

- [1] (15%) A cylinder 1 m in diameter and of 10 kg mass is lodged between the cross pieces which make an angle of 60° with each other as shown in Figure 1. Determine the tension in the horizontal rope DE assuming a smooth floor.

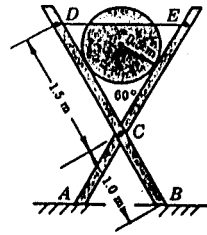


Figure 1

- [2] (10%) Calculate the forces in members AB, BH, and BG, as shown in Figure 2. Members BF and CG are cables which can support tension only.

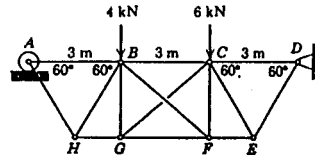


Figure 2

- [3] (15%) In Figure 3, the two identical gears turn about frictionless pivots. A weightless 0.8 m bar rigidly attached to the gear holds the 100 N weight. The other gear is attached to a vertical spring with constant $k = 1,800$ N/m. Determine the angle(s) θ for equilibrium.

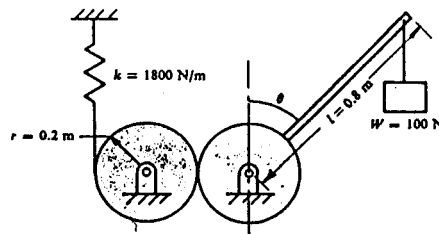


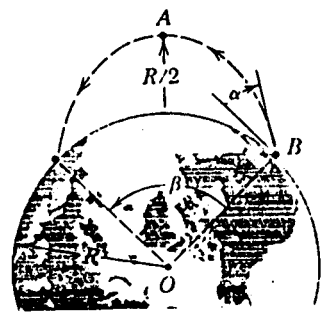
Figure 3

[4] (15%) Please explain the following terminologies

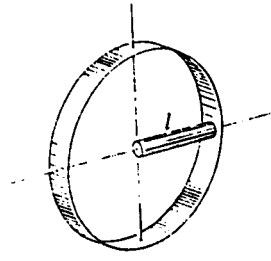
- (1) time
- (2) inertia
- (3) inertial force
- (4) energy
- (5) D'Alembert principle

[5] (5%) Please explain why the inertial force is fictitious force.

[6] (15%) Please compute the magnitude of the necessary launch velocity and angle α at Taipei if the missile trajectory is to intersect the earth's surface at Moscow such that the angle β equals 100° . The altitude at the highest point of the trajectory is $0.5R$.



[7] (15%) A uniform rod of length l and mass m is secured to a circular hoop of radius l as shown. The mass of the hoop is negligible. If the rod and hoop are released from rest on a horizontal surface in the position illustrated, determine the initial values of the friction force F and normal force N under the hoop if friction is sufficient to prevent slipping.



[8] (10%) A jet transport with a landing speed of 200 km/h reduces its speed to 60 km/h with a negative thrust R from its jet thrust reversers in a distance of 425 m along a runway with constant deceleration. The total mass of the aircraft is 140 Mg with mass center at G . Compute the reaction N under the nose wheel β toward the end of the braking interval and prior to the application of mechanical braking. At the lower speed aerodynamic forces on the aircraft are small and may be neglected.

