1. A tank containing 5 cubic meters of water leaks at a constant rate and is elevated a distance of 10 meters. At the end of the trip, half of the water is present. (The density of water is one kilogram per cubic meter.) What is the minimum amount of work done in elevating the tank?

2. Find the length of \( y = \frac{1}{6}(x^2 + 4)^{3/2} \) on \( 0 \leq x \leq 3 \).

3. Differentiate the following functions:

\[
F(x) = (\ln(x))^x \quad G(x) = x^x \quad H(x) = 10\arcsin(2x) \quad K(x) = x^{\ln(\sec^2 x)}
\]

4. Evaluate

\[
I = \int e^{e^x + x} \, dx \quad J = \int \frac{\tan \theta}{(\ln(\cos \theta))^2} \, d\theta
\]

5. \( f(x) = 2 + \sqrt[n]{x + 4} \). Find \( f^{-1}(x) \).

Challenge problem:

\[
\lim_{n \to \infty} \int_0^1 \sqrt{1 + n^2x^{2n-2}} \, dx
\]