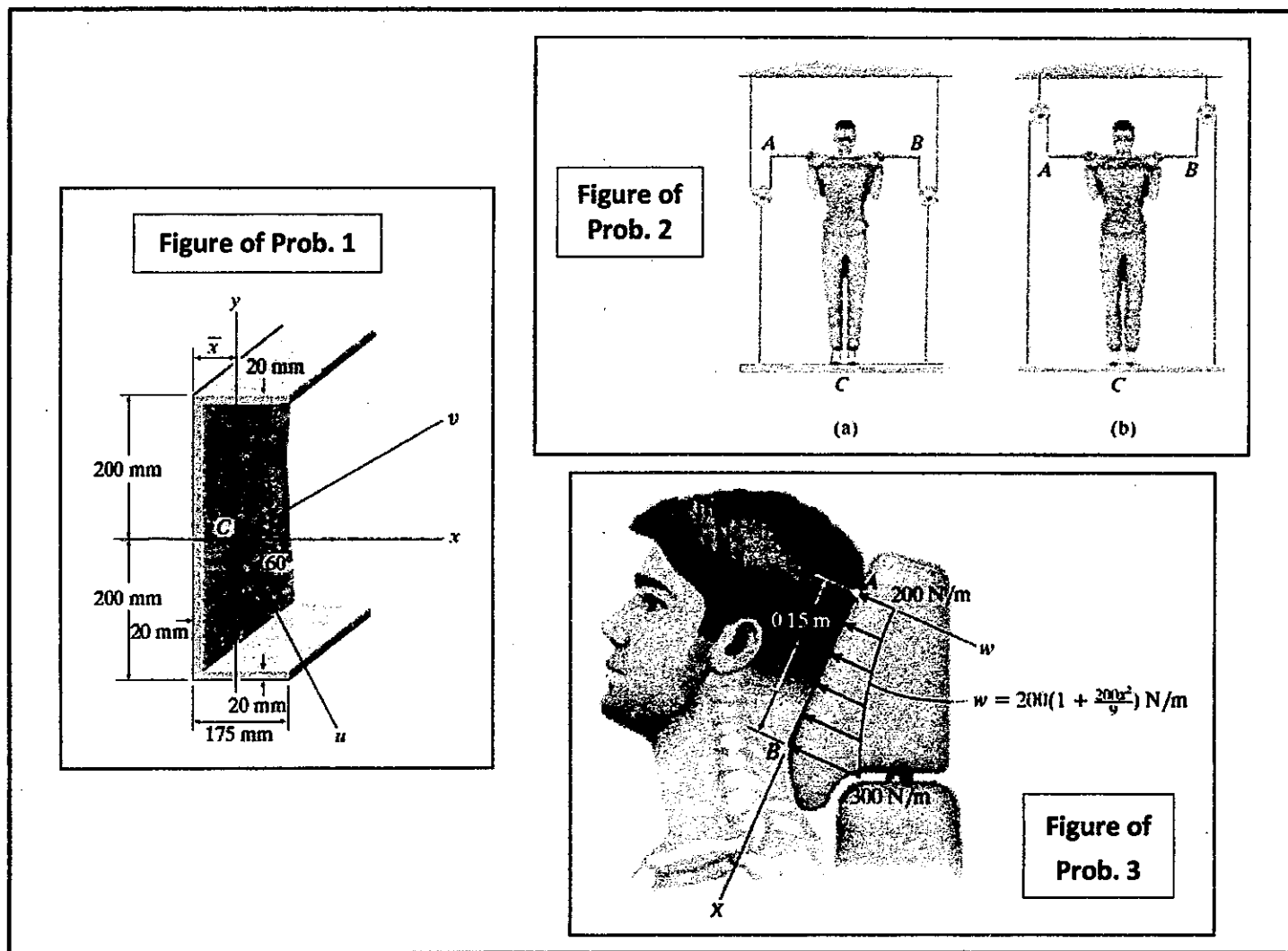


Note: Examinees are responsible of

1. presenting the problem numbers and answers clearly, cleanly, and precisely. The solutions may not necessarily appear in order.
 2. presenting detailed derivations and calculations, otherwise no credit will be granted.
1. **20pts** (a) Locate the centroid \bar{x} of the beam's cross-sectional area, and (b) determine the moments of inertia and the product of inertia of this area with respect to the u and v axes. Write your final answer in the form: (a) ($\bar{x} = \underline{\hspace{2cm}}$) (5pts); (b) ($I_u, I_v, I_{uv} = \underline{\hspace{2cm}}, \underline{\hspace{2cm}}, \underline{\hspace{2cm}}$) (15pts).
 2. **20pts** A man having a weight of 875 N attempts to hold himself using one of the two methods shown. Determine the total force, F , he must exert on bar AB in each case and normal reaction, N_C , he exerts on the platform at C. The platform has a weight of 150 N. Write your final answer in the form: (a) ($F, N_C = \underline{\hspace{2cm}}, \underline{\hspace{2cm}}$) (10pts); (b) ($F, N_C = \underline{\hspace{2cm}}, \underline{\hspace{2cm}}$) (10pts).
 3. **10pts** Great number of neck injuries are caused by rear-end car collisions. To alleviate this problem, an automobile seat restraint has been developed that provides additional pressure contact with the cranium. During dynamic tests the distribution of load on the cranium has been plotted and shown to be parabolic. Determine the equivalent resultant force and its location measured from point A. Write your final answer in the form: (F_R, \bar{x}) = ($\underline{\hspace{2cm}}, \underline{\hspace{2cm}}$).



4. 20pts The system shown is at rest when a constant 150-N force is applied to collar B . (a) If the force acts through the entire motion, determine the speed of collar B , v_B , as it strikes the support at C . (b) After what distance d should the 150-N force be removed if the collar is to reach support C with zero velocity. Write your final answer in the form: $(v_B, d) = (\quad , \quad)$.

5. 15pts Rod AB of length 300 mm is connected by ball-and-socket joints to collars A and B , which slide along the two rods shown. Knowing that collar B moves toward Point D at a constant speed of 50 mm/s, determine the velocity of collar A when $c = 120$ mm. Write your final answer in the form: $v_A = \quad$.

6. 15pts A 5-kg block, attached to the lower end of a spring whose upper end is fixed, vibrates with a period of 6.8 s ($= \tau_{n1}$). Determine the period (τ_{n2}) of a 3-kg block which is attached to the center of the same spring if the upper and lower ends of the spring are fixed. Write your final answer in the form: $\tau_{n2} = \quad$.

