More Work and Pressure

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1 Work:

1) Easy: A mountain climber is about to haul up a 50 m length of hanging rope. If the rope has density .0755 kg/m, how much work does it take?

2) Easy: A rectangular water tank has length 20 ft, width 10 ft, and depth 15 ft. If the tank is full, how much work does it take to pump the water out of the top of the tank? What if the tank is half full? Recall the density of water is 62.5 lb/ft^3.

3) Harder: Consider an inverted right, circular conical tank (so the point of the tank is on the ground) with top radius 10 ft and height 20 ft. Suppose the tank is full of salid oil weighing 57 lb/ft^3. How much work does it take to pump a full tank out of the top? What about a half-full tank?

4) Harder: A bag of sand originally weighing 114 lb was lifted at a constant rate. The sand leaked out at a steady rate, and the sand was half gone by the time the bag had been lifted 18 ft. How much work was done lifting the sand this far?

5) Harder: To design the interior surface of a huge stainless steel tank, you revolve the curve $y = x^2$, $0 \leq x \leq 4$, about the y-axis. The container, with dimensions in meters, is to be filled with seawater, which weighs $10,000$ newtons per cubic meter. How much work will it take to empty the tank by pumping water to the tank's top?

2 Force and Pressure:

1) Easier: A rectangular fish tank of interior dimensions 2 x 2 x 4 ft (with height 2 ft) is filled to within 2 inches of the top with water. Find the force against each side and the bottom of the tank. Recall the density of water is 62.5 lb/ft^3.

2) Easier: A semicircular plate of diamter 2ft is submerged straight down in the water with the diameter on the surface. Find the force exerted by water on one side of the plate. Recall that the density of water is 62.5 lb/ft^3.

3) Harder: A tank truck hauls milk in a 6 ft diameter horizontal right circular cylindrical tank. What is the force on the end of the tank when the tank is half full? Milk has a density of 64.5 lb/ft^3.

4) Harder: Consider a trough in the shape of an inverted triangular prism 30 ft long, 10 ft high, and 8 ft wide (so the cross section is an isosceles triangle with base 8 ft and height 10 ft.) Recall the density of water is 62.5 lb/ft^3. The end plates were designed to withstand a force of 6667 lb. How many cubic feet of water can the tank hold without exceeding the design limitations?