QUESTION 1

Let:

A = the volume of the solid formed by revolving the figure bounded by $y = x^2 - 2x + 4$, $y = 0$, $x = 1$, and $x = 2$ about the x-axis

B = the volume of the solid formed by revolving the figure bounded by $y = -|x - 4| + 3$ and $y = 0$ about the x-axis

C = the volume of the solid formed by revolving the figure bounded by $y = -|x - 4| + 3$, $y = 0$ $x = 1$, and $x = 4$ about the y-axis

D = the volume of the solid formed by revolving the figure bounded by $9x^2 + 4y^2 = 36$ about the x-axis

Find $A + B + C - D$.

QUESTION 2

Let:

$$\begin{aligned}
A &= \lim_{x\to 2} x^3 - 4x^2 + 5x - 6 \\
B &= \lim_{x\to 1} \frac{x^6 + 2x^5 - x - 2}{x^5 - 1} \\
C &= \lim_{x\to 0} \frac{\tan(x)\sin(x)\cos(\frac{\pi}{2} - x)}{x^3} \\
D &= \lim_{x\to \infty} \frac{2^x}{x!}
\end{aligned}$$

Find $A + B + C + D$.

QUESTION 3

Let $f(x) = (\frac{1}{2})^x$ and $g(x) = 2^x$, and:

$$
\begin{aligned}
A &= \text{the left hand Riemann sum of } f(x) \text{ using 21 equal sub-intervals over the domain } [0,\ 21] \\
B &= \text{the left hand Riemann sum of } g(x) \text{ using 21 equal sub-intervals over the domain } [0,21] \\
C &= \text{the midpoint Riemann sum of } f(x) \text{ using 10 equal sub-intervals over the domain } [0,\ 20] \\
D &= \text{the midpoint Riemann sum of } g(x) \text{ using 10 equal sub-intervals over the domain } [0,\ 20]
\end{aligned}
$$

Find $(\frac{A}{B}) \cdot (\frac{D}{C})$.

QUESTION 4

Let:

$$\begin{aligned} A &= \frac{d^2}{dx^2}(\sin x \cos x) \text{ at } x = \frac{\pi}{12} \\ B &= \frac{d}{dx}(x^4 + 8x^3 + 24x^2 + 32x + 16) \text{ at } x = 2 \\ C &= \frac{d}{dx}\left(\frac{(x+3)^4(x+1)^3}{x^2}\right) \text{ at } x = 1 \\ D &= \frac{d}{dx}(x^x) \text{ at } x = 2 \end{aligned}$$

Find $A + \dfrac{C}{B} + D$.

QUESTION 5

Let:

$$\begin{aligned}
A &= \int_2^4 ((x-3)^5 - 5(x-3) + 5)dx \\
B &= \int_0^1 \frac{x-2}{x^2-4x-5}dx \\
C &= \int_1^2 \frac{\ln u}{u^2}du \\
D &= \lim_{n\to\infty} \sum_{i=0}^{n} \frac{n}{i^2+n^2}
\end{aligned}$$

Find $A + 2B + 2C + 4D$.

QUESTION 6

Evaluate:

$$\left(\lim_{n\to\infty}\sum_{i=0}^{n}\frac{\sqrt{n^{1/2}+2i^{1/2}+in^{-1/2}}}{n^{5/4}}\right)\left(\lim_{m\to 0}\sum_{n=0}^{\infty}(-1)^n\frac{m^{2n}}{(2n+1)!}\right)$$

QUESTION 7

Starting with zero, for each of the following summations below, if a series converges absolutely, add 7. If it only converges conditionally, add 3. If it diverges, subtract 2.

$$
\begin{aligned}
I &= \sum_{n=0}^{\infty} (-1)^n \frac{n!}{n^n} \\
II &= \sum_{n=4}^{\infty} \frac{1}{n^2 - 9} \\
III &= \sum_{n=0}^{\infty} (-1)^n \left(\frac{n^2 + 4n + 6}{n^2 + 4n + 5} \right) \\
IV &= \sum_{n=0}^{\infty} (-1)^n \frac{2018^n}{n!} \\
V &= \sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n}
\end{aligned}
$$

Give the final answer.

QUESTION 8

Let $g(x)$ be an odd function and:

	$x=1$	$x=2$	$x=3$	$x=4$
$f(x)$	-1	2	3	2
$f'(x)$	3	2	0	5
$g(x)$	1	-3	4	3
$g'(x)$	1	1	1	3

$$\begin{aligned} A &= \frac{d}{dx}(f(x^2)) \text{ at } x=2 \\ B &= \frac{d}{dx}(g(f(x))) \text{ at } x=1 \\ C &= \frac{d}{dx}(f^{-1}(x)) \text{ at } x=-1 \\ D &= \int_1^{-4} \frac{g'(x)}{g(x)}dx \end{aligned}$$

Find $A+B+3C+D$.

QUESTION 9

Let:

$$\begin{aligned} A &= \text{the maximum area of a triangle formed by the side lengths: } 2x-1,\ 4x-6,\ 9-2x \\ B &= \text{the maximum volume of a parallelepiped determined by vectors } <2,x,-1>, <x+2,0,x-3>, <x+1,3,x> \end{aligned}$$

Find $A+B$.

QUESTION 10

Let $f(x) = (x - 2)(3 - x)$ and $g(x) = x^2 - 4$

A = the average rate of change of $f(x)$ with respect to x over [2,3]

B = the area under $f(x)$ over the domain [2, 3]

C = the volume of the solid formed by revolving the figure bounded by $f(x)$ and the x-axis about the y-axis

D = the volume of the solid formed by creating semicircular cross sections perpendicular to the x-axis in the figure bounded by $g(x)$ and $y = 0$

Find $A + 2B + 4C + 5D$.

QUESTION 11

Josh is a fly (the fly-est kid in school actually) traveling according to the velocity equation $v(t) = -4t^3 + 6t^2 + 2t + 4$. Let:

$$\begin{aligned}
A &= \text{his acceleration at } t = \frac{3}{2} \\
B &= \text{his jerk at } t = 1 \\
C &= \text{his position at } t = 3\text{, given his position at } t = 0 \text{ is } 23 \\
D &= \text{the average rate of change of his velocity from } [0,4]
\end{aligned}$$

Find $A + B + C + D$.

QUESTION 12

Let:

$$\begin{aligned} A &= \text{the maximum volume of a cone inside a sphere of radius 3} \\ B &= \text{the maximum volume of a cylinder inside a sphere of radius 3} \\ C &= \text{the maximum volume of a rectangular prism inside a sphere of radius 3} \\ D &= \text{the maximum volume of a sphere inside of a cube of side length 6} \end{aligned}$$

Find $3A + B + C + D$.

QUESTION 13

Let $f(0) = 4$, $f'(0) = 3$, $f''(1) = 0$, and $f'''(x) = 4$, for all x.

$$\begin{aligned} A &= \text{the value of } f(1) \\ B &= \text{the value of } f'(2) - f''(2) \end{aligned}$$

Find $A + B$.

QUESTION 14

Let:

$$\begin{aligned} A &= \int_{-1}^{1} \frac{x^5 - 23x^3 + 81x}{x^2 + 64} dx \\ B &= \int_{0}^{1} x^2 e^x dx \end{aligned}$$

Find $A + B$.