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

Lecture No. 43:
Problems on Centre of gravity and Moment of Inertia

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Lecture Intended Learning Outcomes

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

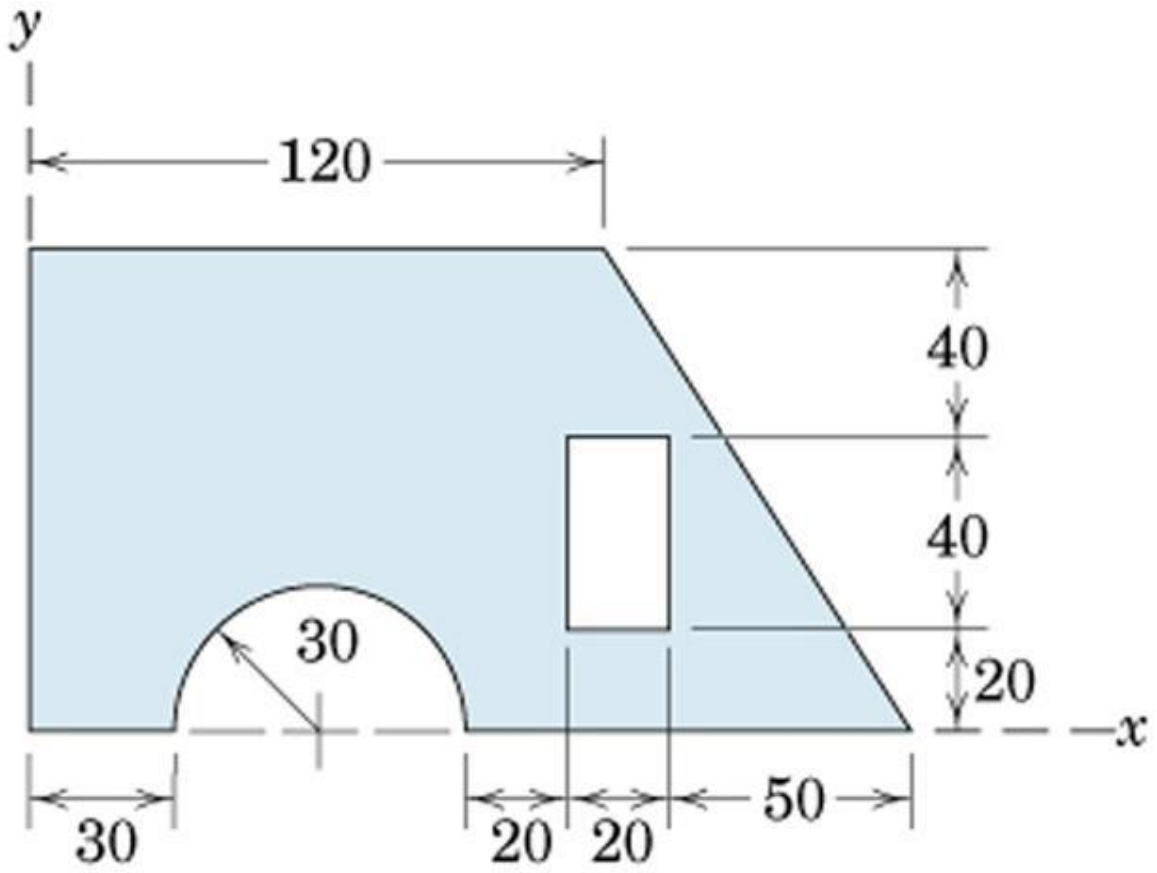
- Calculate the co-ordinates of the centroid of the composite area after converting the composite section into simple regular areas
- Solve for the Moment of Inertia of sections with respect to the considered axis

