#1 Calculus - Hustle MA⊕ National Convention 2024

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Evaluate:

$$\lim_{x \to \infty} \left(\sqrt{x^2 + 6x + 8} - \sqrt{x^2 + 8x + 6} \right)$$

Evaluate:

$$\lim_{x \to \infty} \left(\sqrt{x^2 + 6x + 8} - \sqrt{x^2 + 8x + 6} \right)$$

Answer : ______

Round 1 2 3 4 5

Answer : _____

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Answer : _____

Answer : _____

Round 1 2 3 4 5

#2 Calculus – Hustle MA⊕ National Convention 2024

Find the nonzero coordinate of the *y*-intercept of the line normal to the curve

$$y = \frac{x^4}{2} - \frac{2x^3}{3} + 4x - 5$$
 at $x = 1$.

Round 1 2 3 4 5

Answer : _____

#2 Calculus - Hustle MA® National Convention 2024

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$$y = \frac{x^4}{2} - \frac{2x^3}{3} + 4x - 5$$
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Round 1 2 3 4 5

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 at $x = 1$.

Answer : _____

Answer : _____

Round 1 2 3 4 5 Round 1 2 3 4 5

#3 Calculus - Hustle	
MA© National Convention	2024

#3 Calculus – Hustle MA⊕ National Convention 2024

Find the slope of the tangent line to the curve $2x^2y + 3x^3y^2 - x = 7$ at the point (1, -2).

Find the slope of the tangent line to the curve $2x^2y + 3x^3y^2 - x = 7$ at the point (1, -2).

Answer : _____

Round 1 2 3 4 5

#3 Calculus - Hustle MA⊕ National Convention 2024

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Answer : _____

Round 1 2 3 4 5

#3 Calculus – Hustle MA⊕ National Convention 2024

Find the slope of the tangent line to the curve $2x^2y + 3x^3y^2 - x = 7$ at the point (1, -2).

Answer : _____

Round 1 2 3 4 5

Answer : _____

#4 Calculus - Hustle MA⊕ National Convention 2024

#4 Calculus – Hustle MA⊕ National Convention 2024

Evaluate:

$$\sum_{n=2}^{10} \frac{1}{n^2 - n}$$

Evaluate:

$$\sum_{n=2}^{10} \frac{1}{n^2 - n}$$

Answer : _____

Round 1 2 3 4 5

#4 Calculus - Hustle MA⊕ National Convention 2024

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Answer : _____

Round 1 2 3 4 5

#4 Calculus – Hustle MA® National Convention 2024

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Answer : _____

Round 1 2 3 4 5

Answer : _____

#5 Calculus – Hustle MA⊕ National Convention 2024

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Evaluate:

$$\int_0^1 x^2 \sqrt{1-x} \, dx$$

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Answer : _____

Round 1 2 3 4 5

#5 Calculus – Hustle MA⊕ National Convention 2024

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Answer : _____

Round 1 2 3 4 5

#5 Calculus - Hustle MA⊕ National Convention 2024

Evaluate:

$$\int_0^1 x^2 \sqrt{1-x} \, dx$$

Answer : _____

Round 1 2 3 4 5

Answer : _____

#6 Calculus – Hustle MA⊕ National Convention 2024

If a particular solution to

$$x^2 \frac{dy}{dx} + \frac{y-2}{x^3} = 0$$

contains the points (1,1) and $\left(\frac{1}{\sqrt{2}}, n\right)$, find n.

Answer	:	
--------	---	--

Round 1 2 3 4 5

#6 Calculus - Hustle MA⊕ National Convention 2024

If a particular solution to

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Answer : _____

Round 1 2 3 4 5

Answer : _____

#7 Calculus – Hustle MA⊕ National Convention 2024

#7 Calculus – Hustle MA⊕ National Convention 2024

Evaluate:

$$\lim_{x \to 1} \frac{x^3 + 5x^2 + x - 7}{x^4 - 3x^3 + x^2 + 15x - 14}$$

Evaluate:

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Round 1 2 3 4 5

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Round 1 2 3 4 5

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Answer : _____

Round 1 2 3 4 5

Answer : _____

#8 Calculus - Hustle MA⊚ National Convention 2024

#8 Calculus - Hustle MA⊕ National Convention 2024

Evaluate:

$$\sin\left(\int_3^4 \frac{dx}{\sqrt{25-x^2}}\right)$$

Evaluate:

$$\sin\left(\int_3^4 \frac{dx}{\sqrt{25-x^2}}\right)$$

Answer : _____

Round 1 2 3 4 5

Answer : _____

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#8 Calculus - Hustle MA⊚ National Convention 2024

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Evaluate:

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Answer : _____

Answer : _____

Round 1 2 3 4 5

#9 Calculus - Hustle MA⊕ National Convention 2024

Find the cosine of the acute angle formed by the intersection of $y = x^3 - x - 4$ and its reflection over the line y = x.

