# Forces and Inclines

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## 1 Review of Spring Force

The spring force is $\vec{s} = -k\Delta\vec{x}$. That is, the force is directly proportional to the *change* in length. Use the given weights, spring, ruler and hook to measure the spring constant $k$ for your spring. That is, after drawing an appropriate free-body diagram, we find that

$$|mg| = k|\Delta x| \tag{1}$$

Solving for $k$:

$$k = \frac{mg}{\Delta x} \tag{2}$$

The constant $k$ has units of Newtons per meter. Enter your data and corresponding value for $k$ below:

## 2 Inclined Surfaces

Now place your weights on the ruler and align the spring with the ruler such that the ruler serves as an *inclined plane* for the weights. Use enough weight so that you can observe the increase in length of the spring, even when the spring is nearly horizontal. Draw a free-body diagram for the weight attached to the spring:

## 3 Net Force on Weight

The ruler should be providing a normal force $N = mg\cos\theta$ to keep the weights on the ruler. The net force *down the ruler* should be $F_{net} = mg\sin\theta$, where $\theta$ is the angle between the ruler and the table. Use the protractor to measure the angle between the ruler and the table. Create a graph below of the $\Delta x$ (change in length) of the spring versus $\theta$. Does it follow the expected $\sin\theta$ dependence?