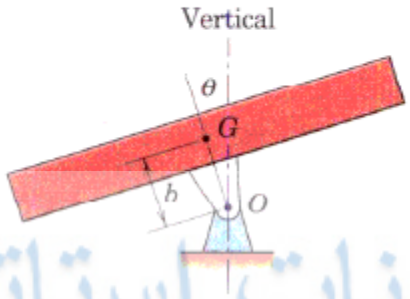
**1** The bar of mass $m$ with center of mass at $G$ is pivoted about a horizontal axis through $O$. Prove the stability conditions for the two positions of equilibrium.

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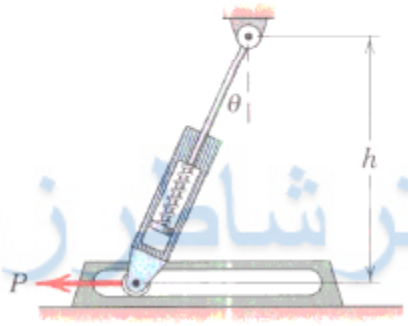
**2** Determine the force $P$ required to maintain equilibrium of the spring-loaded mechanism for a given angle $\theta$. The spring has a stiffness $k$ and is uncompressed at $\theta = 0$. The mass of the parts may be neglected.

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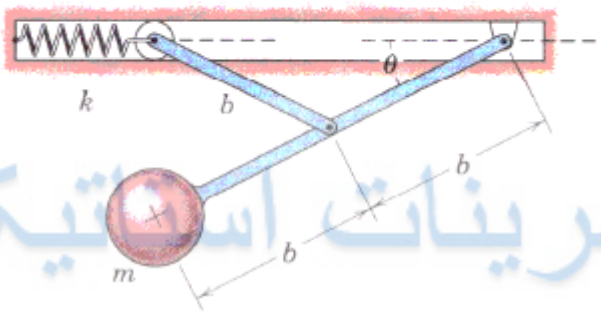
**3**

For the device shown the spring would be unstretched in the position $\theta = 0$. Specify the stiffness $k$ of the spring which will establish an equilibrium position $\theta$ in the vertical plane. The mass of the links is negligible compared with $m$.

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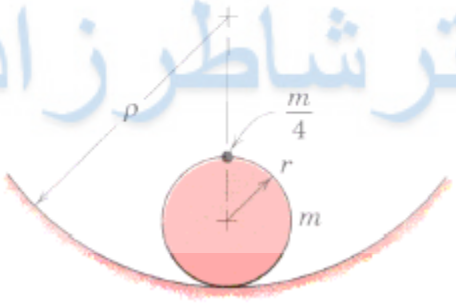
**4**

The cylinder of mass $m$ and radius $r$ rolls without slipping on the circular surface of radius $\rho$. Attached to the cylinder is a small body of mass $m/4$. Determine the maximum value of $\rho$ for which the body is stable in the equilibrium position shown.

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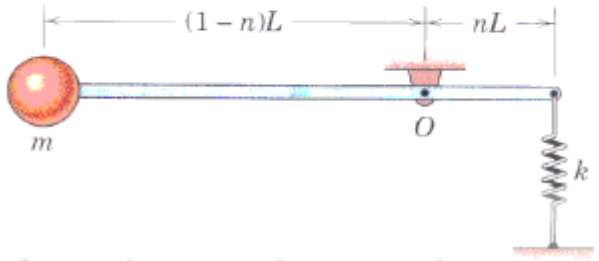
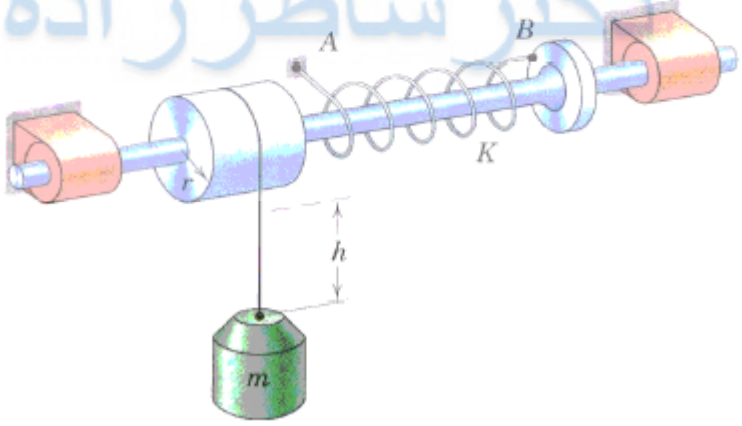
**5**

The system of freely pivoted light bar, end mass $m$, and spring of stiffness $k$ is shown in its equilibrium configuration. The parameter $n$ is a fraction which lies in the range $0 < n < 1$. Show that the system is stable for all values of $n$ in the permitted range.

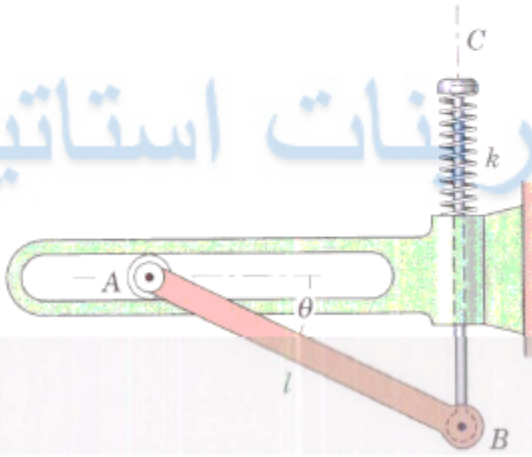



**6**

One end of the torsion spring is secured to the ground at $A$, and the other end is fastened to the shaft at $B$. The torsional stiffness $K$ of the elastic spring is the torque required to twist the spring through an angle of one radian. The spring resists the moment about the shaft axis caused by the tension $mg$ in the cable wrapped around the drum of radius $r$. Determine the equilibrium value of $h$ measured from the dashed position, where the spring is untwisted.



The uniform link $AB$ has a mass $m$, and its left end $A$ travels freely in the fixed horizontal slot. End $B$ is attached to the vertical plunger, which compresses the spring as $B$ falls. The spring would be uncompressed at the position $\theta = 0$. Determine the angle $\theta$ for equilibrium (other than the impossible position corresponding to $\theta = 90°$) and designate the condition which will ensure stability.

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