## #1 Precalculus – Hustle MA⊕ National Convention 2024

Given vectors  $u = \langle 5, 20, 0 \rangle$  and  $v = \langle 2, -1, 12 \rangle$ . Find the dot product of the two vectors.

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Answer :			
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Round 1 2 3 4 5

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Round 1 2 3 4 5

## #2 Precalculus – Hustle MA⊕ National Convention 2024

Express  $N = \frac{\sqrt{6}}{1+\sqrt{6}}$  in simplest form with a positive integer denominator.

#2 Precalculus - Hustle	
MA⊕ National Convention 2	2024

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Round 1 2 3 4 5

## #3 Precalculus – Hustle MA⊕ National Convention 2024

Find the smallest possible angle of rotation (in degrees, clockwise or counterclockwise) needed to eliminate the *xy* term from:

$$7x^2 + 4\sqrt{3}xy + 3x - 8y - 5y^2 + 7 = 0$$

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Round 1 2 3 4 5

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Round 1 2 3 4 5

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## #4 Precalculus - Hustle MA⊕ National Convention 2024

Find 
$$x + y$$
 if  $x = \sqrt{20 - \sqrt{20 - \sqrt{20 - \cdots}}}$   
and  $y = (\sqrt{2}i - \sqrt{6})^6$ 

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Answer	:	
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Round 1 2 3 4 5

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Round 1 2 3 4 5

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Round 1 2 3 4 5

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## #5 Precalculus - Hustle MA⊕ National Convention 2024

The range of the function  $f(x) = \tan^{-1} \theta$  can be expressed as (a, b). Compute a + b.

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## #6 Precalculus – Hustle MA⊕ National Convention 2024

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Round 1 2 3 4 5

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Round 1 2 3 4 5

#### #6 Precalculus - Hustle MA⊕ National Convention 2024

Find the determinant of:

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$$

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

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

Round 1 2 3 4 5

## #7 Precalculus – Hustle MA⊕ National Convention 2024

Find the determinant of:

$$\begin{bmatrix} 3 & 0 & 2 & -1 \\ 1 & 2 & 0 & -2 \\ 4 & 0 & 6 & -3 \\ 5 & 0 & 2 & 0 \end{bmatrix}$$

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#8 Precalculus - Hustle	
MA® National Convention 2024	4

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Round 1 2 3 4 5

#8 Precalculus – Hustle MA⊕ National Convention 2024

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Round 1 2 3 4 5

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## #9 Precalculus - Hustle MA© National Convention 2024

Given:  $6^x + 36^x = 72$  and  $\log_6 y = x$ , find y.

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#### #10 Precalculus – Hustle MA® National Convention 2024

When the solutions to  $x^6 - 4096 = 0$  are graphed on the complex (Argand) plane, they can be connected to form a hexagon. What is the area enclosed by the hexagon?

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7112 W C1		

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## #11 Precalculus - Hustle MA⊕ National Convention 2024

What is the sum of the reciprocals of the roots of  $S(x) = 12x^6 - 7x^4 - 6x^3 + 12x + 4$ 

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Ancwar	
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Round 1 2 3 4 5

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Round 1 2 3 4 5

## #12 Precalculus – Hustle MA® National Convention 2024

Let  $f(x) = \frac{(x-3)^2}{x^2-5x+6}$ . Find the equations of all asymptotes in the graph of f(x).

