2022 MAΘ National Convention Relay
Theta Seat
Question 0

Let $\mathbf{A}$ = the sum of the roots of $x^2 - 49 = 0$

2022 MAΘ National Convention Relay
Alpha Seat
Question 0

$$\mathbf{B} = \tan\left(\frac{\mathbf{A}\pi}{12}\right)$$

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Mu Seat
Question 0

$\mathbf{C} = f'(\mathbf{B})$ if $f(x) = x^3 + x^2$

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Question 1

The equation $x^4 - 3x^3 + 5x^2 - 27x - 36 = 0$ has 2 pure imaginary roots. Those roots are $\pm$ **A**i, with **A** > 0.

2022 MAΘ National Convention Relay
Alpha Seat
Question 1

In triangle ZLU, LU=12 and the measure of angle L is $(10 \bullet A)$ degrees. Let **B =** the sum of the integer values of ZU for which there are two possible values for side length ZL

2022 MAΘ National Convention Relay
Mu Seat
Question 1

Snowman flies **B =** mpm(miles per minute) over land and 27 mpm over water. His palace is on one side of a river 9 mile wide. He spots Mrs. Snowman nine miles down from his palace on the other side of the river. Let **C =** the number of minutes it will take for him to get to Mrs. Snowman if he uses the quickest route?

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Question 2

Given $|z+3|=|z-1|=|z-i|$, with z being a complex number such that z=**A+Ai**

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Alpha Seat
Question 2

Let **B** = $\lim_{x\to\infty}\left(\sqrt{2x^2-Ax+2020}-\sqrt{2x^2+Ax}\right)$

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Question 2

Find **C** such that $\int_{C}^{\tan(\cos^{-1}(B))} \frac{1}{\sqrt{x}\left(1+\sqrt{x}\right)^2}\,dx=\frac{1}{5}$

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Question 3

Let **A=** the number of ordered pairs (X,Y) of INTEGERS that satisfy: $X^2+Y^2-8X+4Y-5=0$

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Alpha Seat
Question 3

The Snowman messed up again and passed out his **A** Alpha scantrons at random to his **A** Alpha's. The probability he passed out at least (**A-2)** scantrons to the correct Alpha is $\frac{N}{A!}$. Let **B =** the sum of the digits of N.

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Mu Seat
Question 3

Let **C =** the volume of a solid with regular hexagonal cross-sections perpendicular to the x-axis and the longest diagonal of the hexagon lying in the region bounded by the curve $4x^2+16-4B+By^2=4y^2$

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Mu Seat
Question 4

Find the area inside $r = 3\sin\theta$ and outside $r = 2 - \sin\theta$. Let **A =** the area times $\sqrt{3}$

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Theta Seat
Question 4

For integers x>0, let **B=** the number of pairs of points M and U that lie on the graph of $y = x^2$, M to the left and below U, such that the slope of $\overline{MU}$ is **A**.

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Question 4

Let **C=** the product of the solutions to: $\log_B k + \log_{k^2} \frac{1}{2B} = 1$.

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Question 5

Let **A=** $\int_{-1}^{2} \left|2x^3 - 3x^2 - 9x + 10\right| dx$.

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Question 5

Two tangents are drawn to a circle from an exterior point Z; they touch the circle at points L and U, respectively. A third tangent intersects segment ZL at W and ZU at F, and touches the circle at J. If ZL = **A**, then the perimeter of triangle WFZ is **B**.

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Question 5

Triangle XYZ has side lengths XZ = **C**, YZ = 21, and XY = 32. The line through the incenter of triangle XYZ parallel to $\overline{YZ}$ intersects $\overline{XY}$ at J and $\overline{XZ}$ at P. If the perimeter of triangle XJP is **B,** find **C.**

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Mu Seat
Question 6

Given: $\left(f\left(x\right)\right)^2 = g^{-1}\left(80x + 2020\right)$. Let **A=** $f\left(x\right) f'\left(x\right) g'\left(f\left(x\right)\right)^2$

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Question 6

If a sequence is defined by $a_1 = 2, a_{n+1} = a_n + 2n$ for $n \geq 1$, then a_A =N. Let **B=** the sum of the digits of N.

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Alpha Seat
Question 6

Two sides of a triangle have lengths of 8 and **B**, and the sine of the acute angle between them is $\frac{1}{3}$. If this angle measure is doubled, let **C =** the ratio of the area of the new triangle to the area of the old?

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Alpha Seat
Question 7

Let **A =** the area of the triangle formed by the foci and any endpoint of either latus rectum for the following conic. $9x^2 + 5y^2 + 54x + 40y + 116 = 0$

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Mu Seat
Question 7

A man 6 feet tall walks at a rate of (**B-5)** ft/sec away from a light that is (**B+5)** feet above the ground. When he is **B** feet from the base of the light, the rate at which the length of his shadow is changing is **A** ft/sec.

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Question 7

A cone is inscribed in a sphere of radius (**B+2)** so that the slant height of the cone is equal to twice the length of the radius of the cone. Let **C=** the volume of the cone in terms of π.

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Alpha Seat
Question 8

Heritage and Buchholz have a cross country meet with 5 runners on each team. A runner who finishes in the nth position contributes n to his teams score. The team with the lower score wins. If there are no ties among runners, let **A=** the number of different winning scores that are possible

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Mu Seat
Question 8

Let **B=**the total area of the regions between the graphs $y = -6x + 60$ and $y = 6(x-10)^2 - 18(x-10)$ from x = (**A** -2) to x = **A**?

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Question 8

A Square in inscribed in an isosceles triangle, with one of its sides on the triangle's base. The length of the base of the triangle is **B** and its legs have length of (**B-2)** Let **C=** the side of the square

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Question 9

If $\cos L + \cos U = 1$
$\sin L + \sin U = \sqrt{\frac{5}{3}}$, let **A** = sec(L-U).

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Mu Seat
Question 9

The length of the curve described by $x = Arc\sin t,$ and $y = \frac{1}{2}\ln(1-t^2)$ for $0 \le t \le \boldsymbol{B} = \ln\sqrt{A}$

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Question 9

Let **C** = the length of the conjugate axis of the hyperbola $x^2 - 8By^2 + 20Bx + 48By + 50B = 0$.