

**#1 Calculus – Hustle**  
**MAΘ National Convention 2026**

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Evaluate:  $\int_0^1 \frac{x^3}{x^2+1} dx$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

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**#2 Calculus – Hustle**  
**MAΘ National Convention 2026**

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Let  $f(y) = \frac{1}{y^2} - 2$ . Using two iterations of Newton's Method to approximately solve the equation  $f(y) = 0$  with an initial guess of  $y_0 = 1$ , we approximate  $\frac{1}{\sqrt{2}}$  as a rational number of the form  $\frac{a}{2^b}$ , where  $a$  and  $b$  are positive integers with  $b$  as small as possible. Compute the value of  $a + b$ .

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#2 Calculus – Hustle**  
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Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#3 Calculus – Hustle**  
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Find the area enclosed by the parametric curve  
 $x = \sin t$  ,  $y = t \sin t$  for  $t$ -values in the interval  
 $[0, \pi]$ .

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#3 Calculus – Hustle**  
**MAΘ National Convention 2026**

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Round 1 2 3 4 5

**#4 Calculus – Hustle**  
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Find the slope of the line  $L$  through the point  $(2,3)$  such that  $L$ , the  $x$ -axis, and the  $y$ -axis bound a triangular region in the first quadrant with the smallest possible area.

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#4 Calculus – Hustle**  
**MA© National Convention 2026**

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Round 1 2 3 4 5

**#5 Calculus – Hustle**  
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Compute the sum of the  $x$ -coordinates of all inflection points of the function

$$f(x) = 6x^5 - 35x^4 + 70x^3 - 60x^2.$$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#5 Calculus – Hustle**  
**MAΘ National Convention 2026**

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Round 1 2 3 4 5

**#6 Calculus – Hustle**  
**MAΘ National Convention 2026**

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Evaluate:  $\int_{-\infty}^{\infty} \left( |x|^3 e^{-x^2} \right) dx$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#6 Calculus – Hustle**  
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Round 1 2 3 4 5

**#7 Calculus – Hustle**  
**MAΘ National Convention 2026**

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Let  $I = \int_0^{\frac{\pi}{2}} \sin(x - \cos x) dx$  and

$J = \int_0^{\frac{\pi}{2}} (\sin(\cos x) \cos x) dx$ . Find the value of  $I + J$ .

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#7 Calculus – Hustle**  
**MAΘ National Convention 2026**

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Round 1 2 3 4 5

**#8 Calculus – Hustle**  
**MA© National Convention 2026**

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A spherical bubble is being inflated at a constant rate of one liter per minute. When the bubble contains eight liters of air, how fast is its surface area changing, in square liters per minute?

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#8 Calculus – Hustle**  
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Round 1 2 3 4 5

**#9 Calculus – Hustle**  
**MAΘ National Convention 2026**

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Let  $y = f(t)$  be a solution to the differential equation  $\frac{dy}{dt} = y(10 - 3y)$ . Determine the value of  $\lim_{t \rightarrow \infty} f(t)$ .

Answer : \_\_\_\_\_

Round 1 2 3 4 5

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Round 1 2 3 4 5

**#10 Calculus – Hustle**  
**MAΘ National Convention 2026**

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Let  $a_n = \sum_{i=1}^n \left( e^{-\frac{i}{n}} \right)$ . Compute the value of

$$\lim_{n \rightarrow \infty} \left( \frac{a_n}{n} \right).$$

**Answer :** \_\_\_\_\_

**Round 1 2 3 4 5**

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**Round 1 2 3 4 5**

**#11 Calculus – Hustle**  
**MAΘ National Convention 2026**

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Evaluate:

$$\int_{-1}^1 \left( \frac{x^{2023} \sin^2(2026x) \cos(2026x)}{x^{2026} + 2026} \right) dx$$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#11 Calculus – Hustle**  
**MAΘ National Convention 2026**

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Round 1 2 3 4 5

**#12 Calculus – Hustle**  
**MAΘ National Convention 2026**

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Define  $\{x\} = x - \lfloor x \rfloor$ , where  $\lfloor x \rfloor$  is the greatest integer less than or equal to  $x$ . Find the value of  $\int_{-1}^1 (x\{x\}^2) dx$ .

