PENANG SANGAM HIGH SCHOOL

P. O. BOX 44, RAKIRAKI

LESSON NOTES - 7

SCHOOL: <u>PENANG SANGAM HIGH</u>   **SUBJECT:** <u>TECHNICAL DRAWING</u>   **YEAR/ LEVEL:** <u>13 A/B</u>

Strand	TD13.1 GEOMETRY
Sub - Strand	TD13.1.2 Centroids
Content Learning Outcome	TD13.1.2.1 Determine the centroid of composite shapes using funicular polygon method.

CENTROIDS

Learning Outcomes

By the end of this topic, students will:

- define centroid.
- find the centroid by using funicular polygon method.

Introduction

- The Centroid of an area is the centre or mean position of all the elements of which the area consists.
- It is the centre of an object or the centre of gravity.
- It is the point of intersection of all the medians.
- The centre of mass of a uniform object is also called a centroid.
- For shapes like square, circle and rectangle, the centroid is located simply by the intersecting diagonals or centre lines however, for triangles, the intersection of the medians locates the centroid.
- The medians are found by bisecting the internal angles.
- However for a combination of quadrilaterals in one figure, the ratio of the area is formed to determine the centroid.

Centroid by Moments

This method allows the use of calculations, graphical drawings and ratios to find the centroid of complex shapes.

How to find the Centroid of Complex Shapes

a)   Divide the complex shape into simple shapes.
b)   Locate the centroid of the simple shapes.
c)   Calculate the area of the simple shapes to determine the ratio of the area.
d)   Divide the distance between the centroids according to the ratio.
e)   The centroid is located closer to the shape with a larger area.

**Centroids Found By Funicular or Link Polygons**

STEPS

1. Divide the figure again into three composing rectangles and find the three centroids by drawing diagonals and calculate the areas of all the three rectangles.

2. A force diagram represented by the line abcd drawn to any convenient scale shows the area value in units of the three rectangles.

3. Join abcd to any pole O to obtain the funicular polygon.

4. Draw the three parallel lines from the centroids.

5. Note these are parallel to the force line abcd.

6. From x draw Bo parallel to bo in the funicular.

7. From its intersection with BC, draw Co parallel to co in the funicular, to give y.

8. From x draw Ao parallel to ao in the funicular.

9. From y draw Do parallel to do.

10. The intersection gives z, which is the resultant parallel to the three forces.

11. Draw the line of the resultant parallel to the force lines from the centroids.

12. Draw the force line ghij showing the values of areas B C A, but labelled clarity GH, HI and IJ, in the diagram.

13. Proceed as before to obtain the second resultant line, and it should be clear that the centroid lies on the intersection of the two resultant lines.

