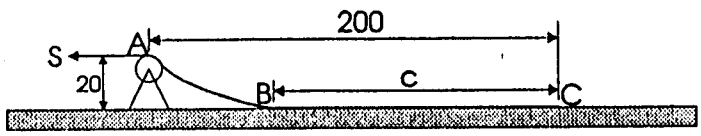
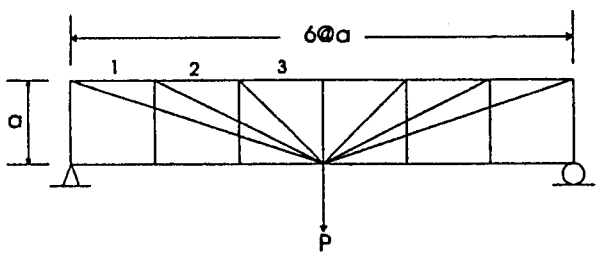
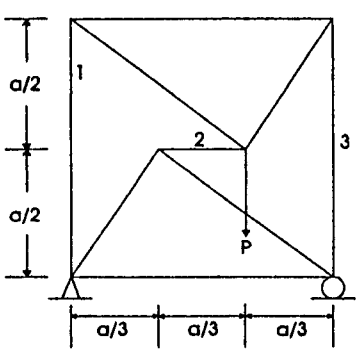
1. A flexible cable of uniform weight per unit length rests partly on a horizontal plane and passes over a small pully at A. By gradually increasing the force S applied to the end of the cable, the length of contact BC with the plane diminishes to a certain limiting value c at which sliding of the cable along the plane impends. Find this limiting value c if the coefficient of friction between the cable and the plane is μ=0.5. (10%)



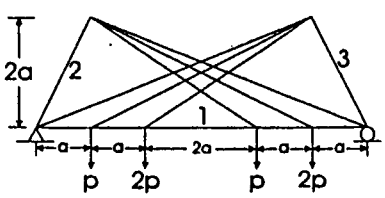
2. Find the forces produced in bars 1, 2, and 3 of the trusses shown below. (30%)



(a)



(b)

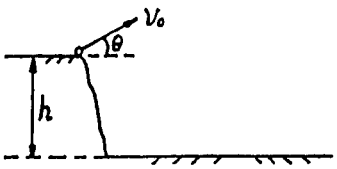


(c)

(20%) 3. A cannonball is fired from the edge of a cliff of height h with an initial velocity v_0, at an angle θ with the horizontal. Neglecting air resistance, find :

(a) the greatest elevation *above the ground* reached by the cannonball,

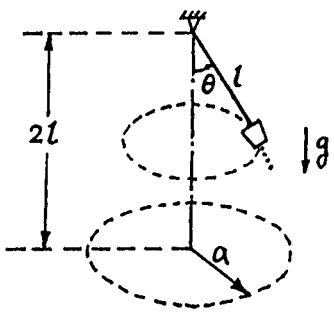
(b) the *horizontal* distance from the gun to the point where the cannonball hits the ground.



(20%) 4. A bucket is attached, as shown below, to a rope of length l and is made to revolve in a horizontal circle with a constsnt speed v.

(a) Determine the angle θ between the rope and the vertical.

(b) Water drops leaking from the bucket fall and hit the floor along a circle of radius a. Find a in terms of l, v, θ, and g.



(20%) 5. On a horizontal surface, particle A of mass m collides at velocity v_A with particle B of mass m which is initially at rest. Particle B then slides along the rough surface which has a coefficient of sliding friction μ and comes to rest in the distance $d = v_A^2 / (8\mu g)$. Find :

(a) the velocities of particles A and B *after* collision,

(b) the *coefficient of restitution* and the energy loss *due to collision*.