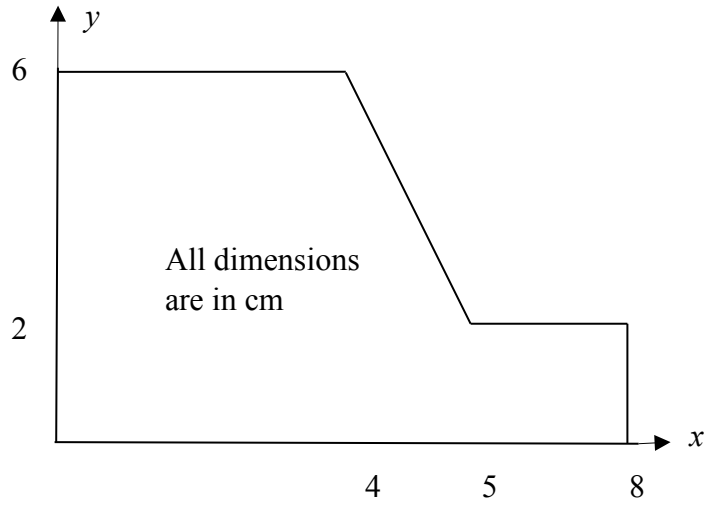
TOPIC

Engineering Mechanics (Statics and Dynamics) – Section VII – Question 3

QUESTION

The $x - y$ coordinates in cm of the centroid of the area given below most nearly is

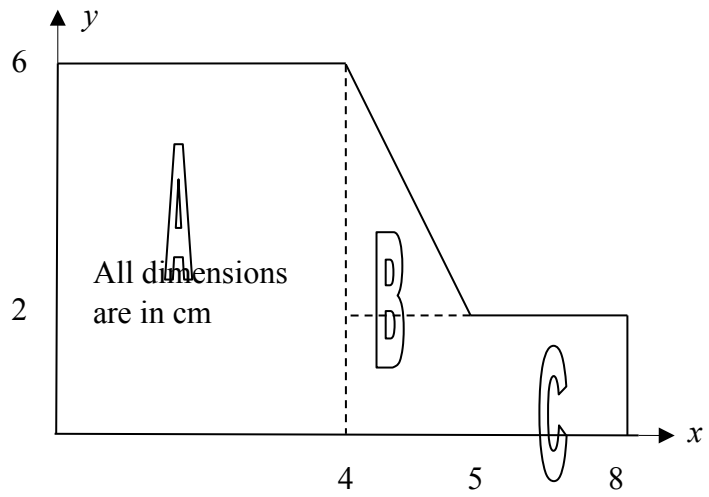
(A) $(3.098, 2.549)$
(B) $(3.078, 2.549)$
(C) $(3.078, 2.627)$
(D) $(3.098, 2.627)$



HINT

Divide the shape into three regions – Regions A, B and C. Let us find the centroid of each of these regions.

SOLUTION



Divide the shape into three regions – Regions A, B and C. Let us find the centroid of each of these regions.

Region A:

Area of $A_A = (4)(6) = 24\text{cm}^2$

$$X_A = \frac{0+4}{2} = 2\text{cm}$$

$$Y_A = \frac{0+6}{2} = 3\text{cm}$$

Region B:

Area of $B, A_B = \frac{1}{2}(1)(4) = 2\text{cm}^2$

$$X_B = 4 + \left(\frac{1}{3}\right)(1) = 4.333\text{cm}$$

$$Y_B = 2 + \left(\frac{1}{3}\right)(4) = 3.333\text{cm}$$

Region C:

Area of $C, A_C = 4 \times 2 = 8\text{cm}^2$

$$X_C = 4 + \frac{4}{2} = 6\text{cm}$$

$$Y_C = 0 + \frac{2}{2} = 1\text{cm}$$

To calculate the coordinates of the centroid of the whole geometry

$$x = \frac{\sum_{i=A,B.C} x_i A_i}{\sum_{i=A,B,C} A_i}$$

$$= \frac{x_A A_A + x_B A_B + x_C A_C}{A_A + A_B + A_C}$$

$$= \frac{2\times 24 + 4.333\times 2 + 6\times 8}{24+2+8}$$

$$= 3.078\text{cm}$$

$$y = \frac{\sum_{i=A,B.C} y_i A_i}{\sum_{i=A,B,C} A_i}$$

$$= \frac{y_A A_A + y_B A_B + y_C A_C}{A_A + A_B + A_C}$$

$$= \frac{3\times 24 + 3.333\times 2 + 1\times 8}{24+2+8}$$

$$= 2.549\text{cm}$$

So the centroid is at

$$(x, y) = (3.078, 2.549)\text{cm}$$

ANSWER

(B)

CONTRIBUTOR

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