention 2016

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#23 Calculus – Hustle
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Find the maximum of the profit function $P(x) = 10\sqrt{x} - x/3$ where x is the number of people that visit a shop per hour. Note that the capacity of the shop is 200 people/hour.

Answer : _____

Round 1 2 3 4 5

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#24 Calculus - Hustle
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Evaluate:

$$\lim_{n \rightarrow \infty} \sum_{i=1}^n \frac{n}{n^2 + 3i^2}$$

Answer : _____

Round 1 2 3 4 5

#24 Calculus - Hustle
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#25 Calculus - Hustle
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Find $F'(\pi/6)$ given

$$F(x) = \int_{\cos x}^{\sin x} (1 - t^2) dt$$

Answer : _____

Round 1 2 3 4 5

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