Find the exact value of the area of the shaded regions, written as a fraction.

Answer: ________________________

Round 1 2 3 4 5

Find the exact value of the area of the shaded regions, written as a fraction.

Answer: ________________________

Round 1 2 3 4 5
Give the x value where a relative minimum exists on the graph of f(x).

Answer : __________________

Round 1 2 3 4 5
Find the average rate of change of $y$ with respect to $x$ for the interval $[2,5]$ as a decimal.

**Answer:** ________________

Round 1 2 3 4 5

---

Find the average rate of change of $y$ with respect to $x$ for the interval $[2,5]$ as a decimal.

**Answer:** ________________

Round 1 2 3 4 5
If the average value of \( f(x) \) on the interval \([0,2]\) is 0.4; find the value of:

\[
\int_{2}^{0} f(x) \, dx
\]

Answer : ________________

Round  1  2  3  4  5
Evaluate: $\int_{1}^{e} \ln x \, dx$

Answer: ________________

Round 1 2 3 4 5

Evaluate: $\int_{1}^{e} \ln x \, dx$

Answer: ________________

Round 1 2 3 4 5
If \( \int \frac{3x-4}{(x-3)(x+2)} \, dx = \ln |f(x)| + C \), where \( f(x) \) contains no constant factors other than 1, find \( f(x) \) in factored form.

Answer: _______________

Round 1 2 3 4 5

If \( \int \frac{3x-4}{(x-3)(x+2)} \, dx = \ln |f(x)| + C \), where \( f(x) \) contains no constant factors other than 1, find \( f(x) \) in factored form.

Answer: _______________

Round 1 2 3 4 5
Using the graph of the derivative of $f$ below, find the x values where the graph of $f$ will have a relative maximum.

Answer: ____________

Round 1 2 3 4 5

Using the graph of the derivative of $f$ below, find the x values where the graph of $f$ will have a relative maximum.

Answer: ____________

Round 1 2 3 4 5
Given the graph above with x-coordinates labeled as letters a-h, find all x coordinates of points of inflection of the given graph.

Answer: ________________________

Round 1 2 3 4 5

Given the graph above with x-coordinates labeled as letters a-h, find all x coordinates of points of inflection of the given graph.

Answer: ________________________

Round 1 2 3 4 5
Evaluate: \( \lim_{\theta \to 0} \frac{\theta^2 + 2\theta}{\sin(2\theta)} \)

Answer: ________________

Round 1 2 3 4 5

Evaluate: \( \lim_{\theta \to 0} \frac{\theta^2 + 2\theta}{\sin(2\theta)} \)

Answer: ________________

Round 1 2 3 4 5
Evaluate: \( \int_{1}^{\sqrt{3}} \frac{1}{x^2 + 1} \, dx \)

Answer: ________________________

Round 1 2 3 4 5

Evaluate: \( \int_{1}^{\sqrt{3}} \frac{1}{x^2 + 1} \, dx \)

Answer: ________________________

Round 1 2 3 4 5
Find the sum of areas $A + B$, written as a fraction.

Answer: ________________________

Round 1 2 3 4 5

Find the sum of areas $A + B$, written as a fraction.

Answer: ________________________

Round 1 2 3 4 5
Given the open box formed by cutting the four square corners from the rectangle and folding, find the value of the height of the box that gives a maximum volume, written as a fraction.

Answer: ________________
Round 1 2 3 4 5

Given the open box formed by cutting the four square corners from the rectangle and folding, find the value of the height of the box that gives a maximum volume, written as a fraction.

Answer: ________________
Round 1 2 3 4 5
#13 Calculus – Hustle  
MAØ National Convention 2017

Find the x-value of the point on the graph of 
\[ y = \frac{6}{x^2 + 3} \]  
such that the slope of the tangent to the graph at this point is a minimum.

Answer: _________________  
Round 1  2  3  4  5

#13 Calculus – Hustle  
MAØ National Convention 2017

Find the x-value of the point on the graph of 
\[ y = \frac{6}{x^2 + 3} \]  
such that the slope of the tangent to the graph at this point is a minimum.

