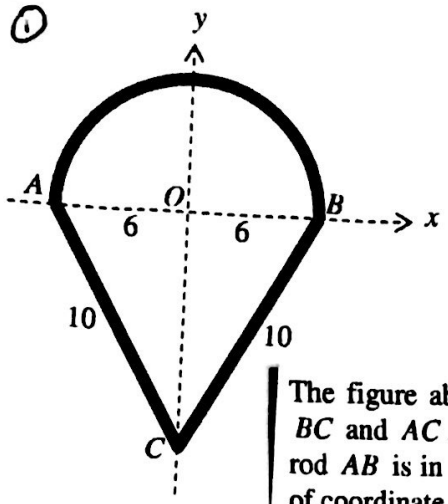
(1)



The figure above shows a **framework** consisting of three thin **uniform rods** AB, BC and AC. The rods BC and AC are straight lines, both of lengths 10 units. The rod AB is in the shape of a semicircular arc of radius 6 units with centre at O. A set of coordinate axes is defined with O as the origin, as shown in figure.

a) Determine the position of the centre of mass of the framework from O.

A particle of mass 4 kg is attached to the midpoint of AB. The centre of mass of the **loaded framework** is now at O.

b) Find the mass of the framework.

(2)

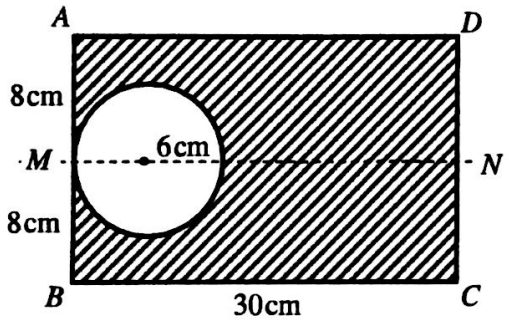


figure 1

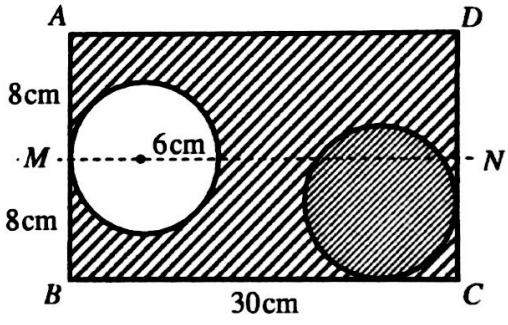


figure 2

Figure 1 shows a rectangular lamina $ABCD$ where $|AB| = 16\text{cm}$ and $|BC| = 30\text{cm}$.

The points M and N are the midpoints of AB and CD.

A circle of radius 6 cm whose centre lies on MN at a distance of 6 cm from AB, is removed from the lamina $ABCD$, forming a composite **S**.

a) Determine the position of the centre of mass of **S** from AB.

The circular section removed in part (a) is now attached to a new position on **S** so that BC and CD are now tangents to the circular section. The new composite is shown in figure 2 and is denoted by **T**.

b) Determine the distance of the centre of mass of **T** from AB and BC.