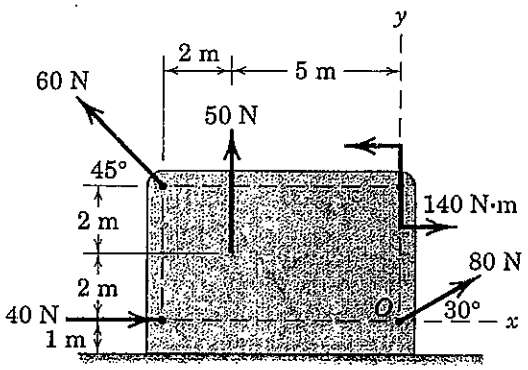
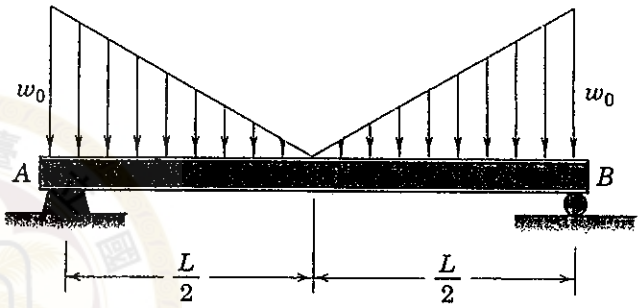
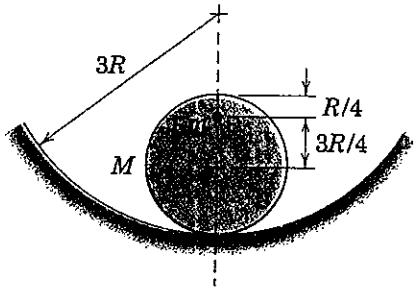
(一). Determine the resultant of the four forces and one couple which act on the plate shown. (10 分)



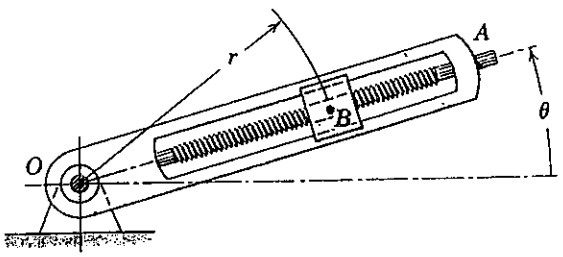
(二). Draw the shear and moment diagrams for the beam loaded as shown. Specify the maximum moment M_{max}. (20 分)



(三). The cylinder of mass M and radius R rolls without slipping on the circular surface of radius $3R$. Attached to the cylinder is a small body of mass m. Determine the required relationship between M and m if the body is to be stable in the equilibrium position shown. (20 分)



(四). Rotation of the radially slotted arm is governed by $\theta = 0.2t + 0.02t^3$, where θ is in radians and t is in seconds. Simultaneously, the power screw in the arm engages the slider B and controls its distance from O according to $r = 0.2 + 0.04t^2$, where r is in meters and t is in seconds. Calculate the magnitudes of the velocity and acceleration of the slider for the instant when $t=3s$. (15 分)



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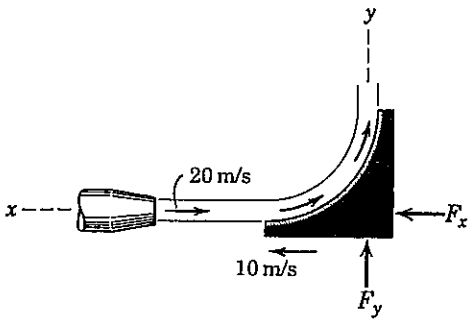
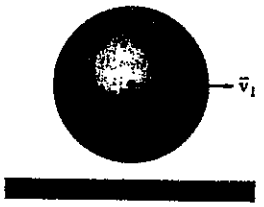
(五). The 90° vane moves to the left with a constant velocity of 10 m/s against a stream of fresh water issuing with a velocity of 20 m/s from the 25-mm-diameter nozzle. Calculate the forces F_x and F_y on the vane required to support the motion. (15 分)



(六). A uniform sphere of mass m and radius r is projected along a rough horizontal surface with a linear velocity $\bar{v}_1$ and no angular velocity. Denoting by μ_k the coefficient of kinetic friction between the sphere and the surface, determine (a) the time t_2 at which the sphere will start rolling without sliding, (b) the linear and angular velocities of the sphere at time t_2. (20 分)



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