1. (10 points each) Determine if the following infinite series converge or diverge. If a series converges, please find its sum.

(a) \[ \sum_{k=0}^{\infty} 5 \left( \frac{2}{3} \right)^k \]

(b) \[ \sum_{k=1}^{\infty} \frac{k}{k + 2} \]
2. (12 points) A vertical dam has a semicircular gate whose diameter is located 10 feet below the surface of the water. The radius of the gate is 2 feet. Find the hydrostatic force on the gate.
3. (10 points) Suppose that a force of 2 Newtons is needed to stretch a spring 12 centimeters beyond its natural length. How much work is done stretching the spring 15 centimeters beyond its natural length?
4. (12 points) Determine whether the sequence below converges or diverges. If it converges, find its limit.

\[ \left\{ (-1)^{n-1} \frac{n}{n^2 + 1} \right\}_{n=0}^{\infty} \]
5. (10 points) Set up but do not evaluate a definite integral for the arc length of the curve 
\( y = x^5 \) for \(-2 \leq x \leq 5\).
6. (12 points) Find the volume of the solid of revolution obtained by rotating the region bounded between the curves $y = x$ and $y = \sqrt{x}$ about the line where $y = 1$. 

![Diagram showing the region of revolution between the curves $y = x$ and $y = \sqrt{x}$ around the line $y = 1$.]
7. (12 points) Set up but do not evaluate a definite integral for the surface area of the solid of revolution generated by revolving \( y = \sqrt[3]{x} \) about the \( x \)-axis for \( 0 \leq x \leq 8 \).
8. (12 points) Find the volume of the solid of revolution obtained by rotating the region bounded between \( y = \sqrt{x} \), the \( y \)-axis, and the line \( x + y = 2 \) around the \( y \)-axis.