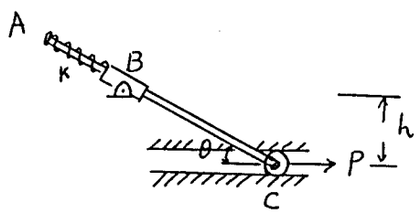
1. The rod AC is free to slide in the pivoted collar at B. The end C is constrained by the roller to move horizontally. The spring is unstretched when AC is vertical. Show that the equilibrium position is defined by the equation:

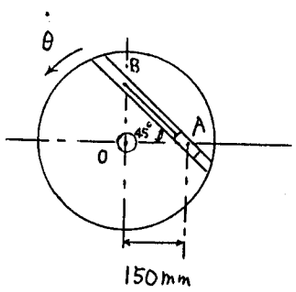
$\frac{P}{Kh}\tan\theta + \sin\theta = 1$, where K is spring constant

(Using the principle of virtual work)



(20%)

2. The 3-kg slider A fits loosely in the smooth 45° slot in the disk, which rotates in a horizontal plane about its center O. If A is held in position by a cord secured to point B, determine the tension T in the cord for a constant rotational velocity $\dot{\theta}$ = 300 rev/min.



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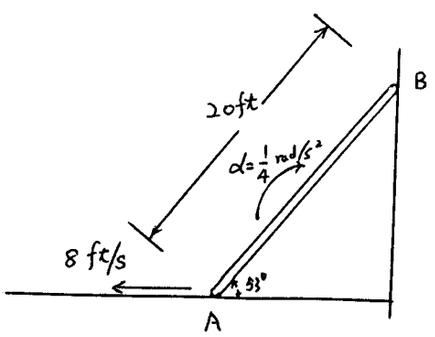
3. At the instant shown, the ladder has an angular acceleration of 1/4 rad/sec^2 clockwise and end A is moving to the left at 8 ft/sec. Determine the acceleration of end A; end B remains in contact with the wall.



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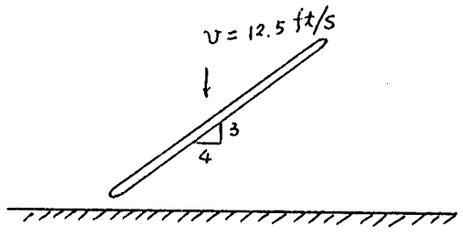
4. Both ends of the 5-ft uniform pole have a vertical velocity of 12.5 ft/sec as end A strikes the floor. If the impact is perfectly plastic, determine the velocity with which end B hits the ground.



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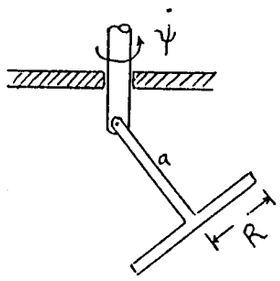
5. A thin disk of radius "R" and mass m has a stem of length "a" which is pinned to a vertical shaft as shown. Show that

(a) If $R < 2a$ at $\dot{\psi}^2 > \frac{4ga}{4a^2-R^2}$, it will be unstable.

(b) It will be stable at all values of angular velocity $\dot{\psi}$ if $R > 2a$.



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