#1 Calculus – Hustle
MAΘ National Convention 2010

$f'(x) = 6x^2 - 3x - 1$ gives the derivative of f for all real values of x. What is the least integer value of x for which the graph of $y = f(x)$ is concave up?

Answer : _____

Round 1 2 3 4 5

#2 Calculus – Hustle
MAΘ National Convention 2010

Evaluate $\int_0^{\pi/4} \left(\frac{\sec^2 x}{\cot x} \right) dx$.

Answer : _____

Round 1 2 3 4 5

#3 Calculus – Hustle
MAΘ National Convention 2010

For $f(x) = \sqrt{x^2 - 2x + 1}$ give the value of $f'(0)$.

Answer : _____

Round 1 2 3 4 5

#4 Calculus – Hustle
MAΘ National Convention 2010

Evaluate for $x = -2$:

$$\lim_{h \to 0} \frac{2(x+h)^2 + 3(x+h) - 2x^2}{h}$$

Answer : _____

Round 1 2 3 4 5

#5 Calculus – Hustle
MAΘ National Convention 2010

The complete interval for which the graph of $f(x) = x^2 e^{2x}$ is decreasing is (a,b). Give the value of a.

Answer : _____

Round 1 2 3 4 5

#6 Calculus – Hustle
MAΘ National Convention 2010

A particle is traveling along the curve $y = 4x^2$, and at a particular point on this curve $\frac{dx}{dt} = 4\frac{dy}{dt}$. If $\frac{dx}{dt}\frac{dy}{dt} \neq 0$ then give the x-coordinate of this point.

Answer : _____

Round 1 2 3 4 5

#7 Calculus – Hustle
MAΘ National Convention 2010

For the function over the domain [0, 3], $f(x) = \sqrt{9 - x^2}$, $g(x) = f^{-1}(x)$. Find value of $g'(x)$ at the point $(1, 2\sqrt{2})$ on the graph of g.

Answer : _____

Round 1 2 3 4 5

#8 Calculus – Hustle
MAΘ National Convention 2010

$f(x) = 2(g(x))^2$ and for differentiable functions f and g, $g(2) = 4$ and $g'(2) = 3$. Find the value of $f'(2)$.

Answer : _____

Round 1 2 3 4 5

#9 Calculus – Hustle
MAΘ National Convention 2010

Given $f'(x) = 3x^2 + 3x - 6$, the graph of f is decreasing at a decreasing rate over a certain interval of x. Give <u>one</u> integer value of x in that interval.

Answer : _____

Round 1 2 3 4 5

#10 Calculus – Hustle
MAΘ National Convention 2010

The average value of $f(x) = -\frac{3}{2}x + k$ over the interval [0, 6] is $-\frac{1}{2}$. Give the value of k.

Answer : _____

Round 1 2 3 4 5

#11 Calculus – Hustle
MAΘ National Convention 2010

The function $f(x) = \begin{cases} ax^2 + 3x + b & for\ \ x \geq 1 \\ 2ax - bx & for\ \ x < 1 \end{cases}$ is continuous and differentiable for all real numbers. What is the value of $|a + b|$?

Answer : _____

Round 1 2 3 4 5

#12 Calculus – Hustle
MAΘ National Convention 2010

Give the area in quadrant I bounded by the graphs of $y = e^x$, $y = e$ and the y-axis.

Answer : _____

Round 1 2 3 4 5

#13 Calculus – Hustle
MAΘ National Convention 2010

For the differential equation $\frac{dy}{dx} = \frac{1}{y}$, the particular solution $y = f(x)$ contains the point $(-1, 2)$. Give the value of $f(5)$.

Answer : _____

Round 1 2 3 4 5

#14 Calculus – Hustle
MAΘ National Convention 2010

How many critical values exist for $f(x) = |\sin x|$ over the interval $[0, 2\pi]$?

Answer : _____

Round 1 2 3 4 5

#15 Calculus – Hustle
MAΘ National Convention 2010

The tangent lines to the curves $f(x) = 4x^2 + 3x + 1$ and $g(x) = 9x - 8x^2 + 2$ are parallel for a certain value of x. Give that value.

Answer : _____

Round 1 2 3 4 5

#16 Calculus – Hustle
MAΘ National Convention 2010

$f'(x) = (kx - 1)(x + 2k)$ for a real non-zero constant k. Give the value of x, in terms of k, for the relative minimum of the graph of f.

Answer : _____

Round 1 2 3 4 5

#17 Calculus – Hustle
MAΘ National Convention 2010

Give all value(s) of c which satisfy the conclusion of the Mean Value Theorem for derivatives, when $f(x) = x^3 - x^2$ is considered over $[-1, 1]$.

Answer : _____

Round 1 2 3 4 5

#18 Calculus – Hustle
MAΘ National Convention 2010

Given that $\int_0^2 f(x)dx = 6$, give the value of $\int_0^2 (3f(x) + 4)dx$.

Answer : _____

Round 1 2 3 4 5

#19 Calculus – Hustle
MAΘ National Convention 2010

When $\int_0^4 (3kx + 1)dx$ is approximated with a right-hand Riemann sum and 4 equal subdivisions, the result is 154. Give the value of k.

Answer : _____

Round 1 2 3 4 5

#20 Calculus – Hustle
MAΘ National Convention 2010

Evaluate $\int_0^{\sqrt{3}} x\sqrt{x^2 + 1}\, dx$.

Answer : _____

Round 1 2 3 4 5

#21 Calculus – Hustle
MAΘ National Convention 2010

What is the x-intercept of the tangent line to $f(x) = 3x^2 - 6x + 1$ at the point on the curve of f when $x = 2$?

Answer : _____

Round 1 2 3 4 5

#22 Calculus – Hustle
MAΘ National Convention 2010

A curve $y = f(x)$ has slope at each point (x, y) to be $\frac{2x}{y}$. If the point (4, 3) is on the graph of f, then give the slope of the line normal to f at $x = 4$.

Answer : _____

Round 1 2 3 4 5

#23 Calculus – Hustle
MAΘ National Convention 2010

Evaluate $\int_0^8 |x - 4| \, dx$.

Answer : _____

Round 1 2 3 4 5

#24 Calculus – Hustle
MAΘ National Convention 2010

For a twice-differentiable function f, $f''(x) = 1$ for all values of x, and $f(1) = 4$ and $f(-1) = 5$. Give the value of $f(0)$.

Answer : _____

Round 1 2 3 4 5

#25 Calculus – Hustle
MAΘ National Convention 2010

For $f(x) = \cos x$, give the value of $f^{(41)}\left(\frac{\pi}{6}\right)$.

Answer : _____

Round 1 2 3 4 5