Course Code: ESC106A
Course Title: Construction Materials and Engineering Mechanics

Lecture No. 37:
Problems on composite areas

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Lecture Intended Learning Outcomes

At the end of this lecture, students will be able to:

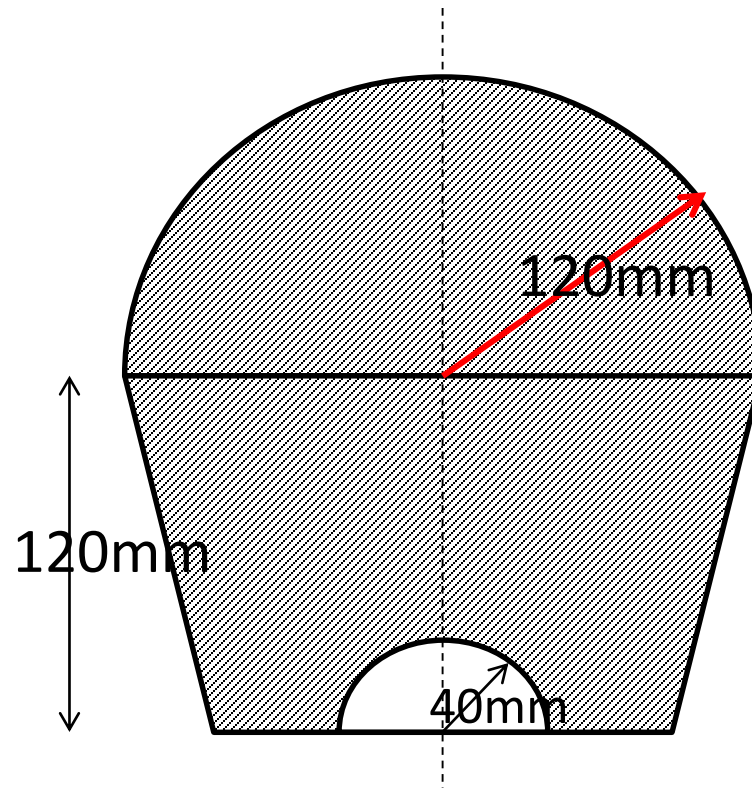- Obtain the centre of gravity of asymmetrical sections.

