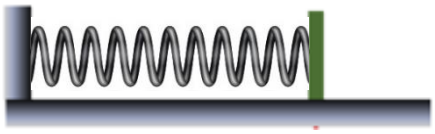
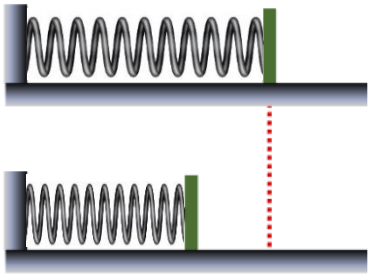
CONCEPT: Hooke's Law & Springs

● When you push/pull against a spring (F_A), spring pushes back in the _____ direction. (Action-Reaction!)

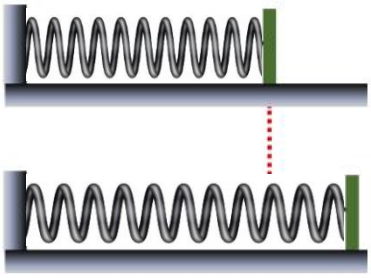


$F_S = -F_A =$ _____ → $|F_s| = |F_A| =$ _____

Ex. 1: You push on a spring with a force of 120N. The spring constant k is 20. How much does it compress?



Ex. 2: How much force is required to pull a spring of length 10m out to 16m, if the spring constant k is 40N/m?



● **x = D**_____

- Relaxed position → _____ (x = ___)
- **NOT** the spring's length → (x = _____)

● **k =** spring's force constant

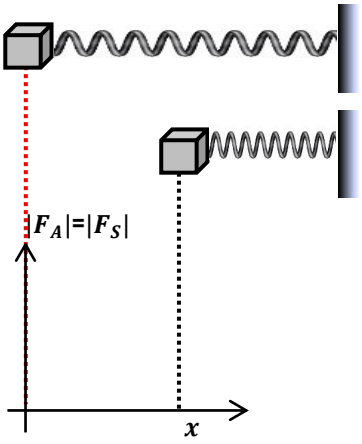
- Measures how _____ the spring is.
- Higher **k** → _____ to deform
  - Ex. 1: **x** = **k** = **F** =
  - Ex. 2: **x** = **k** = **F** =
- Units of **k**: _____

● F_S **= R**_____ force, always opposes deformation

CONCEPT: WORK DONE BY SPRINGS

- For **CONSTANT** Forces only, we calculate Work using **W=Fdcosθ**
  - For **VARIABLE** (i.e. not constant) Forces, we use the _____ of the Force instead ⇒ W_{Var} = _____$\Delta x cos\theta$
- The most common variable force you'll see is the **Spring** Force (Hooke's Law) ⇒ $F_s = -F_A = -kx$
  - Work Done BY SPRING when compressing: $W_S = -W_{F_A}$ = _____

EXAMPLE: You push a light box attached on a spring with a spring constant k = 500N/m. If you compress the spring by 2m, **(a)** write an expression for the work done by your push and the spring; **(b)** Calculate the work done by you & the spring.



PROBLEM: It takes 200 J of energy to compress a 1.0 m-long spring to 70 cm. How much additional work would you have to do to compress this same spring from 70 cm to 50 cm?

WORK & ENERGY
$KE = \frac{1}{2}mv^2$
$W = Fd\cos\theta$
$W_g = -mg\Delta y$
$W_{FA} = -W_s = -\frac{1}{2}k\Delta x^2$
$W_{NET} = \Sigma W = F_{NET}d\cos\theta = \Delta K$

● In general, the work done ON or BY a spring between two points **A→B:** $W_{s,A\to B}$ = _____