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Round 1 2 3 4 5

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Answer : _____

Round 1 2 3 4 5

Answer : _____

#10 Calculus – Hustle MA⊕ National Convention 2024

Find the sum of the integers in the interval of convergence for the series

$$\sum_{n=1}^{\infty} \frac{(x+3)^n}{n5^{n-1}}$$

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Allswer	:	

Round 1 2 3 4 5

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Round 1 2 3 4 5

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Answer : _____

Round 1 2 3 4 5

Answer : _____

#11 Calculus – Hustle MA® National Convention 2024

Find the area above the x-axis and under the parametric curve given by

$$x = t - \sin t$$

$$y = 1 - \cos t$$

for $0 \le t \le 2\pi$.

#11 Calculus - Hustle MA⊕ National Convention 2024

Find the area above the x-axis and under the parametric curve given by

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Answer : ______

Round 1 2 3 4 5

Answer : _____

#12 Calculus – Hustle MA® National Convention 2024

The amount of water per minute dripping out of an inverted conical container with base radius 4 and height 12 is 4π units cubed per minute. When the height of the water is 4, find the number of units per minute that the height of the water is decreasing.

#12 Calculus - Hustle MA⊕ National Convention 2024

The amount of water per minute dripping out of an inverted conical container with base radius 4 and height 12 is 4π units cubed per minute. When the height of the water is 4, find the number of units per minute that the height of the water is decreasing.

A	
Answer	

Round 1 2 3 4 5

#12 Calculus - Hustle MA⊕ National Convention 2024

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Answer : _____

Round 1 2 3 4 5

#12 Calculus - Hustle MA⊕ National Convention 2024

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Answer : ______

Round 1 2 3 4 5

Answer : _____

#13 Calculus – Hustle MA⊕ National Convention 2024

Determine the coefficient of the x^3 term in the Maclaurin series expansion of $\frac{7}{x-1} + 24 \cos \sqrt{x}$.

#13 Calculus - Hustle MA⊕ National Convention 2024

Determine the coefficient of the x^3 term in the Maclaurin series expansion of $\frac{7}{x-1} + 24 \cos \sqrt{x}$.

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#13 Calculus – Hustle MA⊚ National Convention 2024

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Round 1 2 3 4 5

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Determine the coefficient of the x^3 term in the Maclaurin series expansion of $\frac{7}{x-1} + 24 \cos \sqrt{x}$.

Answer : _____

Round 1 2 3 4 5

Answer : _____

#14 Calculus – Hustle MA⊕ National Convention 2024

The circle given by $x^2 + y^2 - 4x - 4y - 7 = 0$ is rotated about the line 4x + 3y + 6 = 0. Find the volume of the solid formed.

#14 Calculus – Hustle MA⊕ National Convention 2024

The circle given by $x^2 + y^2 - 4x - 4y - 7 = 0$ is rotated about the line 4x + 3y + 6 = 0. Find the volume of the solid formed.

Answer : ______

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Round 1 2 3 4 5

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Answer : _____

Round 1 2 3 4 5

Answer : _____

#15 Calculus – Hustle MA⊕ National Convention 2024

Gwen and Rachel want to enclose 5 identical rectangular regions for their pet greyhounds with 60 meters of fence (see below diagram). What is the maximum area for one of the 5 regions ?	Gwen and Rachel want to enclose 5 identical rectangular regions for their pet greyhounds with 60 meters of fence (see below diagram). What is the maximum area for one of the 5 regions ?			
Answer :	Answer :			
Round 1 2 3 4 5	Round 1 2 3 4 5			
#15 Calculus – Hustle MA⊕ National Convention 2024	#15 Calculus – Hustle MA⊕ National Convention 2024			
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Answer : _____

