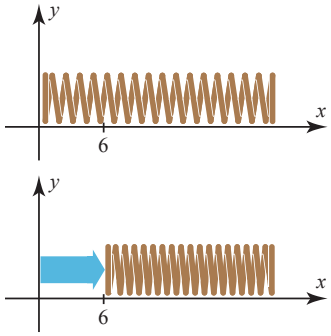
1. Five pounds of force is required to compress a spring six inches.

(a) How much work is done in compressing the spring six inches?

(b) How much work will be done in compressing the spring an additional six inches?



2. A 10-foot chain weighing 2 lbs per linear foot is coiled up on the floor.

(a) How much work is done in lifting one end of the chain to a height of 6 feet?

(b) How much work is done in lifting the end of the chain to a height of 13 feet?

3. A rectangular tank with a base of 4 feet by 3 feet and a height of 10 feet is filled with water that weighs 62.4 lbs per cubic foot.

(a) How much work is done in pumping half of the water out over the top edge?

(b) How much work is done is pumping all of the water out over the top edge?

4. A fuel tank in the shape of a cone is 4 m high and 6 m across the top. If the fuel weighs 10,000 N per cubic meter, how much work is done in pumping all of the fuel to an engine 3 m above the tank?

5. Find the work required to propel a 3-ton satellite 500 miles above the Earth (assume the radius of the Earth is 4000 miles)?

1. (a) $\displaystyle\int_0^6 \frac{5}{6}\,dx = 15$ in-lbs $= \frac{5}{4}$ ft-lbs

(b) $\displaystyle\int_6^{12} \frac{5}{6}\,dx = 45$ in-lbs $= \frac{15}{4}$ ft-lbs

2. (a) $\displaystyle\int_0^6 2y\,dy = 36$ ft-lbs

(b) $\displaystyle\int_0^{10} 2y\,dy + (20)(3) = 160$ ft-lbs

3. (a) $62.4\displaystyle\int_5^{10} 12(10-y)\,dy = 9{,}360$ ft-lbs

(b) (a) $62.4\displaystyle\int_0^{10} 12(10-y)\,dy = 37{,}440$ ft-lbs

4. (a) $10000\displaystyle\int_0^4 \pi\left(\frac{3}{4}y\right)^2\,dy = 480{,}000\pi$ N-m

5. $\displaystyle\int_{4000}^{4500} \frac{3(4000)^2}{y^2}\,dy = \frac{4000}{3}$ mile-tons