PHYS 2125 Lab 4: Hooke's Law

Statics · November 11, 2026

SUMMARY

A spring is loaded with 50–**300 g** and its extension measured, then force (F = mg) is plotted against extension so the slope gives the spring constant k. The least-squares fit gives k = 24.5 ± **0.4 N/m** with $r^2 = 0.999$ and an intercept consistent with zero.

1. Plot force vs extension

Graph below: F (N) on the y-axis vs x (m) on the x-axis. The six points fall on a straight line, F = (**24.47 N/m**)x − **0.015 N**, $r^2 = 0.9990$.

1. Convert mass to force: F = mg with g = 9.81 m/s² and m in kg. 50 g = 0.050 kg gives F = 0.050 × 9.81 = 0.4905 N.
2. F values: 0.4905, 0.981, 1.4715, 1.962, 2.4525, **2.943 N**.
3. Slope = Sxy/Sxx = 17.192/70.268 = 0.24466 N/cm = 24.47 N/m.
4. $r^2 = Sxy^2/(Sxx \cdot Syy) = 0.9990$

2. Find spring constant k from the slope

$$k = 24.5 \text{ N/m (slope } 24.47 \text{ N/m)}$$

1. Hooke's law F = kx means the slope of F vs x is k.
2. Rounded to the precision justified by the uncertainty: k ≈ 24.5 N/m.

Data

m (g)	x (cm)	F (N)
50	2.1	0.4905
100	4.0	0.981
150	6.2	1.4715

Conclusion

The spring obeys Hooke's law over this range with **k = 24.5 N/m**.