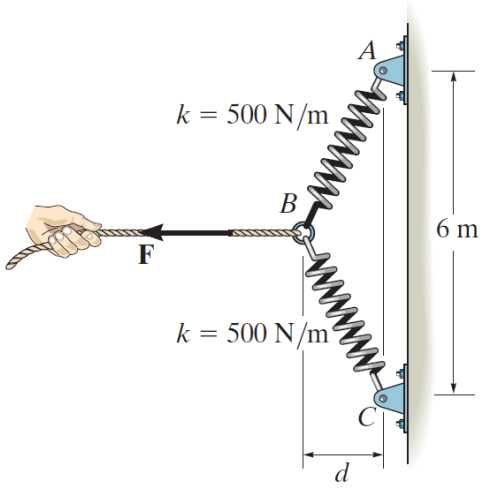
Problem 3-22

The springs BA and BC each have a stiffness of 500 N/m and an unstretched length of 3 m. Determine the horizontal force **F** applied to the cord which is attached to the small ring B so that the displacement of AB from the wall is $d = 1.5$ m.



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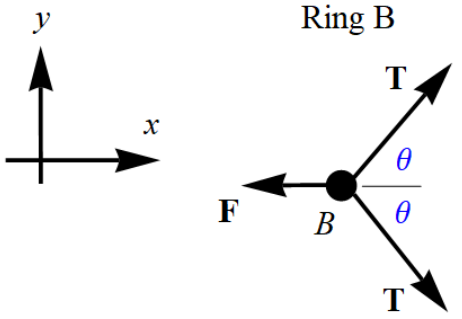
Solution

Draw a free-body diagram for the ring at B.



In order for the system to be in equilibrium, the sum of the forces in each direction must be zero.

$$\sum F_x = 0: \qquad T\cos\theta + T\cos\theta - F = 0$$

$$\sum F_y = 0: \qquad T\sin\theta - T\sin\theta = 0$$

Solve for F in the first equation.

$$F = 2T\cos\theta = 2(k\Delta x)\cos\theta = 2\left[500\left(\sqrt{3^2 + 1.5^2} - 3\right)\right]\cos\theta \approx 158 \text{ N}$$

θ is found from trigonometry.

$$\tan\theta = \frac{3}{d} = 2 \quad \rightarrow \quad \theta = \tan^{-1}(2) \approx 63.4^\circ$$