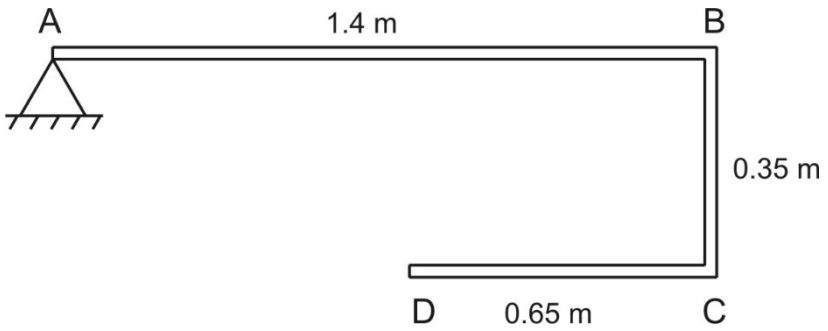
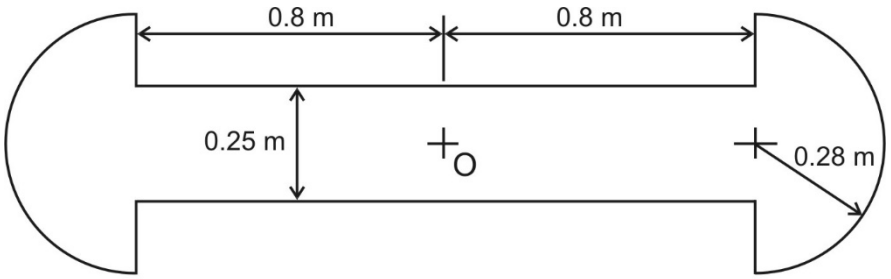
# Dynamics 2 – Tutorial 5

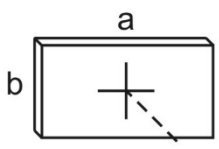
Fixed Axis Rotation Law and Moments of Inertia: Properties and Theorems

1. A steel bar is bent into the shape ABCD shown. The total mass is 128 kg. Evaluate the moment of inertia of the bar about an axis through A perpendicular to the page (the bar can obviously be divided into 3 parts). You will need to use the parallel axis theory. [131.7 $kgm^2$]
   If the bar is simply supported at A, and end B is released from an initial horizontal position, calculate the **initial** angular acceleration of the bar (note: think how you can do this without needing to work out the position of G for the bent bar).




2. The shaped thin steel plate shown has a total mass of 170 kg. Find its moment of inertia about an axis through its centre O perpendicular to its plane. To help you do this you can make use of the standard result for the moment of inertia of a rectangular plate for a perpendicular axis through its centre given in the figure. You will need to think carefully about dealing with the semicircular end of the plane. You can make use of the result for a circular dish about its centre: $I = \frac{1}{2}MR^2$. [79.33 $kgm^2$]




$$I_o = \frac{1}{12}M(a^2 + b^2)$$

3. In the Figure, A is a cable drum with a mass of 60 kg, diameter of 1.6 m and a radius of gyration of 1.45 m. Mass M of 250kg is linked to the cable through the small pulley shown. Gear G, attached to the cable drum A drives rotor B (moment of inertia 12.5 $kgm^2$) through a 4/1 reduction gear ratio. If mass M is released, how long would it take to fall 4m?