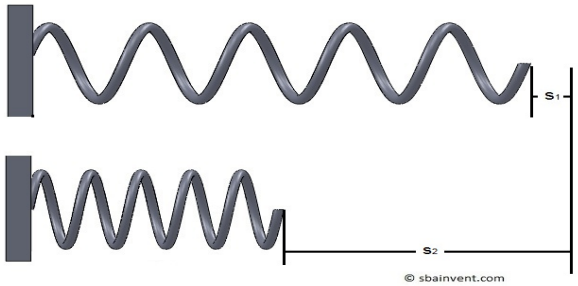
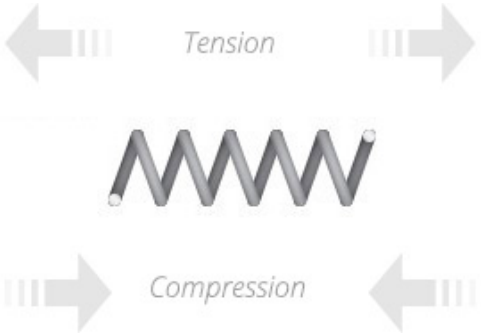
Forces from Springs

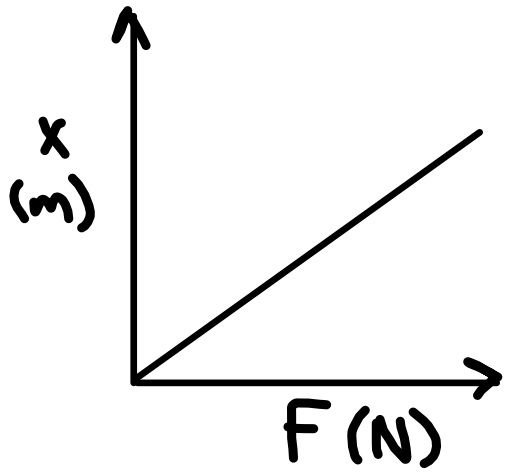
1. Students will understand how springs exert forces when compressed or stretched.
2. Students will understand and be able to apply Hooke's Law.
3. Students will know how Hooke's Law can be combined with Newton's 2nd law (and the friction equation) to solve static and dynamics problems.





All objects deflect (stretch or compress) when forces are applied to them.

Springs deflect in a nearly linear fashion so they are easy to account for in equations involving forces.



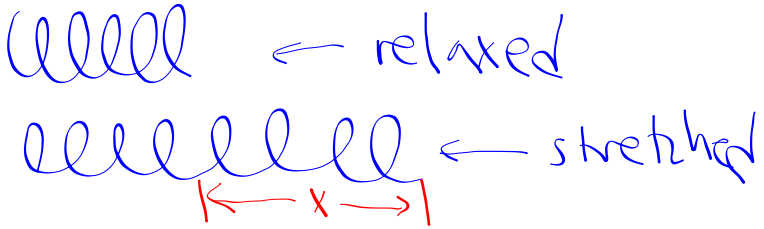
Hooke's Law expresses the linear relationship between force (both applied and from the spring!).

$$F_{spring} = kx$$

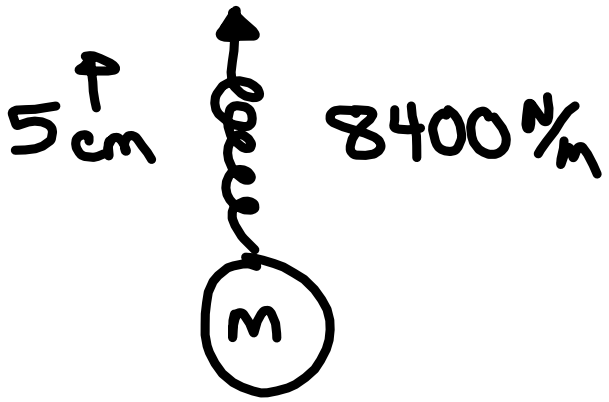
x = the deflection of spring

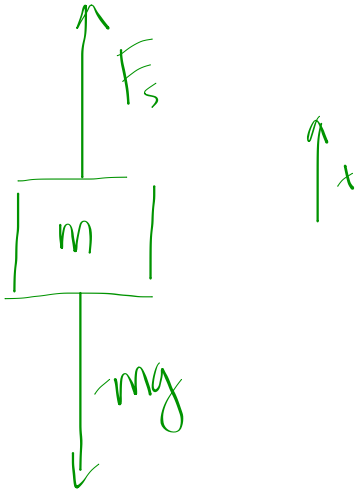
the amount (in cm, inches, m, etc.) that the spring is squished or stretched.

k = spring constant (N/m, N/cm, lb/in, etc...) This is unique for each spring



Example 1: (Static Equilibrium)





What is m?