Contents

Problems on center of Gravity

Centre of gravity

1. Find the CG of the shaded area of the given Figure.
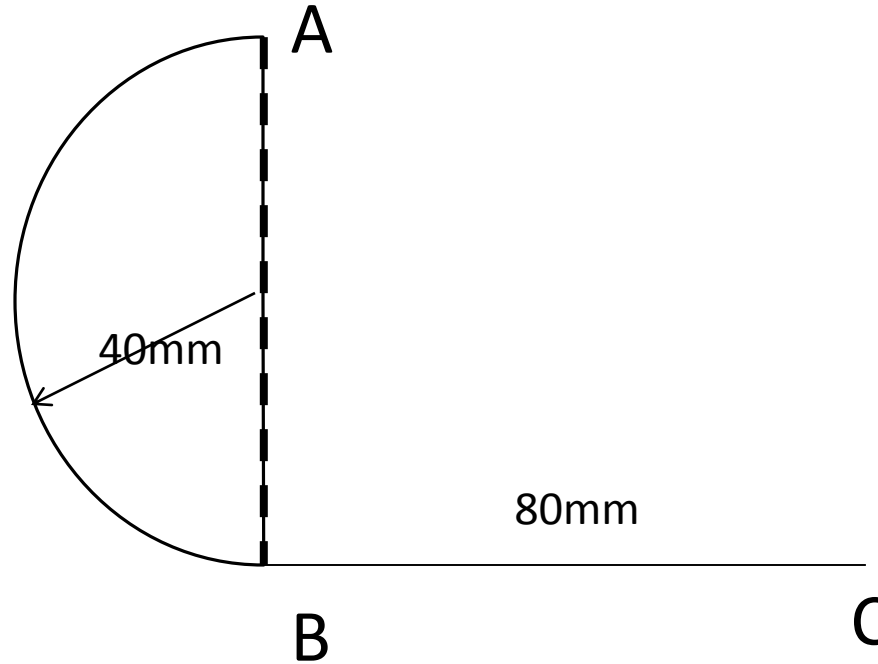

120mm

120mm

40mm

$$\bar{x} = 120mm$$

$$\bar{y} = 121.55mm$$

Centre of gravity

2. A slender homogeneous wire of uniform cross section is bent into the form as shown in the Figure. Determine the position of the centroid of the wire with respect to the given axes.

A

40mm

80mm

B

C

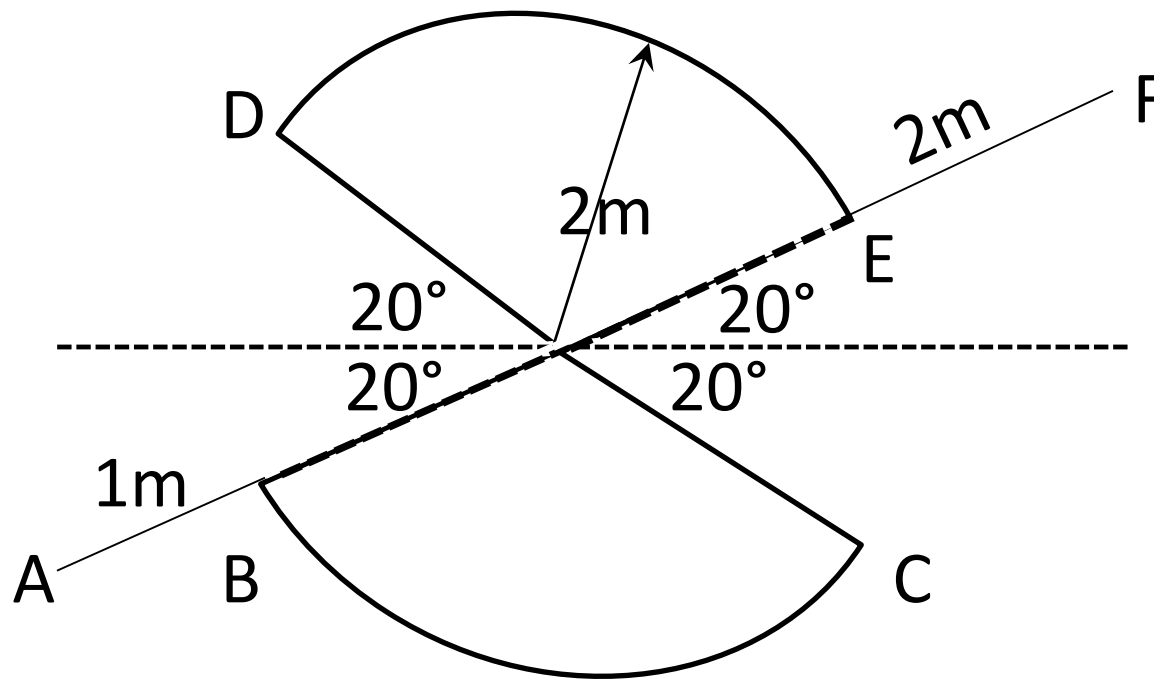$$\bar{x} = \frac{x_1 l_1 + x_2 l_2}{l_1 + l_2}$$

$$\bar{x} = 40mm$$

$$\bar{y} = 24.44mm$$

Centre of gravity

3.A metal wire is bent in the form ABCDEF. Find the centroid of the combined length of the wire. The arcs BC and DE form parts of the same circle.

