

Final Exam Problem 04: Chapter 05

The problem below has been analyzed to determine which skills should be demonstrated in the solution.

The rod shown has a length $L = 4\text{ft}$, and is pinned at its end O . The attached spring has a stiffness $k = 50\text{lb/ft}$, and an unstretched length $l_0 = 2\text{ft}$. The spring is unstretched when $\theta = 0^\circ$.

- A) Draw the free body diagram for rod OC . Do this carefully and pay attention to the various angles!

Skill: Visual representation of force systems

- B) Calculate the spring force $F = k\Delta l$ by determining the stretched length l of the spring in the position shown.

Skill: Applying the equation for the spring force, $F = k(l - l_0)$

Skill: The geometry is not a right triangle, so Law of Cosines is required to find the stretched length l of the spring

- C) Determine the tension T in the cord when the system is in equilibrium at 45° (Hint: You'll need to solve for the spring angle θ !).

Skill: Again, it's not a right triangle, so Law of Sines is the fastest way to find the angle θ

Skill: Choosing an appropriate point for summing the moments; choosing O eliminates the unknown reaction force

Skill: Writing the moment equation and consistently applying a sign convention

Skill: Algebraically solving for the tension T , or correctly using a solver

- D) Determine the reaction force \vec{R} at point O .

Skill: Force summation

Skill: Solving a system of equations

Skill: Using correct vector notation to write the final answer