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Round 1 2 3 4 5

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Round 1 2 3 4 5

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## #13 Precalculus - Hustle MA⊕ National Convention 2024

Solve for x:

$$\log_{\sqrt{6}} \begin{vmatrix} 2 & 3 & 2 \\ 2 & 3 & 1 \\ 4 & 9 & 1 \end{vmatrix} = x$$

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Round 1 2 3 4 5

#14 Precalculus – Hustle MA© National Convention 2024	#14 Precalculus – Hustle MA⊕ National Convention 2024
Simplify: $\log_{11} 625 \cdot \log_7 243 \cdot \log_5 14641 \cdot \log_3 16807$	Simplify: $\log_{11} 625 \cdot \log_7 243 \cdot \log_5 14641 \cdot \log_3 16807$
Answer :	Answer :
Round 1 2 3 4 5	Round 1 2 3 4 5
#14 Precalculus – Hustle MA⊕ National Convention 2024	#14 Precalculus – Hustle MA⊕ National Convention 2024
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Answer : \_\_\_\_\_

Round 1 2 3 4 5

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#15 Precalculus - Hustle	
MA® National Convention 2024	

If ABCDEF is a regular hexagon with  $EA = 3\sqrt{3}$ , compute its area.

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Round 1 2 3 4 5

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Round 1 2 3 4 5

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#16 Precalculus - Hustle
MAΘ National Convention 2024

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Round 1 2 3 4 5

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Round 1 2 3 4 5

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Round 1 2 3 4 5

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### #17 Precalculus - Hustle MA⊕ National Convention 2024

For all nonzero real numbers x,

$$2f(x) + f\left(\frac{1}{x}\right) = x$$

Find f(x) as a single fraction.

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Round 1 2 3 4 5

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## #18 Precalculus - Hustle MA⊕ National Convention 2024

Evaluate:

$$\sum_{n=1}^{\infty} \frac{1}{n^2 + 6n + 8}$$

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Answer	
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Round 1 2 3 4 5

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Round 1 2 3 4 5

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Round 1 2 3 4 5

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## #19 Precalculus - Hustle MA⊕ National Convention 2024

Find the positive difference between the maximum and minimum *y* values among all points on the polar graph

$$r^2 = -6r\cos\theta + 7$$

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Round 1 2 3 4 5

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Round 1 2 3 4 5

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#### #20 Precalculus – Hustle MA⊕ National Convention 2024

Aditi, Angela, Anjana, Devika, and Navya are playing a dice game, where the players roll one fair six-sided die. Aditi starts, and they take turns in the aforementioned order. If the first person to roll a 5 or higher wins, what is the probability that Anjana wins?

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Answer		
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Round 1 2 3 4 5

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

Round 1 2 3 4 5

## #21 Precalculus - Hustle MA⊕ National Convention 2024

Compute:

$$\frac{\sin\frac{\pi}{12} + \cos\frac{\pi}{12}}{\sin^3\frac{\pi}{12} + \cos^3\frac{\pi}{12}}$$

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Answer:	

Round 1 2 3 4 5

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Round 1 2 3 4 5

## #22 Precalculus - Hustle MA⊕ National Convention 2024

Let T(x) be an odd cubic polynomial with a root at x = 11. If its other roots are n and s, then what is the value of  $n^2 + s^2$ ?

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

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

Round 1 2 3 4 5

#### #23 Precalculus - Hustle MA⊕ National Convention 2024

The graph of the equation

$$x^2 - y^2 + 6x + 4y + 5 = 0$$

is a pair of intersecting lines. Compute the sum of the coordinates of the y-intercepts of the two lines.

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

Round 1 2 3 4 5

#### #23 Precalculus - Hustle MA⊕ National Convention 2024

The graph of the equation

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Round 1 2 3 4 5

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## #24 Precalculus - Hustle MA⊕ National Convention 2024

## Find the amplitude of:

$$N(x) = 3\sin\left(x - \frac{\pi}{4}\right) + 4\cos\left(x + \frac{\pi}{4}\right)$$

## #24 Precalculus – Hustle MA⊕ National Convention 2024

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Round 1 2 3 4 5

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Round 1 2 3 4 5

## #25 Precalculus - Hustle MA⊕ National Convention 2024

Compute:

$$\sin\left(\tan^{-1}\left(-\frac{3}{4}\right) + \cot^{-1}\left(-\frac{5}{12}\right)\right)$$

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Round 1 2 3 4 5

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Round 1 2 3 4 5

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Round 1 2 3 4 5