

1. Water is to be raised from a well 40 feet deep by means of an old oaken bucket attached to a rope. When the bucket is full of water, it weighs 30 pounds. However, the bucket has a hole in it that causes it to lose water at a rate of $\frac{1}{4}$ a pound per second (assume that the bucket will be raised at a uniform rate of 5 feet per second). Neglecting the weight of the rope, find the work done in raising the bucket.

2. How much work is required to raise a 1 kilogram object 50 meters using a cord which has a mass of 9 grams per meter? Oh, and you should assume that you are on the moon (where the acceleration due to gravity is only $1.6 \frac{m}{sec^2}$) and that you are standing on a ledge 150 meters above the object.

3. a 20-lb monkey is attached to a 50-ft chain weighing .5 lb/ft. The other end of the chain is attached to the 40-ft high ceiling of the monkey's cage. Find the amount of work done by the monkey in climbing up her chain to the ceiling.

4. A gas station stores its gasoline in a tank under the ground. The tank is spherical with a radius of 4 feet and the top of the tank is 10 feet under the ground, find the total amount of work needed to pump all of the gasoline out of the tank (assume that the density of gasoline is $\rho = 45\text{lb}/\text{ft}^3$).

5. Suppose a 1.5-meter rod has density $\rho(x) = x^3 - 4x + 6$ grams per meter, x meters from the left end of the rod. Find both the mass and the center of mass of this rod *exactly*.
6. Half of a uniform circular disc of radius one meter lies with diameter on the y -axis and center at the origin. The mass of the disc is 1 kg. Find the location of its center of mass.