1.) The Taylor series for a function $f(x)$ about $x = 0$ is given by

$$\sum_{n=1}^{\infty}(-1)^n \frac{x^n}{n+1}$$

a.) Determine the largest interval on which the Taylor series for f converges. Make it clear which, if any, of the endpoints are included in the interval.

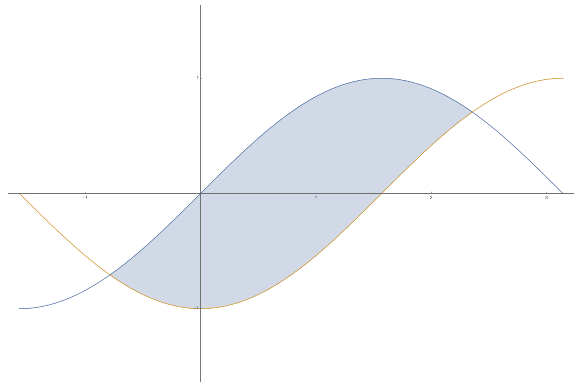
b.) Note that

$$f\left(\frac{1}{2}\right) = -\frac{1}{4} + \frac{1}{12} - \frac{1}{32} + \cdots$$

Show that $f\left(\frac{1}{2}\right) \geq -\frac{1}{4}$ and that $f\left(\frac{1}{2}\right) \leq -\frac{1}{6}$.

c.) Write the Taylor series for the function $g(t) = \int_0^t f(x)dx$ about $x = 0$.

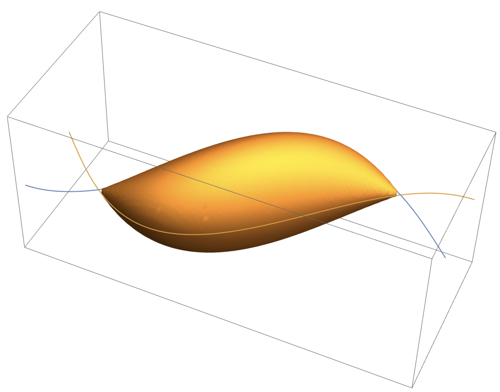
2.) Let R be the region in the plane shown below, bounded by $y = \sin x$ and $y = -\cos x$. The origin is marked with a dot for reference.



a.) Calculate the area of R.

b.) Write an expression involving integrals whose value is the perimeter of R. (**Do not evaluate the integrals.**)

c.) There is a solid in 3-space whose cross-section perpendicular to the x-axis is a disk, centered on the xy-plane, whose boundary touches the edges of R, as shown. Find the volume of this solid.



3.) a.) Find a value a such that $\int_{-\infty}^{a}(1+e^{-x})^{-1}dx = 1$.

b.) Determine whether the series $\sum_{n=1}^{\infty} \frac{1}{\ln(e^n - n)}$ converges.
