$A = \int_3^1 \left(3x^2 - 2x + 2\right)dx$

$B =$ the value of $f'(2)$ if $f(x) = x^3 - x^2 + x - 2$

$C = \lim_{x \to -\infty} \dfrac{37429x^2 - 66x^3 - 12473}{6x^3 + 47923x - 97624}$

$D =$ the minimum value of $f(x) = x^2 - 2x + 6$

Compute the value of the determinant $\begin{vmatrix} A & B \\ C & D \end{vmatrix}$.

Which of the following statements concerning the graph of $f(x) = ax^3 + bx^2 + cx + d$ are true? Assume *a*, *b*, *c*, and *d* are all rational and nonzero. (Write the letters of the correct statements on your answer sheet.)

(A) $f(x)$ has a point of inflection at $x = -\dfrac{b}{3a}$.

(B) The distance along the *x*-axis between the two extrema of $f(x)$ is $\dfrac{\sqrt{b^2 - 3ac}}{3a}$.

(C) The graph of $f(x)$ is tangent to the *x*-axis at $x = -1$ if and only if $4a - 3b + 2c - d = 0$.

(D) The leftmost of the two extrema is a local minimum if and only if $a > 0$.

Let R denote the region of the plane bounded by the graphs of the lines $y = 2x + 3$, $y = 2$, $x = 0$, and $x = 1$.

$A =$ the volume of the solid formed by revolving R about the line $y = -2$

$B =$ the volume of the solid formed by revolving R about the line $x = -2$

Compute $A - B$.

Let $\alpha R^3 =$ the volume of the largest cylinder that can be inscribed in a sphere of radius R. Find α.

If $f(x) = \left(3x^4 + 7\right)^3 (2 - 5x)^6 \cos^5\left(x - \frac{\pi}{6}\right)$, then what is the value of $f'(0)$?

Let $\beta R^3 =$ the volume of the largest cylinder that can be inscribed in the largest cone that can be inscribed in a sphere of radius R. Find β.

Compute $\int_{-5}^{2} \left| x^3 - 2x^2 - 9x + 18 \right| dx$.

Let $f(x) = \sqrt{36 - x^2}$.

$M = \int_{-6}^{6} f(x)dx$

$A =$ the area of the region bounded by the *y*-axis, the graph $f(x)$, and the line $y = x\tan\theta$ for $0 < \theta < \frac{\pi}{2}$

$R =$ the arc length of the curve $f(x)$ from $(-3\sqrt{3},3)$ to $(3\sqrt{2},3\sqrt{2})$.

$K =$ the slope of the curve $f(x)$ at the point where $f(x)$ intersects the line $y = bx$

Compute the product $MARK$.

Mrs. Singleton and Mr. Bantz are chatting about their favorite functions. Mrs. Singleton tells Mr. Bantz that her favorite function is a cubic polynomial function with rational coefficients. "Go on," he says, intrigued. Mrs. Singleton continues, "well, it has a point of inflection at $(2,-6)$, but my favorite part is the local maximum at $(-1,48)$." At this point, Mr. Bantz doesn't need any more clues. "Oh, *that* one," he says, "My wife loves that one." Find the sum of the coefficients of Mrs. Singleton's favorite function.

Find the sum of the positive numbers *A* and *B* which satisfy the following equalities.

$$\int_0^A we^{w^2}\,dw = 9 \qquad \int_1^B y\ln y\,dy = \frac{1}{4}(e^2+1)$$

Let $f(x) = x^2 - 2x - 8$.

$A =$ the value of x guaranteed by Rolle's Theorem on $[-2,4]$

$B =$ the value of x guaranteed by the Mean Value Theorem for Derivatives on $[6,12]$

$C =$ the average value of $f(x)$ on $[-6,9]$

$D =$ the minimum value of $f(x)$

Compute $A + B + C + D$.

Each of the following statements concerning the function $f(x) = 3x^4 - 10x^3 - 27x^2 + 108x - 74$ has a value, indicated to the left of each statement. Find the sum of the values of the correct statements.

(-4) $f(x)$ has an x-intercept at $x = 1$.

(1) $f(x)$ has a point of inflection at $(2,2)$.

(0) $f(x)$ has a local minimum at $(-2,-270)$.

(5) $f(x)$ has a y-intercept at $y = -74$.

(-2) $f(5) = 376$

Compute $\int_{\frac{3}{2}}^{\frac{9}{4}} \frac{dx}{\sqrt{3x-x^2}}$.

$A = \lim_{h\to 0} \frac{f(1)-f(1-h)}{h}$ for $f(x) = \ln x$

$B = \lim_{h\to 0} \frac{g\left(\frac{\pi}{6}+h\right)-g\left(\frac{\pi}{6}\right)}{h}$ for $g(x) = \cot x$

$C = \lim_{y\to 3} \frac{h(y)-h(3)}{y-3}$ for $h(x) = x^3 + 2x^2 + 3x + 4$

Find $A + B + C$.

Compute $\int_{\frac{\pi}{6}}^{\frac{5\pi}{4}} e^{4x}\cos 5x dx$.