Contents

Problems on Center of Gravity and Moment of inertia

Problems on CG and MI

1. Locate the centroid of the shaded area.



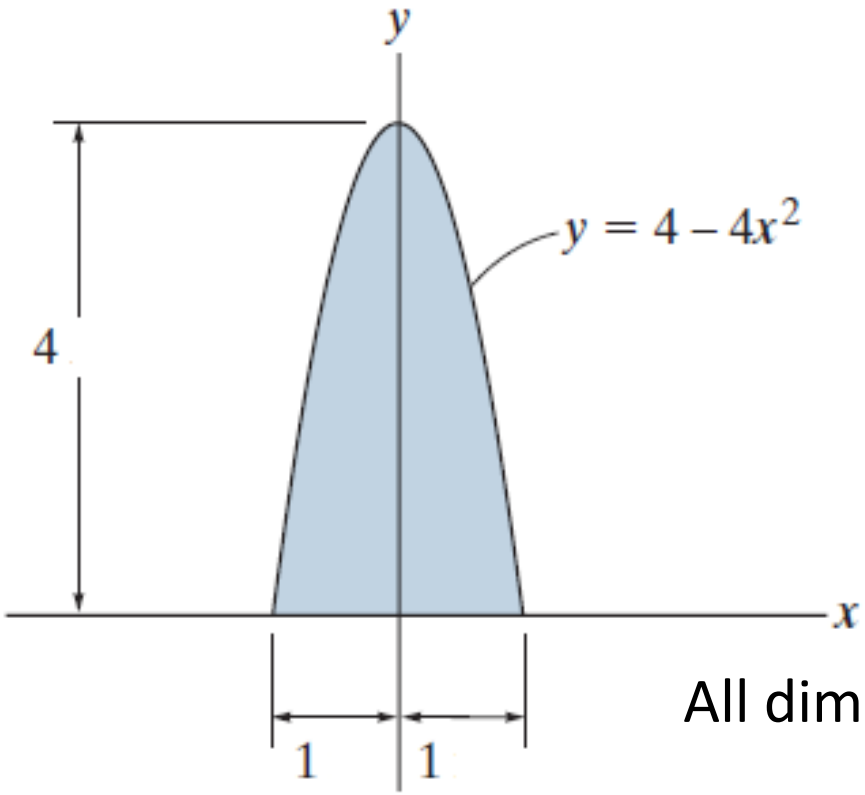
Dimensions in millimeters

$\bar{x} = 75mm$

$\bar{y} = 50.83mm$

Problems on CG and MI

2. Determine the moment of inertia of the area about the y axis. Solve the problem using rectangular differential elements: (a) having a thickness of dx, and (b) having a thickness of dy. Find out the centroid also