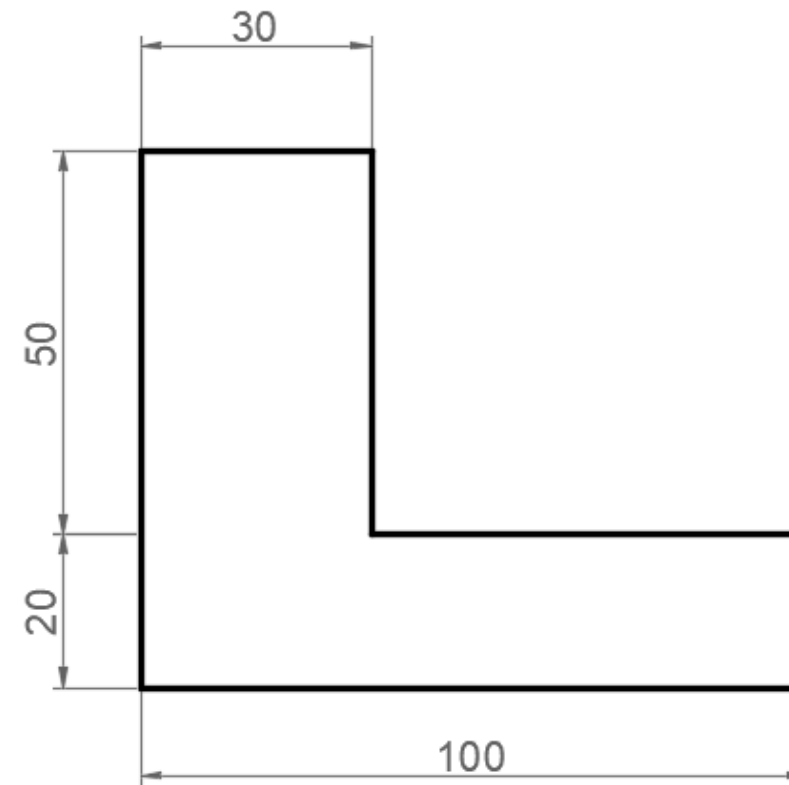**Example**
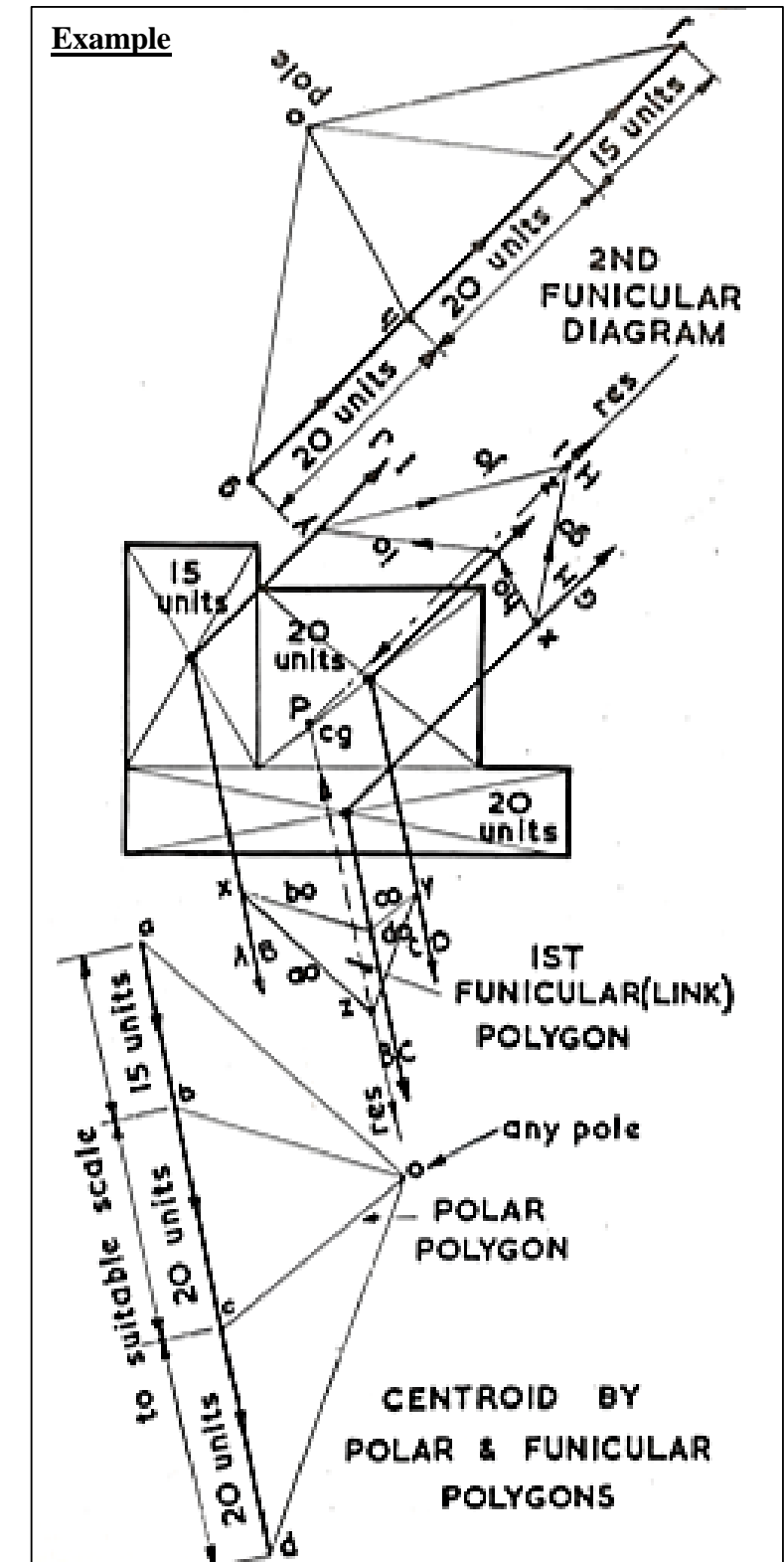
QUESTION 1

Given: The shaped block.

Required: Locate the centroid of the block using funicular polygon method.
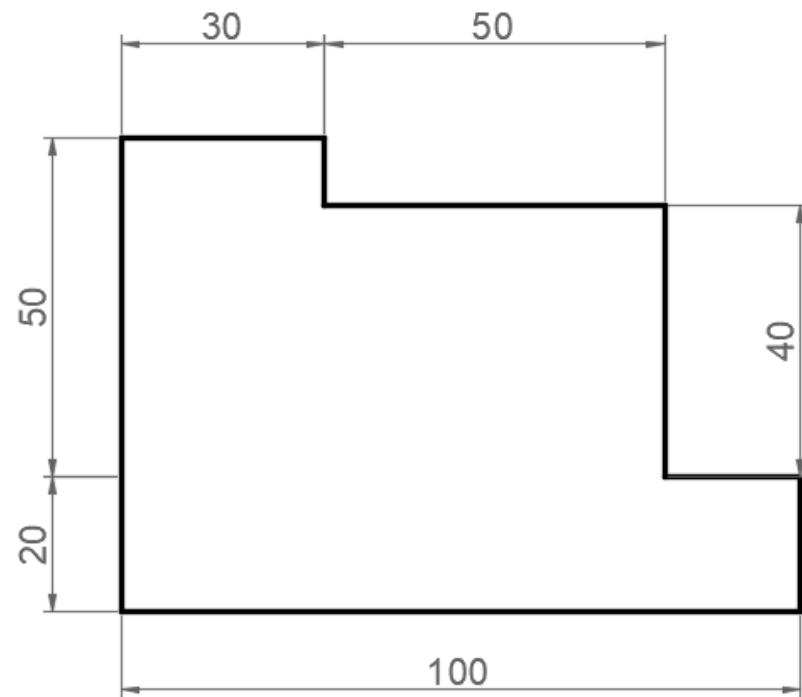
QUESTION 2

Given: The shaped block.

Required: Locate the centroid of the block using funicular polygon method.

THE END