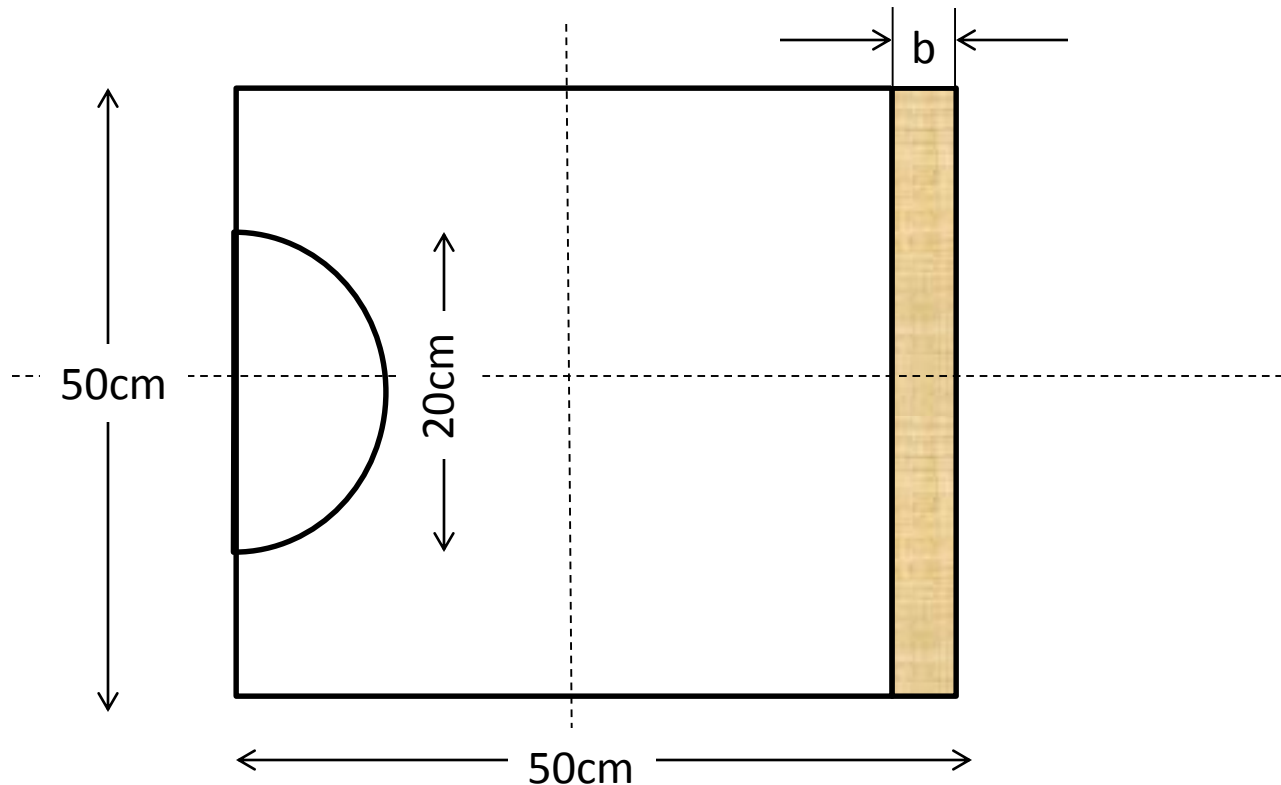$$\bar{x} = \frac{x_1 l_1 + x_2 l_2}{l_1 + l_2}$$