All dimensions in cm

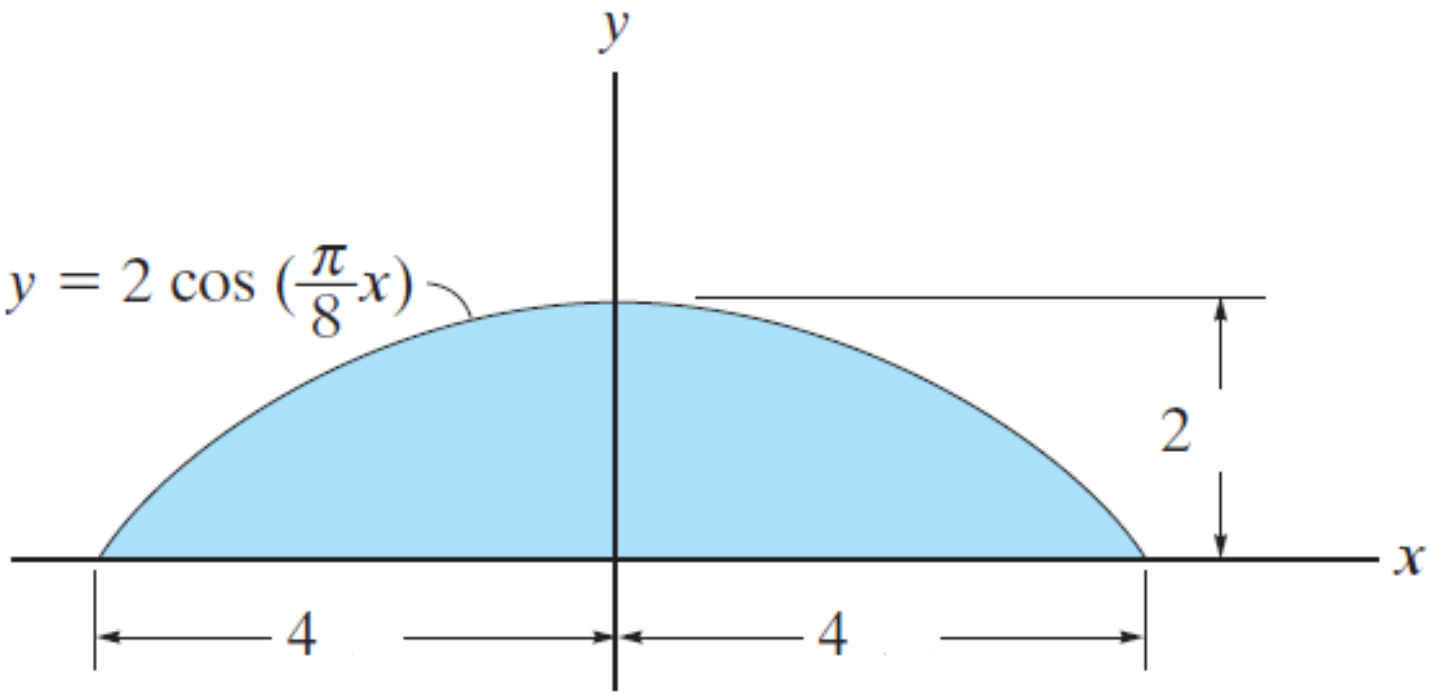
$$\bar{x} = 0$$

$$\bar{y} = 1.6cm$$

$$I_{yy} = 1.07cm^4$$

Problems on CG and MI

3. Determine the moment of inertia of the area about the y axis.



All dimensions in cm

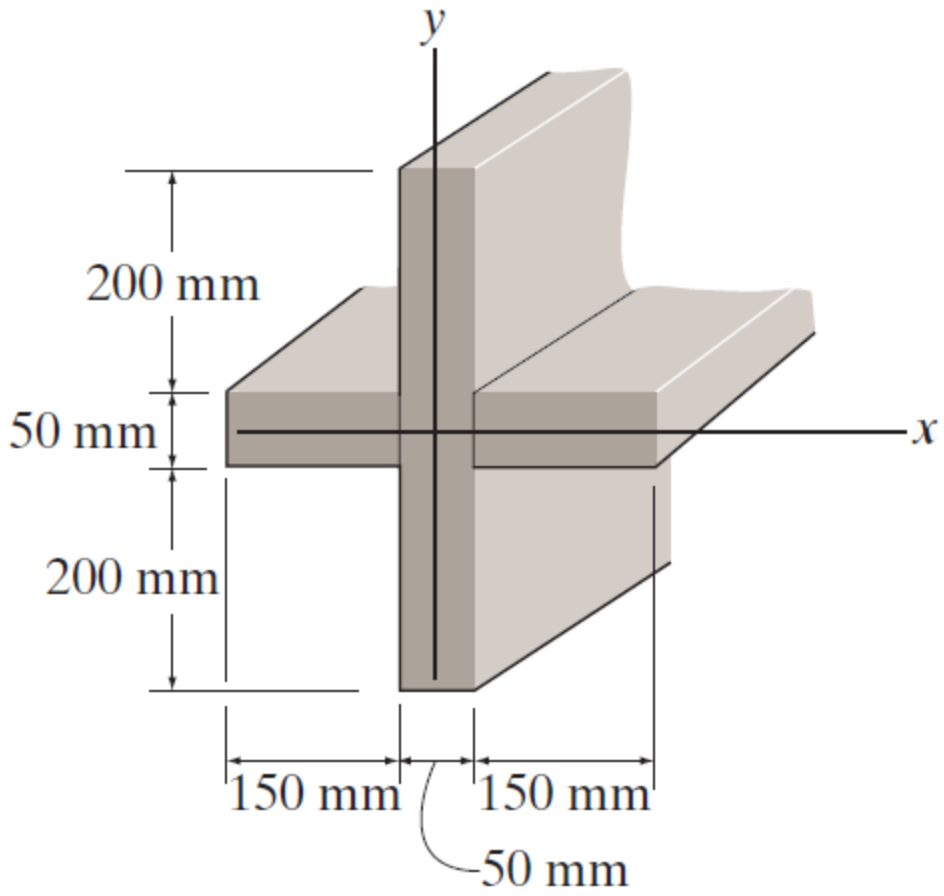
Hint: Apply the principle of integration by parts

$Ans:$

$I_{yy} = 96.92 cm^4$

Problems on CG and MI

4. Determine the moment of inertia of the given beam's cross-sectional area about the centroidal x and y axes.



$$I_{xx} = 382{,}812{,}500 mm^4$$

$$I_{yy} = 332{,}812{,}500 mm^4$$

Summary

- The composite areas are divided into simple areas and the coordinates of the centre of gravity are determined.
- Integration method is adopted to find out the centre of gravity of irregular/curved sections
- Moment of inertia of the sections are found out with respect to the centroidal axis.