Answer: _________________  
Round 1  2  3  4  5
Find the sum of $a$ and $b$ if

$$f(x) = \begin{cases} 
ax^2 + b, & x < 2 \\
-8x + a, & x \geq 2
\end{cases}$$

is differentiable over all real numbers.

Answer: ________________

Round 1 2 3 4 5

Answer : ________________

Round 1 2 3 4 5
Evaluate: \( \int_{0}^{\frac{\pi}{2}} \sec^2 x (1 + \tan x) \, dx \)

Answer: ________________________

Round 1 2 3 4 5

Answer: ________________________

Round 1 2 3 4 5
Evaluate: \[ \int_{0}^{\frac{\pi}{20}} \tan(5x) \cdot \cos(5x) \, dx \], written as a fraction.

Answer: ________________________

Round 1 2 3 4 5

Evaluate: \[ \int_{0}^{\frac{\pi}{20}} \tan(5x) \cdot \cos(5x) \, dx \], written as a fraction.

Answer: ________________________

Round 1 2 3 4 5
Evaluate: \[ \int_{0}^{\pi} 2^{\sin x} \cos x \, dx \]

Answer: ________________

Round 1 2 3 4 5

Evaluate: \[ \int_{0}^{\pi} 2^{\sin x} \cos x \, dx \]

Answer: ________________

Round 1 2 3 4 5
If \( f(x) = 2 + |x - 3| \) for all \( x \), then what is the value of \( f'(x) \) at \( x = 4 \)?

Answer: ________________________

Round 1 2 3 4 5

If \( f(x) = 2 + |x - 3| \) for all \( x \), then what is the value of \( f'(x) \) at \( x = 4 \)?

Answer: ________________________

Round 1 2 3 4 5
Find the volume of the solid of revolution generated by revolving the region bounded by 
\( y = \sqrt{1 - x^2} \) and \( y = 0 \) about the \( x \)-axis.

Answer: ________________

Round 1 2 3 4 5

Find the volume of the solid of revolution generated by revolving the region bounded by 
\( y = \sqrt{1 - x^2} \) and \( y = 0 \) about the \( x \)-axis.

Answer: ________________

Round 1 2 3 4 5
If \( \int_{0}^{1} \frac{e^x}{e^{2x} + 3e^x + 2} \, dx = \ln A \), where \( A \) is real, find the value of \( A \), written as an unfactored fraction.

Answer: ________________

Round 1 2 3 4 5
Evaluate: \( \lim_{{x \to 0}} \frac{\sqrt{25 - x^2} - 5}{x} \)

Answer: ________________________
Round 1 2 3 4 5

Evaluate: \( \lim_{{x \to 0}} \frac{\sqrt{25 - x^2} - 5}{x} \)

Answer: ________________________
Round 1 2 3 4 5
Find the eccentricity of the graph of the solution to the slope field above, given that solution is a conic section.

Answer: ________________
Round 1 2 3 4 5

Find the eccentricity of the graph of the solution to the slope field above, given that solution is a conic section.

Answer: ________________
Round 1 2 3 4 5
Find the value of \( f'(7) \), given that
\[
f(x) = \ln \left( \frac{(x-1)^2}{x+2} \right).
\]

Answer: ________________

Round 1 2 3 4 5

Find the value of \( f'(7) \), given that
\[
f(x) = \ln \left( \frac{(x-1)^2}{x+2} \right).
\]

Answer: ________________

Round 1 2 3 4 5
If a curve is continuous, crosses the $x$-axis at two distinct points, and has a tangent at every point between those two $x$-intercepts, the tangent to the curve at some point between the $x$-intercepts is parallel to the $x$-axis.

The theorem above is generally attributed to what mathematician (last name only)?

Answer: ________________

Round 1 2 3 4 5
Find the sum of all x values for the graph of y in the interval [0,5] where the graph is not differentiable. The curve does not have a vertical tangent at any point in the diagram.

Answer: ________________________

Round 1 2 3 4 5

Find the sum of all x values for the graph of y in the interval [0,5] where the graph is not differentiable. The curve does not have a vertical tangent at any point in the diagram.

Answer: ________________________

Round 1 2 3 4 5