$F_s = kx$

$= 8400\ N/m \cdot 5\ cm \cdot \frac{1\ m}{100\ cm}$

$= 420\ N$

$\Sigma F = ma = 0$

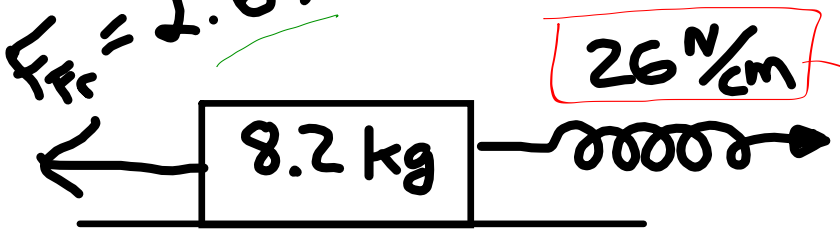
$F_s + -mg = 0$

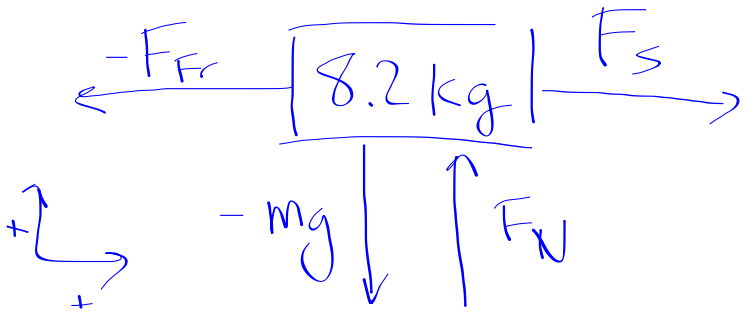
!

EXAMPLE 2 (Static Equilibrium)

$F_{Fr} = 2.6\,N$

What is x?





$\Sigma F_x = ma_x = 0$

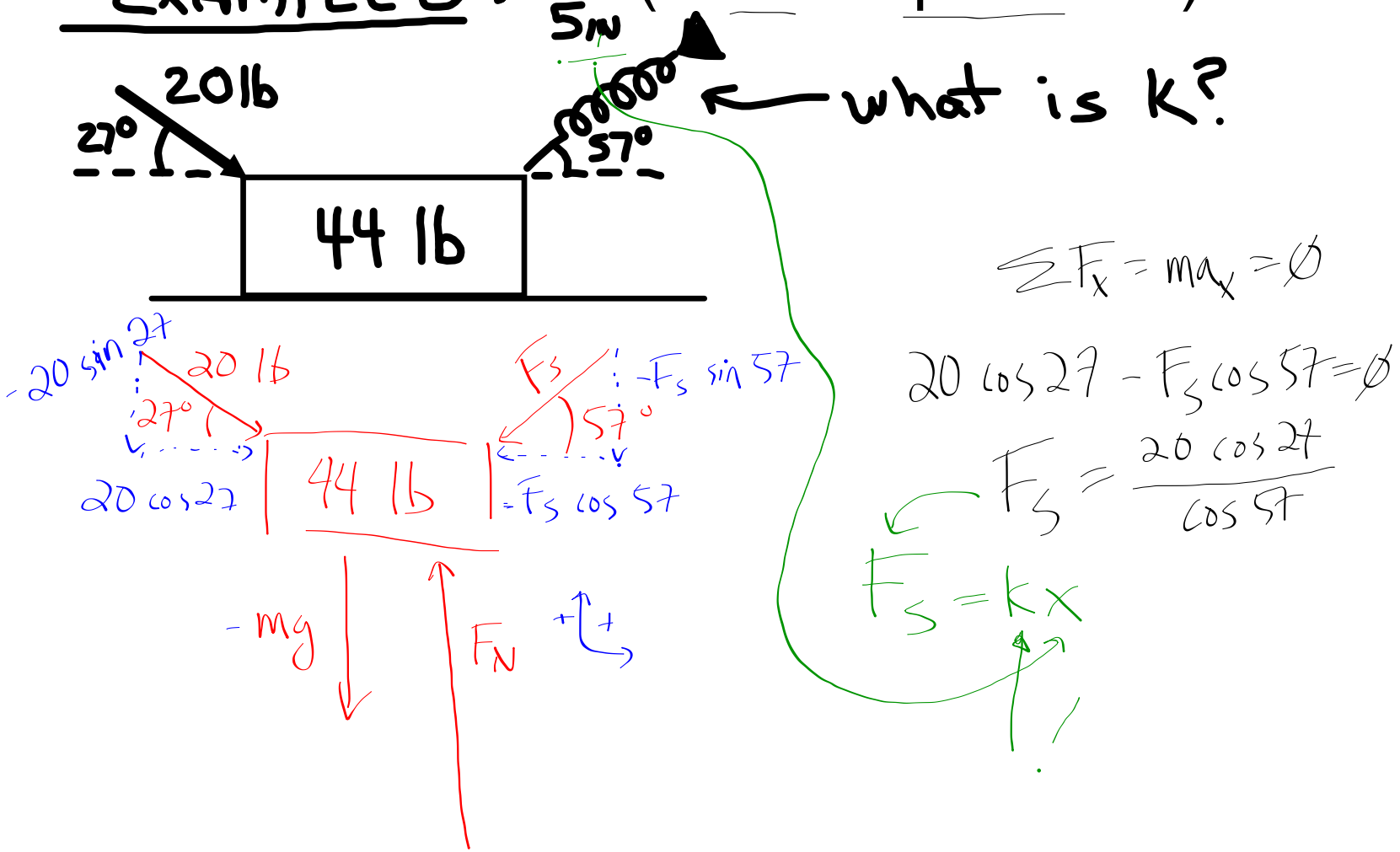
$-F_{Fr} + F_S = 0$

$-2.6 + F_S = 0$

$F_S = 2.6$

$F_S = kx$

Example 3: (Static Equilibrium)



$$\Sigma F_x = ma_x = 0$$

$$20\cos 27 - F_s \cos 57 = 0$$

$$F_s = \frac{20\cos 27}{\cos 57}$$

$$F_s = kx$$