Answer : \_\_\_\_\_

Round 1 2 3 4 5

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Round 1 2 3 4 5

**#13 Calculus – Hustle**  
**MAΘ National Convention 2026**

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Compute  $(f \circ g \circ h \circ k)'(2)$ , where the derivative is taken with respect to  $x$ , with  $f(x) = \cos(\operatorname{Arcsin} x)$ ,  $g(x) = \tan(\operatorname{Arccos} x)$ ,  $h(x) = \sin(\operatorname{Arctan} x)$ , and  $k(x) = x^2$ .

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#13 Calculus – Hustle**  
**MAΘ National Convention 2026**

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Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#14 Calculus – Hustle**  
**MAΘ National Convention 2026**

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Evaluate:  $\frac{\int_0^{\infty} (x^{-\ln x}) dx}{\int_{-\infty}^{\infty} (e^{-x^2}) dx}$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#14 Calculus – Hustle**  
**MAΘ National Convention 2026**

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**MAΘ National Convention 2026**

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Round 1 2 3 4 5

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**MAΘ National Convention 2026**

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Round 1 2 3 4 5

**#15 Calculus – Hustle**  
**MAΘ National Convention 2026**

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For real number  $\alpha$ , the polar curves with equations  $r = 3\alpha \csc \theta$ ,  $r = 5\alpha \sec \theta$ ,  $r = -\alpha \sec \theta$ , and  $r = -2\alpha \csc \theta$  enclose a bounded region with area  $A_\alpha$ . Compute the average value of  $A_\alpha$  over  $\alpha \in [-1, 1]$ .

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#15 Calculus – Hustle**  
**MAΘ National Convention 2026**

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Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#16 Calculus – Hustle**  
**MAΘ National Convention 2026**

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Let  $u = f(x)$  be a  $C^2$  solution to the differential equation  $\frac{d^2u}{dx^2} = 1 + u^2$  such that

$$f(0) = \left. \frac{df}{dx} \right|_{x=0} = 0. \text{ Compute the sum of the first}$$

two nonzero coefficients in the Maclaurin series for  $f(x)$ , where terms are written in order of increasing  $x$ -exponent.

**Answer :** \_\_\_\_\_

**Round 1 2 3 4 5**

**#16 Calculus – Hustle**  
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**Round 1 2 3 4 5**

**#17 Calculus – Hustle**  
**MAΘ National Convention 2026**

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Evaluate:  $\int_{-\infty}^{\ln 2} e^{x+e^x} dx$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#17 Calculus – Hustle**  
**MAΘ National Convention 2026**

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Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#18 Calculus – Hustle**  
**MA© National Convention 2026**

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Find the equation, in slope-intercept form, of the tangent line to the function  $f(x) = 3x^3 + 2x^2 + x$  at the point where  $x = 1$ .

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#18 Calculus – Hustle**  
**MA© National Convention 2026**

---

Find the equation, in slope-intercept form, of the tangent line to the function  $f(x) = 3x^3 + 2x^2 + x$  at the point where  $x = 1$ .

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#18 Calculus – Hustle**  
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Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#19 Calculus – Hustle**  
**MA® National Convention 2026**

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A typical cola can is in the shape of a closed cylinder with volume 12. Determine the radius of the base that minimizes the amount of material used to construct the can.

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#19 Calculus – Hustle**  
**MA® National Convention 2026**

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Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#19 Calculus – Hustle**  
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Round 1 2 3 4 5

**#19 Calculus – Hustle**  
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Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#20 Calculus – Hustle**  
**MAΘ National Convention 2026**

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The point on the line with equation  $5x + 8y = 10$  that is closest to the origin has  $x$ -coordinate of the form  $\frac{a}{b}$ , where  $a$  and  $b$  are relatively prime positive integers. Find the value of  $b - a$ .

