

Practice on Work Problems
Math 112
Fall 2009

1. A worker on a scaffolding 75 ft above the ground needs to lift a 500 lb bucket of cement from the ground to a point 30 ft above the ground by pulling on a rope weighing 0.5 lb/ft. How much work is required?
Answer: 15,900 ft-lbs.
2. An anchor weighing 100 lb in water is attached to a chain weighing 3 lb/ft in water. Find the work done to haul the anchor and chain to the surface of the water from a depth of 25 ft.
Answer: 3437.5 ft-lbs
3. A bucket of water of mass 20 kg is pulled at constant velocity up to a platform 40 meters above the ground. This takes 10 minutes, during which time 5 kg of water drips out at a steady rate through a hole in the bottom. Find the work needed to raise the bucket to the platform.
Answer: 6860 joules
4. 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 all the water out? (Water weighs 62.4 lb/ft³.)
Answer: 1,404,000 ft-lbs
5. A water tank is in the form of a right circular cylinder with height 20 ft and radius 6 ft. If the tank is half full of water, find the work required to pump all of it over the top rim. (Water weighs 62.4 lb/ft³.)
Answer: 1,058,591.1 ft-lbs
6. Suppose the tank in the above Problem is full of water. Find the work required to pump all of it to a point 10 ft above the top of the tank.
Answer: 2,822,909.50 ft-lbs
7. Water in a cylinder of height 10 ft and radius 4 ft is to be pumped out. Find the work required if
 - (a) The tank is full of water and the water is to be pumped over the top of the tank.
 - (b) The tank is full of water and the water must be pumped to a height 5 ft above the top of the tank.
 - (c) The depth of water in the tank is 8 ft and the water must be pumped over the top of the tank.

Answer:

- (a) 156,828 ft-lbs
- (b) 313,656 ft-lbs
- (c) 150,555 ft-lbs

8. A gas station stores its gasoline in a tank under the ground. The tank is a cylinder lying horizontally on its side. (In other words, the tank is not standing vertically on one of its flat ends.) If the radius of the cylinder is 4 feet, its length is 12 feet, and its top is 10 feet under the ground, find the total amount of work needed to pump the gasoline out of the tank. (Gasoline weighs 42 lb/ft^3 .)

Answer: 354,673 ft-lbs