A force of 100lb is required to stretch a spring 4 inches beyond its natural length. How much work is done stretching it from its natural length to 6 inches beyond its natural length

$f = kx$

$100lb = k \cdot 4in$

$k = 25\ lb/in$

$W_i = f_i \cdot \Delta x_i$

$= k x_i \cdot \Delta x_i$

$= 25 x_i \Delta x_i$

$W = \int_0^6 25x\,dx$

$= 25 \int_0^6 x\,dx$

$= 25\left(\frac{1}{2}x^2\Big|_0^6\right)$

$= 25\left(\frac{1}{2} \cdot 36\right)$

$= 450$

Suppose that 2J of work is required to stretch a spring from its natural length of 30 cm to a length of 42 cm.

How much work is needed to stretch it from 35 cm to 40 cm.

$W = \int_a^b f(x)\,dx$

$$2 = \int_0^{0.12} kx\,dx$$

$$2 = k\int_0^{0.12} x\,dx$$

$$2 = k\left(\tfrac{1}{2}x^2\Big|_0^{0.12}\right)$$

$$2 = k\left(\tfrac{1}{2}\cdot 0.12^2\right)$$

$$k = \frac{2500}{9}$$

$$W = \int_{0.05}^{0.1} \frac{2500}{9}\,x\,dx$$

$$= \frac{2500}{9}\int_{0.05}^{0.1} x\,dx$$

$$= \frac{2500}{9}\left(\tfrac{1}{2}x^2\Big|_{0.05}^{0.1}\right)$$

$$= \frac{2500}{9}\cdot\frac{1}{2}\left(0.1^2 - 0.05^2\right)$$

$$= \frac{25}{24}$$

Find the work to empty an inverted conical tank if the water starts 1 m down and the cone is 12 m tall and the radius is 2m by pumping all of the water out a spout located 3m above the tank.

Density of water = $1000\ kg/m$

Gravity = $9.8\ m/s^2$

$$P = 1000(9.8) = 9800$$

$$W = \int_a^b P\,A(y)(h-y)\,dy$$