Solve for $x$: $|x|^2 - |x| - 2 = 4$

Answer: ____________________

Round 1 2 3 4 5

Round 1 2 3 4 5
In how many ways can Jack plant three oak trees and six willow trees in a row if no two oak trees can be next to each other? Assume trees of the same type are indistinguishable.

Answer: ________________

Round 1 2 3 4 5

In how many ways can Jack plant three oak trees and six willow trees in a row if no two oak trees can be next to each other? Assume trees of the same type are indistinguishable.

Answer: ________________

Round 1 2 3 4 5
Evaluate: \[ \sum_{n=1}^{\infty} \frac{1}{n^2 + 4n + 3} \]

Answer: ______________

Round 1 2 3 4 5
Find the sum of all $x \in [0, 2\pi)$ such that $\cos(2x) = \sin(x)$.

Answer: ________________

Round 1 2 3 4 5

Find the sum of all $x \in [0, 2\pi)$ such that $\cos(2x) = \sin(x)$.

Answer: ________________

Round 1 2 3 4 5
Find $a + b - (c + d)$.

Answer: ________________
Find the positive difference between the maximum and minimum $y$ values among all points on the graph of $r^2 = 4r\cos\theta - 3$.

Answer: ________________

Round 1 2 3 4 5

Find the positive difference between the maximum and minimum $y$ values among all points on the graph of $r^2 = 4r\cos\theta - 3$.

Answer: ________________

Round 1 2 3 4 5
\[ u = i - k \]
\[ v = 2i + j + 3k \]
Find \( 2(u \cdot v)^2 + |u \times v|^2 \).

Answer: ____________________

Round 1 2 3 4 5

\[ u = i - k \]
\[ v = 2i + j + 3k \]
Find \( 2(u \cdot v)^2 + |u \times v|^2 \).

Answer: ____________________

Round 1 2 3 4 5
Robert, Ryan, Jay, Case, and Theo are playing a dice game where the players roll one standard fair die. Robert starts, and they take turns in the aforementioned order. If the first person to roll a 5 or higher wins, what is the probability Jay wins?

Answer: ______________

Round 1 2 3 4 5

Robert, Ryan, Jay, Case, and Theo are playing a dice game where the players roll one standard fair die. Robert starts, and they take turns in the aforementioned order. If the first person to roll a 5 or higher wins, what is the probability Jay wins?

Answer: ______________

Round 1 2 3 4 5
Let $\alpha$ equal the smaller angle of intersection between $y = 2x$ and $x - 2y = 20$. Find $\csc \alpha$.

**Answer:**

Round 1 2 3 4 5

**Answer:**

Round 1 2 3 4 5

Let $\alpha$ equal the smaller angle of intersection between $y = 2x$ and $x - 2y = 20$. Find $\csc \alpha$.

**Answer:**

Round 1 2 3 4 5

**Answer:**

Round 1 2 3 4 5
Given \( \cos x = \frac{3}{5} \) and that the terminal side of \( x \) lies within the first quadrant, evaluate:

\[ 3 \sin^2 x + 8 \tan^2 x + \csc^2 x + 25 \sin^2 x + 3 \cos^2 x \]
\[ -8 \sec^2 x - \cot^2 x \]

Answer: ________________________
Round 1 2 3 4 5

Answer: ________________________
Round 1 2 3 4 5
Let $\theta$ be the smallest positive angle of counterclockwise rotation so that the major and minor axes of $4x^2 + 4xy + 4y^2 + 2x + 7y + 1 = 0$ coincide with the $x$ and $y$ axes. Find $\sin \theta$.

Answer: _________________

Round 1 2 3 4 5

Let $\theta$ be the smallest positive angle of counterclockwise rotation so that the major and minor axes of $4x^2 + 4xy + 4y^2 + 2x + 7y + 1 = 0$ coincide with the $x$ and $y$ axes. Find $\sin \theta$.

Answer: _________________

Round 1 2 3 4 5
Given \(2f(x) + f\left(\frac{1}{x}\right) = x\), find \(f(x)\) as a single fraction.