$$\bar{x} = 0.196m$$

$$\bar{y} = 0.072m$$
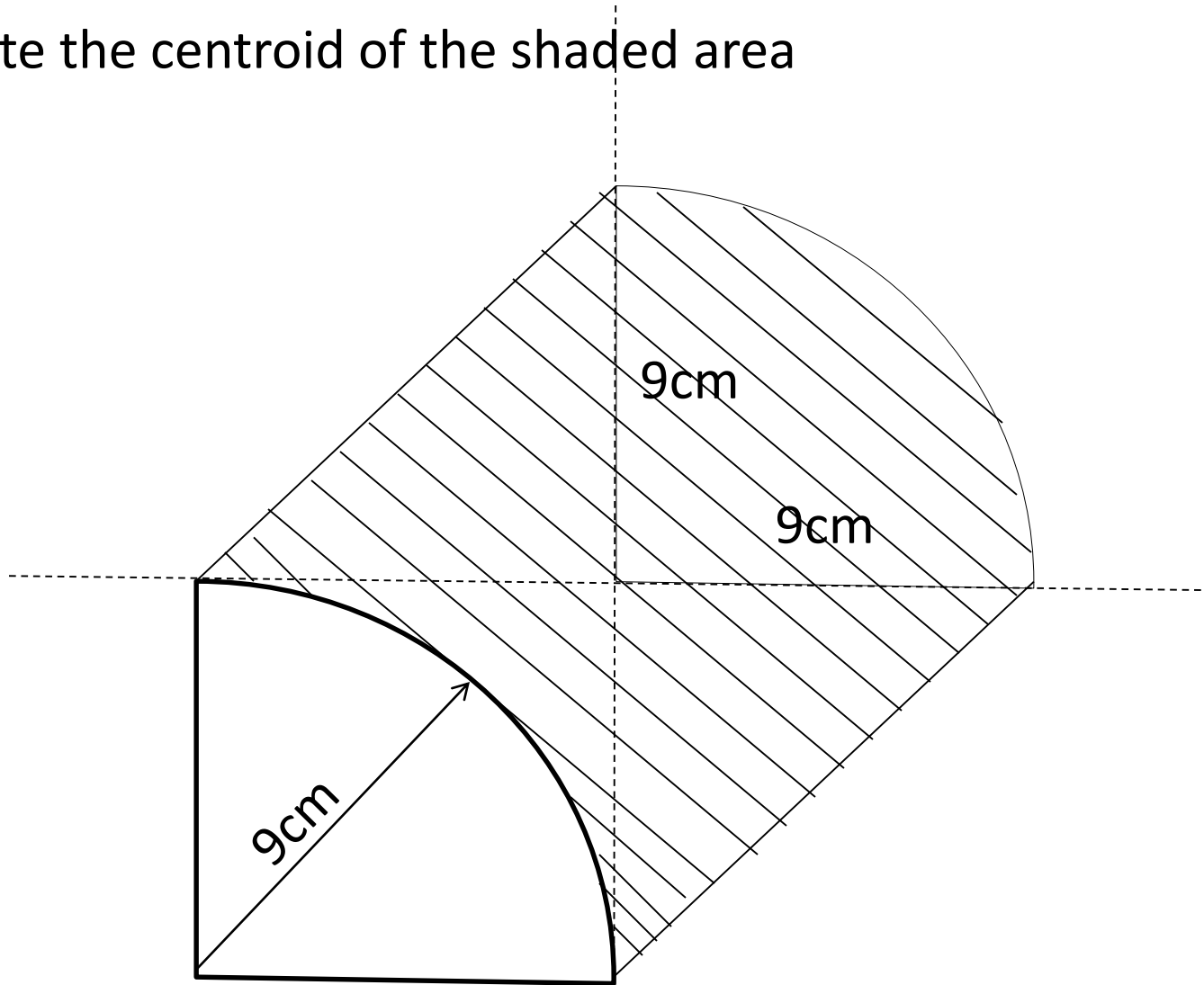
Centre of gravity

4. A semi circle area of 20cm diameter was removed from a thin plate of 50x50cm (Refer Figure). It is desired to maintain the centroid of the plate at the original point. Determine the width of the material shown shaded to be removed to achieve this.

$$b = 2.76cm$$

Centre of gravity

5. Locate the centroid of the shaded area

9cm

9cm

9cm

$$\overline{x} = 1.28cm$$

$$\overline{y} = 1.28cm$$

Summary

- The centroid is the location of the geometric center for the body. It is determined using a moment balance of geometric elements with respect of a reference axis

- For asymmetric elements, the co-ordinates of the CG need to be obtained by dividing it into simpler areas