#1 Pre-Calculus – Hustle
MAΘ National Convention 2010

Find the real part of $(\cos(2)+i\cdot\sin(2))^{2010}$

Answer : _____

Round 1 2 3 4 5

#2 Pre-Calculus – Hustle
MAΘ National Convention 2010

Given the equation, $\sum_{n=0}^{1005} x^{2\cdot n} = 0$, let $a =$ the sum of the roots and $b =$ the product of the roots. Find $a+b$.

Answer : _____

Round 1 2 3 4 5

#3 Pre-Calculus – Hustle
MAΘ National Convention 2010

Given $A = \begin{bmatrix} \ln 10 & i^{-2010} \\ i^{2012} & \log e \end{bmatrix}$, $O = \begin{bmatrix} \cos\left(\frac{\pi}{3}\right) & \log_{14} 2 \\ \log_2 14 & 4 \end{bmatrix}$, and $M = A\cdot O$. Find $\det(M)$.

Answer : _____

Round 1 2 3 4 5

#4 Pre-Calculus – Hustle
MAΘ National Convention 2010

Solve for *n*, where *n* is an integer:

$$\prod_{x=1}^{5} cis(x) = cis(n)$$

Answer : _____

Round 1 2 3 4 5

#5 Pre-Calculus – Hustle
MAΘ National Convention 2010

If $\tan x + \cot x = 10$, find $\tan^3 x + \cot^3 x$

Answer : _____

Round 1 2 3 4 5

#6 Pre-Calculus – Hustle
MAΘ National Convention 2010

If $\sin(2 \cdot x) = \frac{4}{5}$, find the value of $\sin^4 x + \cos^4 x$.

Answer : _____

Round 1 2 3 4 5

#7 Pre-Calculus – Hustle
MAΘ National Convention 2010

The vector $2010 \cdot \sqrt{3} + 2010 \cdot i$ is rotated $\frac{\pi}{6}$ radians clockwise. Find this new vector in $a + b \cdot i$ form with $a, b \in \Re$.

Answer : _____

Round 1 2 3 4 5

#8 Pre-Calculus – Hustle
MAΘ National Convention 2010

The vectors in the Argand Plane $\sqrt{34} \cdot e^{\arctan\left(\frac{3}{5}\right) \cdot i}$ and $\sqrt{10} \cdot e^{\arctan\left(\frac{1}{3}\right) \cdot i}$ are equidistant to a point lying on the imaginary axis. Find this point in $a + b \cdot i$ form with $a, b \in \Re$.

Answer : _____

Round 1 2 3 4 5

#9 Pre-Calculus – Hustle
MAΘ National Convention 2010

When expressed in rectangular coordinates, the center of the ellipse $r = \dfrac{2}{1 - \frac{1}{2} \cdot \cos\theta}$ can be expressed in the form (x, y) where x and y are real numbers. Find $x + y$.

Answer : _____

Round 1 2 3 4 5

#10 Pre-Calculus – Hustle
MAΘ National Convention 2010

The solutions to $x^2 + 3 \cdot \sqrt{5} \cdot x - 7 \cdot i = 0$ can be written in the form $a \cdot \sqrt{b} + c + d \cdot i$ where $a, b, c, d \in \Re$ and b is prime. Find the sum of the real parts of both solutions.

Answer : _____

Round 1 2 3 4 5

#11 Pre-Calculus – Hustle
MAΘ National Convention 2010

Let $f(x) = 2010 + x \cdot i$, where $x \in \Re$. Find the minimum value of $|f(x)|$, the absolute value of $f(x)$.

Answer : _____

Round 1 2 3 4 5

#12 Pre-Calculus – Hustle
MAΘ National Convention 2010

Find the product of all the **pure imaginary** solutions to $x^4 - x^3 + 19 \cdot x^2 - 25 \cdot x - 150 = 0$.

Answer : _____

Round 1 2 3 4 5

#13 Pre-Calculus – Hustle
MAΘ National Convention 2010

Let θ be the angle of inclination that each of the asymptotes of the hyperbola defined by $16 \cdot x^2 - 25 \cdot y^2 = 400$ makes with the positive x-axis. Find $\left|\tan\theta\right|$.

Answer : _____

Round 1 2 3 4 5

#14 Pre-Calculus – Hustle
MAΘ National Convention 2010

Evaluate: $\sum_{n=4}^{\infty} \frac{5}{n^2 - 5 \cdot n + 6}$

Answer : _____

Round 1 2 3 4 5

#15 Pre-Calculus – Hustle
MAΘ National Convention 2010

What is the smallest integer larger than $\log_2(7!)$?

Answer : _____

Round 1 2 3 4 5

#16 Pre-Calculus – Hustle
MAΘ National Convention 2010

If $\cos x + \cos y = \frac{1}{2}$ and $\sin x + \sin y = \frac{1}{4}$, find $\cos(x - y)$. Note: x and y are first quadrant angles.

Answer : _____

Round 1 2 3 4 5

#17 Pre-Calculus – Hustle
MAΘ National Convention 2010

Given the equation
$\sin x + \sqrt{3} \cdot \cos x = 2 \cdot \sin(x + \theta)$. Solve for θ,
where $\theta \in \left(0, \frac{\pi}{2}\right)$

Answer : _____

Round 1 2 3 4 5

#18 Pre-Calculus – Hustle
MAΘ National Convention 2010

When written in standard form, how many digits does the expression $\prod_{n=1}^{100} 100^{100}$ have?

Answer : _____

Round 1 2 3 4 5

#19 Pre-Calculus – Hustle
MAΘ National Convention 2010

Evaluate the following expression:
$\cos\left(2 \cdot \arcsin\left(\frac{3}{4}\right)\right)$

Answer : _____

Round 1 2 3 4 5

#20 Pre-Calculus – Hustle
MAΘ National Convention 2010

How many asymptotes (vertical, horizontal, and/or slanted) does the graph of the equation $f(x) = \frac{x^3 - 8}{x^2 - 3 \cdot x - 4}$ have?

Answer : _____

Round 1 2 3 4 5

#21 Pre-Calculus – Hustle
MAΘ National Convention 2010

The exact value of $\tan(15^\circ)$ can be written in the form $a-\sqrt{b}$, where a and b are integers. Find $a+b$.

Answer : _____

Round 1 2 3 4 5

#22 Pre-Calculus – Hustle
MAΘ National Convention 2010

$\cos\left(\frac{\pi}{8}\right)$ can be written in the from $\frac{1}{2}\cdot\sqrt{a+\sqrt{a}}$. Find a^2.

Answer : _____

Round 1 2 3 4 5

#23 Pre-Calculus – Hustle
MAΘ National Convention 2010

Find the 100^{th} term in the following sequence: $3,7,13,21,31,43,\ldots$

Answer : _____

Round 1 2 3 4 5

#24 Pre-Calculus – Hustle
MAΘ National Convention 2010

The rectangle with vertices $(2,3),(2,-3),(-2,3),(-2,-3)$ is rotated 180° around the *x*-axis. Find the volume of this cylinder.

Answer : _____

Round 1 2 3 4 5

#25 Pre-Calculus – Hustle
MAΘ National Convention 2010

Given $A = \begin{bmatrix} 2 & 1 \\ 1 & 2 \end{bmatrix}$ and $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$, solve the equation $\det(A - \lambda \cdot I) = 0$ for the constant λ, and then find the absolute value of the difference between the largest and smallest value of λ.

Answer : _____

Round 1 2 3 4 5