

## WORK

1. A water tank has the shape of a sphere with a diameter of 10ft. If the depth of the water in the tank is 7ft, what percent of the water is left?

If a constant force  $F$  moves an object a distance of  $x$ , then the work done is  $W = F \cdot x$ . If the force varies with the position of the object then the work done is instead

$$W = \int_a^b F(x)dx$$

2. Suppose you are in a treehouse 20ft above the ground and you have lowered a bucket to the ground so that your parents can send your lunch up to you. Together your lunch and the bucket weigh 3lbs and the rope weighs 0.5 lbs/ft. How much work will it take to pull your lunch up to the treehouse?

Robert Hooke (1635-1703) is known for first using the word “cell” in biology, arranging London’s streets in a grid after the Great Fire in 1666, and for Hooke’s law of springs: “as the extension, so the force.” Put more clearly, the force required to stretch (or compress) a spring  $x$  units beyond its natural length is proportional to  $x$ . Thus  $F = kx$  for some constant  $k$  (called the **spring constant**).

3. A force of 8 N is needed to stretch a spring 2 cm beyond its natural length.
  - a) Find the spring constant.
  - b) How much work does it take to stretch the spring 5 cm beyond its natural length?
  - c) Give a function  $W(x)$  for the work required to stretch the spring  $x$  cm beyond its natural length.