Round # _____

A = ________________
B = ________________
C = ________________

Final answer:

CODE: ________________

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Round 1

Part 1
A football team's scores as a function of practice time (in hours) is modeled by
\[ y = -0.05x^2 + 2x + 7. \]
What is the optimum number of hours for them to practice?

A = the optimum number of hours

Part 2
Given \[ y = \frac{4}{3} \sin \left( x + \frac{3\pi}{5} \right) - \frac{2\pi}{3} \]
B = the denominator of the sum of the period and the phase shift

Part 3
At what \( x \) values, if any, does the function
\[ f(x) = \frac{x^2 - 9}{x^2 + 7x + 12} \]
have a vertical asymptote?

C =
\[ \begin{cases} 
\text{the } x \text{ value of the asymptote} \\
\text{the sum of the } x \text{ values of the asymptotes} \\
\text{nothing, if there are no vertical asymptote(s)}
\end{cases} \]

Final answer = \( \frac{A}{B} + C \)
Round 2

Part 1
Solve the inequality. Write answer in interval notation.

\[ x^3 + x^2 - x - 1 > 0 \]

A = lower bound of the interval

Part 2
A stunt driver drives a car over cliff into the sea. The car falls 4.9 m in the first second, 14.7 m in the second and 24.5 m in the third second, etc.

B = the number meters the car falls in the 6th second

Part 3
Evaluate:

\[
\begin{vmatrix} -3 & 2 \\ 1 & 5 \end{vmatrix} + \begin{vmatrix} 1 & -2 & -3 & 0 \\ -1 & 1 & 0 & 2 \\ 0 & 2 & 0 & 3 \\ 3 & 4 & 0 & 2 \end{vmatrix}
\]

C = sum of the determinants

Final: \[ A + B + C \]
Round 3

Part 1
Given $f(x) = 5x - x^2$, find
\[
\frac{f(5 + h) - f(5)}{h}
\]
A = constant in the expression

Part 2
Find the equation of a parabola in general form if the parabola passes through the points A (-1,5), B (0, -1) and C (2, -1).
B = sum of the coefficients

Part 3
The one real zero of the function
\[
f(x) = 3x^3 - 7x^2 - 7x - 10
\]
lies between what two consecutive integers?
C = product of the two integers

Final: $|A| + |B| - C$
Round 4

Part 1
Solve for \( x \): \( 8(2^{3x+1}) = (4^{3-x})(16^x) \)

\[ A = x \]

Part 2
Find the exact solution set of the equation:
\[ \log_4(x+12) = 4 - \log_4(x-12) \]

\[ B = x \]

Part 3
Solve for \( x \) on the interval \([0, 2\pi]\) if
\[ \cos x + \sin x \tan x = 2 \]

\[ C = \text{largest solution} \]

Final: \( 12C \left( \frac{A}{B\pi} \right) \)
Round 5

Part 1
In the expansion of \((t - p)^8\), what is the coefficient of the term containing \(t^2\)?

\[ A = \text{coefficient} \]

Part 2
Fourteen people are entered into a race. Assuming no ties, how many ways could the first three places be awarded?

\[ B = \text{number of ways} \]

Part 3
The average of five students' test scores is 68. When the highest and lowest scores are eliminated, the average of the remaining scores is 72.

\[ C = \text{the average of the eliminated scores} \]

Final: \( \frac{B}{A} - C \)
Round 6

Part 1

\[ \log_{\sqrt{3}} \frac{1}{2} = -\frac{1}{2} \]

A = x

Part 2

Given \( x^2 + 4y + 17 = 10x - y^2 \), find the center and radius.

B = sum of the center coordinates

Part 3

A water wave is created in a wave tank. It has an amplitude of 3 and a period of \( \frac{2\pi}{3} \). Express the equation of the wave as a sine function.

C = sum of all the constants in the equation (hint: \( A\sin(Bx+C)+D=y \))

Final: \( B^4 - C \)
Round 7

Part 1
Malone found the equation
\[ h = -25(t - 2)^2 + 100 \]
gave the height \( h \) (in feet) of his model rocket \( t \) seconds after it has been launched.

\[ A = \text{time the rocket was in the air} \]

Part 2
In the food chain, barracuda feed on bass and bass feed on shrimp. Suppose that the size of the barracuda population is estimated by the function
\[ r(x) = 1000 + \sqrt{20x} \], where \( x \) is the size of the bass population. Also suppose that the bass population is estimated by the function
\[ s(x) = 2500 + \sqrt{x} \], where \( x \) is the size of the shrimp population.

\[ B = \text{barracuda population when the shrimp population is 4,000,000} \]

Part 3
Given \( f(x) = \frac{x + 5}{x - 5} \) and \( f(x) = -3 \)

\[ C = x \text{ when } f(x) = -3 \]

Final:
\[ \frac{B}{A(C)} \]
Round 8

Part 1
Evaluate exactly:
\[ \sin^2 20^\circ + \frac{1}{\sec^2 20^\circ} + \frac{1}{\cos^2 40^\circ} - \tan^2 40^\circ \]

A = answer

Part 2
Find the exact value for \( \sin \theta \) if \( \cos \theta = -\frac{3}{4} \) and \( \theta \) is in quadrant III

B = \( \sin \theta \)

Part 3
Suppose that \( \sin \theta + \cos \theta = 1.2 \)
What is the value of \( \sin 2\theta \)?

C = answer

Final: \( 25C - B^{-A} \)
Round 9
Part 1
Solve the system: \[
\begin{align*}
\frac{x + y}{2} &= 2 \\
\frac{x + y^2}{4} &= 4
\end{align*}
\]

A = sum of all the coordinates of all the points of intersection

Part 2
A red die and a blue die are rolled simultaneously.
What is the probability that the red die shows a larger number than the blue die?

B = denominator - numerator
(in lowest terms)

Part 3
Let \( f(x) = 3x + 1 \) and \( g(x) = 2x + 5 \)
Then \( f(g(x)) - g(f(x)) = ? \)

C = answer

Final: \( 6A - 4B + C \)
Round 10

Part 1

\[ x^4 - 8x^3 + 17x^2 - 18x + 6 = \]
\[ (x^2 + ax + 2)(x^2 + bx + 3) \]

A = the value of ab

Part 2

Find the value of \( x \) such that \( 4x + 6, x + 6, 4x - 2 \) are the first 3 terms of an arithmetic sequence.

B = x

Part 3

Find the product of:

\[
\begin{bmatrix} 3 & 2 \\ -1 & 4 \end{bmatrix} \cdot \begin{bmatrix} 6 & 1 \\ 2 & 3 \end{bmatrix} \cdot \begin{bmatrix} 2 \\ -1 \end{bmatrix}
\]

C = answer matrix and take entry \( R_1C_1 - R_2C_1 \)

Final: \( C - AB \)