

#1 Precalculus – Hustle
2008 FAMAT State Convention

$$\sin\left(\frac{\pi}{4}\right) + \cos\left(\frac{3\pi}{4}\right) + \tan\left(\frac{5\pi}{4}\right) = B. \text{ Find } B.$$

Answer: _____

Round 1 2 3 4 5

#2 Precalculus – Hustle
2008 FAMAT State Convention

Let $\vec{u} = i - 2j + k$, $\vec{v} = -3i + 3j - 2k$, and $\vec{w} = (\vec{u} \times \vec{v}) - (\vec{v} \times \vec{u})$. Find $\|\vec{w}\|$.

Answer: _____

Round 1 2 3 4 5

#3 Precalculus – Hustle
2008 FAMAT State Convention

For $\triangle ABC$, $c = 10$, $\sin C = \frac{1}{2}$, and $\cos B = -\frac{1}{2}$.

What is the area of the circle of radius R that circumscribes this triangle? (Hint: $R = \frac{abc}{4 \cdot A}$,

where $A =$ area of $\triangle ABC$)

Answer: _____

Round 1 2 3 4 5

#4 Precalculus – Hustle
2007 FAMAT State Convention

Let θ be the acute angle of rotation for the conic $16x^2 + 4xy + 8y^2 - 4x + 8y + 17 = 0$. What is $\cot(2\theta)$?

Answer: _____

Round 1 2 3 4 5

#5 Precalculus – Hustle
2008 FAMAT State Convention

For what values of x and y

does $\begin{vmatrix} \sin x & \cos x & 0 \\ \sin y & \cos y & 0 \\ \tan x & \tan y & 1 \end{vmatrix} = \frac{1}{2}$, given that

$x + y = \frac{\pi}{3}$ and $0 \leq x \leq \frac{\pi}{2}$, $0 \leq y \leq \frac{\pi}{2}$, and $x > y$.

Give your answer in the form (x, y) .

Answer: _____

Round 1 2 3 4 5

#6 Precalculus – Hustle
2008 FAMAT State Convention

What is the probability that a randomly chosen distinguishable permutation of MOSQUITOS has U and I together?

Answer: _____

Round 1 2 3 4 5

#7 Precalculus - Hustle
2008 FAMAT State Convention

Given $0 < x < \frac{\pi}{2}$, evaluate

$\csc^2 x - \cot^2 x + \tan^2 x - \sec^2 x$.

Answer: _____

Round 1 2 3 4 5

#8 Precalculus – Hustle
2008 FAMAT State Convention

Find the area of $\triangle ABC$, where $A(1, -2, 0)$, $B(2, 2, 2)$, and $C(2, -1, -2)$ are points in xyz -space.

Answer: _____

Round 1 2 3 4 5

#9 Precalculus – Hustle
2008 FAMAT State Convention

Let $\vec{u} = 3i - 4j$ and $\vec{v} = -7i + j$. Find $\frac{\|\vec{u} + \vec{v}\|}{\|\vec{u}\| + \|\vec{v}\|}$

Answer: _____

Round 1 2 3 4 5

#10 Precalculus – Hustle
2008 FAMAT State Convention

Let $y = e^{x^2 \ln x}$. Find the real value of x when $y = 16$.

Answer: _____

Round 1 2 3 4 5

#11 Precalculus – Hustle
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If $\sum_{n=1}^{2006} (\sqrt{-1})^n = a + bi$, find $a + b$.

Answer: _____

Round 1 2 3 4 5

#12 Precalculus – Hustle
2008 FAMAT State Convention

If $\frac{\pi}{2} \leq u \leq \pi$, $\frac{3\pi}{2} \leq v \leq 2\pi$, $\cos u = -\frac{3}{5}$ and $\sin v = -\frac{5}{13}$, find $\sin(u + v)$.

Answer: _____

Round 1 2 3 4 5

#13 Precalculus – Hustle
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If $z = 2cis\left(\frac{3\pi}{4}\right)$, where \bar{z} denotes the conjugate of z and $cis\theta = \cos\theta + i\sin\theta$, and $(\bar{z})^5 = a + bi$, find ab .

Answer: _____

Round 1 2 3 4 5

#14 Precalculus - Hustle
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$\frac{a+bi}{25} = \frac{i}{3-4i} + \frac{2}{2+i}$. Find $2a+b$.

Answer: _____

Round 1 2 3 4 5

#15 Precalculus – Hustle
2008 FAMAT State Convention

For a certain triangle $\triangle ABC$, $C = 120^\circ$, $a = 5$, and $b = 5$. Find c .

Answer: _____

Round 1 2 3 4 5

#16 Precalculus – Hustle
2008 FAMAT State Convention

What is the period of the following trigonometric function?

$$f(x) = \cos^2(x)$$

Answer: _____

Round 1 2 3 4 5

#17 Precalculus – Hustle
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Point P lies on the ellipse defined by $2x^2 - 8x + y^2 - 8y + 22 = 0$. The distances between P and the foci are d_1 and d_2 . Find $d_1 + d_2$.

Answer: _____

Round 1 2 3 4 5

#18 Precalculus - Hustle
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$$\lim_{x \rightarrow 3} \frac{x^3 - x^2 - 7x + 3}{x - 3} = ?$$

Answer: _____

Round 1 2 3 4 5

#19 Precalculus – Hustle
2008 FAMAT State Convention

The two square roots of $\sqrt{-1}$ are x_1 and x_2 . Find $x_1 x_2$.

Answer: _____

Round 1 2 3 4 5

#20 Precalculus – Hustle
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What is the amplitude of the following trigonometric function?
 $f(x) = 3 \sin x + 7 \cos x$

Answer: _____

Round 1 2 3 4 5

#21 Precalculus – Hustle
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Find the area of the figure defined by the parametric equations:

$$x = 3 \cos t$$

$$y = 4 \sin t$$

Answer: _____

Round 1 2 3 4 5

#22 Precalculus – Hustle
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A cyclist's front wheel, of radius $\frac{1}{2}$ meter, makes a constant 2 revolutions per second. A total of $\frac{A}{B\pi}$ minutes pass before the cyclist travels 2 kilometers. Find A + B.

Answer: _____

Round 1 2 3 4 5

#23 Precalculus – Hustle
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Which non-degenerate conic is defined by the following equation?

$$4x^2 + 4xy + y^2 - 2x - 2y = 0$$

Answer: _____

Round 1 2 3 4 5

#24 Precalculus– Hustle
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The function $f(x) = ax^3 + bx^2 + cx + d$ has two zeroes of $2+i$ and 1. If $b = d$ and a , b , and c are relatively prime, find $(a+c) - (b+d)$.

Answer: _____

Round 1 2 3 4 5

#25 Precalculus – Hustle
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If $x + \frac{1}{x} = 4$, find $x^3 + \frac{1}{x^3}$.

Answer: _____

Round 1 2 3 4 5