Answer : _____

Round 1 2 3 4 5

Round 1 2 3 4 5

#15 Calculus - Hustle

MA® National Convention 2024

#16 Calculus - Hustle MA⊚ National Convention 2024

#16 Calculus - Hustle MA⊕ National Convention 2024

Evaluate:

$$\left(\sum_{n=0}^{\infty} \frac{(-1/3)^n}{2n+1}\right)^2$$

Evaluate:

$$\left(\sum_{n=0}^{\infty} \frac{(-1/3)^n}{2n+1}\right)^2$$

Answer : _____

Round 1 2 3 4 5

Answer : _____

Round 1 2 3 4 5

#16 Calculus – Hustle MA⊕ National Convention 2024

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Answer : _____

Answer : _____

Round 1 2 3 4 5

#17 Calculus - Hustle MA⊕ National Convention 2024

#17 Calculus - Hustle MA⊕ National Convention 2024

Evaluate:

$$\int_3^7 \frac{\ln(x-2)}{\ln(10x-x^2-16)} \ dx$$

Evaluate:

$$\int_{3}^{7} \frac{\ln(x-2)}{\ln(10x-x^2-16)} \ dx$$

Answer : _____

Round 1 2 3 4 5

Answer : _____

Round 1 2 3 4 5

#17 Calculus - Hustle MA⊕ National Convention 2024

#17 Calculus - Hustle MA© National Convention 2024

Evaluate:

$$\int_{3}^{7} \frac{\ln(x-2)}{\ln(10x-x^2-16)} \ dx$$

Evaluate:

$$\int_{3}^{7} \frac{\ln(x-2)}{\ln(10x-x^2-16)} \ dx$$

Answer : _____

Answer : ______

Round 1 2 3 4 5

#18 Calculus - Hustle MA⊕ National Convention 2024

Find the volume of the figure formed by rotating the region between y = x + 6 and the x-axis between x = 1 and x = 4 over the line y = -1.

#18 Calculus - Hustle MA⊕ National Convention 2024

Find the volume of the figure formed by rotating the region between y = x + 6 and the x-axis between x = 1 and x = 4 over the line y = -1.

Answer : _____

Round 1 2 3 4 5

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Answer : _____

Round 1 2 3 4 5

#18 Calculus - Hustle MA⊕ National Convention 2024

Find the volume of the figure formed by rotating the region between y = x + 6 and the x-axis between x = 1 and x = 4 over the line y = -1.

Answer : _____

Round 1 2 3 4 5

Answer : _____

#19 Calculus - Hustle MA⊚ National Convention 2024

Find the sum of the values of x that satisfy the Mean Value Theorem for Derivatives for the function $y = x^3 - 6x - 9$ over the range [-3,3].

#19 Calculus - Hustle MA⊚ National Convention 2024

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Answer : _____

Round 1 2 3 4 5

#19 Calculus - Hustle MA⊚ National Convention 2024

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Answer : _____

Round 1 2 3 4 5

#19 Calculus - Hustle MA⊕ National Convention 2024

Find the sum of the values of x that satisfy the Mean Value Theorem for Derivatives for the function $y = x^3 - 6x - 9$ over the range [-3,3].

Answer : _____

Round 1 2 3 4 5

Answer:____

Which is greater? (Give your answer as A or B)

A)
$$\frac{1}{2022} + \frac{6}{2024} + \frac{1}{2026}$$

B)
$$\frac{4}{2023} + \frac{4}{2025}$$

Which is greater? (Give your answer as A or B)

A)
$$\frac{1}{2022} + \frac{6}{2024} + \frac{1}{2026}$$

$$B) \; \frac{4}{2023} + \frac{4}{2025}$$

Answer : _____

Round 1 2 3 4 5

Answer : _____

Round 1 2 3 4 5

#20 Calculus - Hustle MA⊕ National Convention 2024

Which is greater? (Give your answer as A or B)

A)
$$\frac{1}{2022} + \frac{6}{2024} + \frac{1}{2026}$$

B)
$$\frac{4}{2023} + \frac{4}{2025}$$

#20 Calculus - Hustle MA⊕ National Convention 2024

Which is greater? (Give your answer as A or B)

A)
$$\frac{1}{2022} + \frac{6}{2024} + \frac{1}{2026}$$

B)
$$\frac{4}{2023} + \frac{4}{2025}$$

Answer : _____

Round 1 2 3 4 5

Answer : _____

#21 Calculus - Hustle MA® National Convention 2024

#21 Calculus - Hustle MA⊕ National Convention 2024

Evaluate:

$$\lim_{n \to \infty} \sum_{i=0}^{n-1} \frac{16i}{n^2} \sqrt{16 - \left(\frac{4i}{n}\right)^2}$$

