Student: Sean Villegas **Date:** 06/14/25	**Instructor:** Patrick Mitchell **Course:** MATH-04B-12830 (Summer 2025)	**Assignment:** 6.5 Homework - Work

It takes 1000 J of work to stretch a spring from its natural length of 1 m to a length of 2 m. Find the force constant of the spring.

Hooke's Law describes the relationship between the force, F, applied to a spring with spring constant k and the amount that the spring stretches, x. Symbolically, Hooke's Law is $F = kx$.

The work done by a variable force stretching a spring is $W = \int_a^b F(x)dx$, where a represents the distance between the initial length and the natural length, and b represents the distance between the final length and the natural length. In this exercise a and b are, respectively, 0 and 1.

Since $W = \int_a^b F(x)dx$, $F(x) = kx$, $a = 0$ m, and $b = 1$ m, $W = \int_0^1 kx\,dx = \left[\frac{1}{2}kx^2\right]_0^1$.

So, $W = 1000 = \left[\frac{1}{2}kx^2\right]_0^1 = \frac{1}{2}k(1)^2 = \frac{1}{2}k$.

Thus, the spring's force constant, k, is 2000 N/m.