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#20 Calculus – Hustle**  
**MAΘ National Convention 2026**

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Round 1 2 3 4 5

**#20 Calculus – Hustle**  
**MAΘ National Convention 2026**

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Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#20 Calculus – Hustle**  
**MAΘ National Convention 2026**

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Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#21 Calculus – Hustle**  
**MAΘ National Convention 2026**

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A smooth function  $\theta = f(t)$ , modeling the angle of a pendulum on planet Blearth, satisfies the nonlinear differential equation  $\frac{d^2\theta}{dt^2} = -\cos\theta$ , where  $f(0) = \frac{\pi}{3}$  and  $f'(0) = 0$ . Evaluate  $\frac{1}{2}(f'(1))^2 + \sin(f(1))$ .

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#21 Calculus – Hustle**  
**MAΘ National Convention 2026**

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Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#21 Calculus – Hustle**  
**MAΘ National Convention 2026**

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Round 1 2 3 4 5

**#21 Calculus – Hustle**  
**MAΘ National Convention 2026**

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Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#22 Calculus – Hustle**  
**MAΘ National Convention 2026**

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Evaluate:  $\lim_{x \rightarrow 0} \left( \frac{2x}{3x + 4\sin(5x)} \right)$

**Answer :** \_\_\_\_\_

**Round 1 2 3 4 5**

**#22 Calculus – Hustle**  
**MAΘ National Convention 2026**

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Evaluate:  $\lim_{x \rightarrow 0} \left( \frac{2x}{3x + 4\sin(5x)} \right)$

**Answer :** \_\_\_\_\_

**Round 1 2 3 4 5**

**#22 Calculus – Hustle**  
**MAΘ National Convention 2026**

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Evaluate:  $\lim_{x \rightarrow 0} \left( \frac{2x}{3x + 4\sin(5x)} \right)$

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**Round 1 2 3 4 5**

**#22 Calculus – Hustle**  
**MAΘ National Convention 2026**

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Evaluate:  $\lim_{x \rightarrow 0} \left( \frac{2x}{3x + 4\sin(5x)} \right)$

**Answer :** \_\_\_\_\_

**Round 1 2 3 4 5**

**#23 Calculus – Hustle**  
**MAΘ National Convention 2026**

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Evaluate:  $\int_0^1 \left( x^7 (\ln x)^2 \right) dx$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#23 Calculus – Hustle**  
**MAΘ National Convention 2026**

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Evaluate:  $\int_0^1 \left( x^7 (\ln x)^2 \right) dx$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#23 Calculus – Hustle**  
**MAΘ National Convention 2026**

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Evaluate:  $\int_0^1 \left( x^7 (\ln x)^2 \right) dx$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#23 Calculus – Hustle**  
**MAΘ National Convention 2026**

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Evaluate:  $\int_0^1 \left( x^7 (\ln x)^2 \right) dx$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#24 Calculus – Hustle**  
**MA© National Convention 2026**

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Determine the area of the surface obtained by revolving the parametric curve with equations

$$x = \cos t, \quad y = \sin t, \quad \text{for } 0 \leq t \leq \frac{\pi}{2}, \text{ about the } x\text{-axis.}$$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#24 Calculus – Hustle**  
**MA© National Convention 2026**

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Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#24 Calculus – Hustle**  
**MA© National Convention 2026**

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Round 1 2 3 4 5

**#24 Calculus – Hustle**  
**MA© National Convention 2026**

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Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#25 Calculus – Hustle**  
**MAΘ National Convention 2026**

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Evaluate:  $\lim_{h \rightarrow 0} \left( \frac{2026^{2026^h} - 2026}{h} \right)$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#25 Calculus – Hustle**  
**MAΘ National Convention 2026**

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Evaluate:  $\lim_{h \rightarrow 0} \left( \frac{2026^{2026^h} - 2026}{h} \right)$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#25 Calculus – Hustle**  
**MAΘ National Convention 2026**

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Evaluate:  $\lim_{h \rightarrow 0} \left( \frac{2026^{2026^h} - 2026}{h} \right)$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

**#25 Calculus – Hustle**  
**MAΘ National Convention 2026**

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Evaluate:  $\lim_{h \rightarrow 0} \left( \frac{2026^{2026^h} - 2026}{h} \right)$

Answer : \_\_\_\_\_

Round 1 2 3 4 5