Evaluate:

$$\lim_{n \to \infty} \sum_{i=0}^{n-1} \frac{16i}{n^2} \sqrt{16 - \left(\frac{4i}{n}\right)^2}$$

Answer : _____

Round 1 2 3 4 5

Answer : _____

Round 1 2 3 4 5

#21 Calculus - Hustle

MA® National Convention 2024

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Evaluate:

$$\lim_{n \to \infty} \sum_{i=0}^{n-1} \frac{16i}{n^2} \sqrt{16 - \left(\frac{4i}{n}\right)^2}$$

Answer : _____

Round 1 2 3 4 5

Answer : _____

#22 Calculus - Hustle	
MA® National Convention 2	2024

Find the length of the arc given by $r = 2e^{2\theta}$ between $\theta = \ln \pi$ and $\theta = \ln(2\pi)$.

#22 Calculus - Hustle MA⊕ National Convention 2024

Find the length of the arc given by $r = 2e^{2\theta}$ between $\theta = \ln \pi$ and $\theta = \ln(2\pi)$.

Answer : _____

Round 1 2 3 4 5

#22 Calculus - Hustle MA⊕ National Convention 2024

Find the length of the arc given by $r = 2e^{2\theta}$ between $\theta = \ln \pi$ and $\theta = \ln(2\pi)$.

Answer : _____

Round 1 2 3 4 5

#22 Calculus - Hustle MA® National Convention 2024

Find the length of the arc given by $r = 2e^{2\theta}$ between $\theta = \ln \pi$ and $\theta = \ln(2\pi)$.

Answer : _____

Round 1 2 3 4 5

Answer : _____

#23 Calculus - Hustle	
MA@ National Convention	2024

#23 Calculus – Hustle MA® National Convention 2024

$$\int_0^{\arcsin(\pi/6)} e^{\sin(\sin x)} \sin(2\sin x) \cos x \ dx$$

$$\int_0^{\arcsin(\pi/6)} e^{\sin(\sin x)} \sin(2\sin x) \cos x \ dx$$

Answer : _____

Round 1 2 3 4 5

Answer : ______

Round 1 2 3 4 5

#23 Calculus – Hustle MA⊕ National Convention 2024

#23 Calculus - Hustle MA© National Convention 2024

Evaluate:

$$\int_0^{\arcsin(\pi/6)} e^{\sin(\sin x)} \sin(2\sin x) \cos x \ dx$$

Evaluate:

$$\int_0^{\arcsin(\pi/6)} e^{\sin(\sin x)} \sin(2\sin x) \cos x \ dx$$

Answer : _____

Answer : ______

Round 1 2 3 4 5

#24 Calculus - Hustle MA⊚ National Convention 2024

a, b, and c are positive integers such that the function

$$f(x) = \begin{cases} ax^2 + bx + c, & x < 1 \\ 2cx^2 - 3ax + 2b, & x \ge 1 \end{cases}$$

is differentiable everywhere. If 5c - 3a = 30, find a + b + c.

Answer : ______

Round 1 2 3 4 5

#24 Calculus - Hustle MA⊕ National Convention 2024

a, b, and c are positive integers such that the function

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Round 1 2 3 4 5

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$$f(x) = \begin{cases} ax^2 + bx + c, & x < 1\\ 2cx^2 - 3ax + 2b, & x \ge 1 \end{cases}$$

is differentiable everywhere. If 5c - 3a = 30, find a + b + c.

Answer : _____

Round 1 2 3 4 5

Answer : _____

#25 Calculus – Hustle	
MAO National Convention	2024

Given that $\int_a^b 2x \ dx = 2023$ for positive integers a and b, find the minimum possible value of a.

#25 Calculus – Hustle MA⊕ National Convention 2024

Given that $\int_a^b 2x \ dx = 2023$ for positive integers a and b, find the minimum possible value of a.

Answer : _____

Round 1 2 3 4 5

#25 Calculus - Hustle MA® National Convention 2024

Given that $\int_a^b 2x \ dx = 2023$ for positive integers a and b, find the minimum possible value of a.

Answer : _____

Round 1 2 3 4 5

#25 Calculus – Hustle MA⊕ National Convention 2024

Given that $\int_a^b 2x \ dx = 2023$ for positive integers a and b, find the minimum possible value of a.

Answer : _____

Answer : _____

Round 1 2 3 4 5