Answer: ______________

Round 1 2 3 4 5

Given \(2f(x) + f\left(\frac{1}{x}\right) = x\), find \(f(x)\) as a single fraction.

Answer: ______________

Round 1 2 3 4 5
Given \((\log_a b)^6 + (\log_b a)^6 = 47\), where \(a\) and \(b\) are real numbers with all logarithms defined, find \((\log_a b)^6 + (\log_b a)^6\).

Answer: ________________

Round 1 2 3 4 5

Answer: ________________

Round 1 2 3 4 5
What is the area enclosed by a regular 24-gon inscribed in a circle with radius 1?

Answer: ________________

Round  1  2  3  4  5

What is the area enclosed by a regular 24-gon inscribed in a circle with radius 1?

Answer: ________________

Round  1  2  3  4  5
Evaluate: \[ \sin \left( \frac{\pi}{12} \right) + \cos \left( \frac{\pi}{12} \right) \]

Evaluate: \[ \sin^3 \left( \frac{\pi}{12} \right) + \cos^3 \left( \frac{\pi}{12} \right) \]
Zach is struggling to figure out what $|3+4i|$ equals and asks Will for help. If Will is always correct, what answer does he get?

Answer: ________________

Round 1 2 3 4 5

Zach is struggling to figure out what $|3+4i|$ equals and asks Will for help. If Will is always correct, what answer does he get?

Answer: ________________

Round 1 2 3 4 5
Find $A$ such that
\[
\sum_{n=1}^{\infty} \frac{1}{\sum_{i=0}^{n} \binom{n}{i}} = \ln(A)
\]

Answer: ________________________
Round 1 2 3 4 5

Answer: ________________________
Round 1 2 3 4 5
Gabe makes a regular, convex polygon by connecting the roots of $x^6 = 64$ when plotted on the complex plane. Find the area enclosed by this polygon.

Answer: ________________

Round 1 2 3 4 5

Gabe makes a regular, convex polygon by connecting the roots of $x^6 = 64$ when plotted on the complex plane. Find the area enclosed by this polygon.

Answer: ________________

Round 1 2 3 4 5
What is the distance between the polar coordinates \((3, -\frac{\pi}{12})\) and \((4, \frac{\pi}{4})\)?

Answer: ________________________

Round 1 2 3 4 5
Evaluate: \( \lim_{x \to \infty} \left( \sqrt{x^2 + 3x} - \sqrt{x^2 - x} \right) \)

Answer: ________________
Round 1 2 3 4 5

Evaluate: \( \lim_{x \to \infty} \left( \sqrt{x^2 + 3x} - \sqrt{x^2 - x} \right) \)

Answer: ________________
Round 1 2 3 4 5
If Ankit invests $5 in a bank account with 5% interest compounded continuously, how long (in years) will it take for his money to grow to $2015?

Answer: ________________
Round  1  2  3  4  5

If Ankit invests $5 in a bank account with 5% interest compounded continuously, how long (in years) will it take for his money to grow to $2015?

Answer: ________________
Round  1  2  3  4  5
Find the length of the longest altitude in a triangle with side lengths 7, 8, and 9.

Answer: ________________________

Round 1 2 3 4 5

Answer: ________________________

Round 1 2 3 4 5
What point is the result of the point \((2,4)\) being rotated 60 degrees about the origin?

Answer: ________________________

Round 1 2 3 4 5

Answer: ________________________

Round 1 2 3 4 5
Find the shortest distance between the graphs of \( y = x + 1 \) and \( y = x - 1 \).

Answer: ________________________

Round 1 2 3 4 5

Answer: ________________________

Round 1 2 3 4 5
Find the maximum area of a triangle with sides of lengths $\cos 15^\circ$ and $\sin 15^\circ$.

Answer: _____________________

Round 1 2 3 4 5

Answer: _____________________

Round 1 2 3 4 5

Find the maximum area of a triangle with sides of lengths $\cos 15^\circ$ and $\sin 15^\circ$.

Answer: _____________________

Round 1 2 3 4 5

Answer: _____________________

Round 1 2 3 4 5