Discussion problems 9

1. A side wall of a swimming pool has a lid of

(a) triangular shape

\[ \begin{array}{c}
6m \\
4m \\
\end{array} \]

(b) circular shape

\[ \begin{array}{c}
6m \\
-2m \\
\end{array} \]

In each case, determine the hydrostatic force acting on the lid.

2. A reservoir is obtained by rotating the curve \( y = x^4 \), \( 0 \leq x \leq 1 \) around the y-axis. (Both and y have units m). It is completely filled with liquid of density \( \rho \). (a) Determine the work needed to pump the liquid out the top of the reservoir. (b) Determine the work needed to lift full reservoir by 10 m (so that its bottom is 10 m higher than originally - assume only the liquid inside the reservoir has mass). (c) Assume now that the liquid is leaking at the constant rate as the reservoir is lifted, so that it is empty by the time it is lifted to 10 m. Determine the work spent.

3. Problem 43 on pg. 491 in the book, replacing \( \pi \) by \( \gamma \), "150 lb/ft" by "30,000 N/m," and "weight-density of 50 lb/ft^3" by "density 1000 kg/m^3." Assume \( g = 10 \text{ m/s}^2 \).

4. Determine the center of mass of the region bounded by \( y = 2x^2 \) and \( y = 0 \), on \( 0 \leq x \leq \frac{3}{2} \).

5. Determine the center of mass for the region bounded by \( y = x^3 \) and \( y = \sqrt{x} \).