Pumping Fluid Examples - ANSWERS

MATH 131: Calculus II, Section 1
March 7, 2014

(1) A tank has the shape of an inverted circular cone with height 10m and base radius 4m. It is filled with water to a height of 8m. Find the work required to empty the tank by pumping all of the water to the top of the tank. (Water has a density 1000 kg/m^3.)

$\frac{3211264\pi}{3}$ J

(2) A tank 5 feet long has cross sections in the shape of a parabola $y = x^2$, for $-2 \leq x \leq 2$ (where x and y are in feet). Suppose that the tank is filled to a depth of 3 feet with liquid weighing 15 lb/ft^3. How much work is required to empty the tank by pumping the liquid over the edge of the tank?

$660\sqrt{3}$ ft-lbs

Pumping Fluid and Surface Area

(3) Find the surface area generated by rotating the curve $y = \frac{1}{3}x^3$ for $0 \leq x \leq 2$ about the x-axis.

$\frac{\pi}{9}(17^{3/2} - 1)$

(4) A trough as drawn on the board is filled with a fluid that has density 100 kg/m^3. Find the work required to pump the fluid out of a pipe two meters above the tank.

$\frac{784,000}{3}$ J

(5) A circular swimming pool has diameter 20 feet and a side height of 5 feet. The depth of the water is 4 feet. If water weighs 62.5 lb/ft^3, how much work is required to pump all of the water out of a tube 2 feet above the pool?

$125,000\pi$ ft-lbs

(6) Find the surface area generated by rotating the curve $y = \frac{x^3}{6} + \frac{1}{2x}$ for $1 \leq x \leq 2$ about the x-axis.

$\frac{47}{16}\pi$