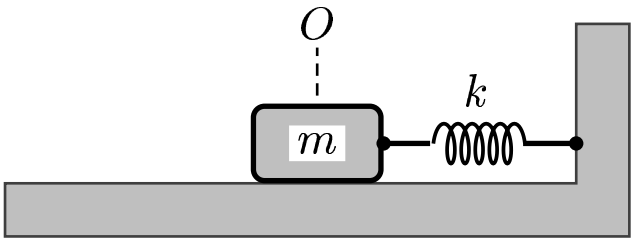
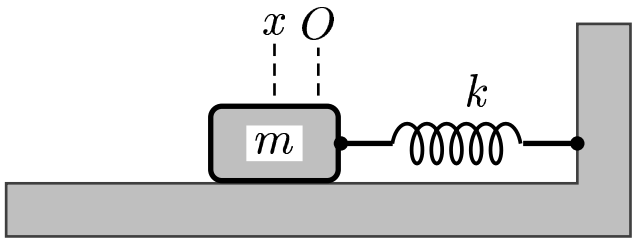
Consider a mass-spring system. The spring force is governed by Hooke's law $F_{spring} = -k\,x$. Denote the potential energy of the spring by $U(x)$. At O $(x = 0)$, the spring is relaxed, and the potential energy $U(0) = 0$.





At x, $U(x)$ represents the work done against the spring force in going from O to x, which is given by

A) $U(x) = -k\,x^2$.

B) $U(x) = +k\,x^2$.

C) $U(x) = +\int_0^x k\,x\,dx$.

D) $U(x) = -\int_0^x k\,x\,dx$.

The force against the spring is $-F_{spring} = k\,x$.

So work done against the spring force from $x = 0$ to x is given by $U(x) = +\int_0^x k\,x\,dx = \frac{1}{2}\,k\,x^2$.

Answer **C**.