

Assignment 1

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Question:

A(-1, 3), B(4,2) and C(3,-2) are the vertices of a triangle.

- Find the coordinates of the centroid G of the triangle
- Find the equation of the line through G and parallel to AC.

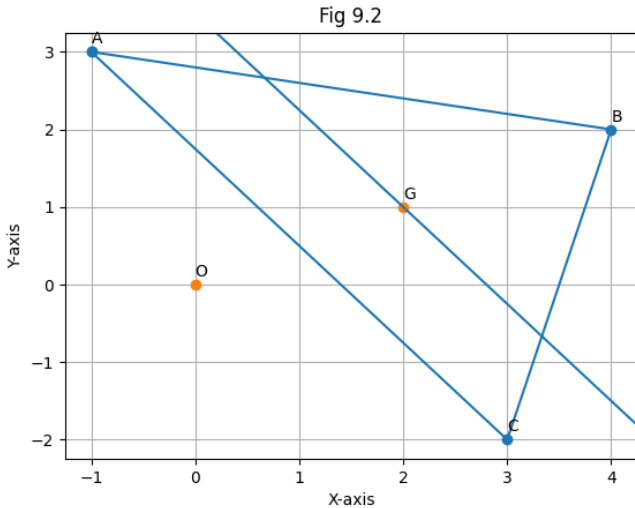
Solution:

- Let L be the line that passes through G such that $L \parallel AC$. Then, L can be expressed as $\vec{G} + k\hat{AC}$

$$\begin{aligned}\hat{AC} &= \frac{\vec{C} - \vec{A}}{|\vec{C} - \vec{A}|} \\ &= \frac{3\hat{i} - 2\hat{j} - (-\hat{i} + 3\hat{j})}{|3\hat{i} - 2\hat{j} - (-\hat{i} + 3\hat{j})|} \\ &= \frac{4\hat{i} - 5\hat{j}}{|4\hat{i} - 5\hat{j}|} \\ &= \frac{4\hat{i} - 5\hat{j}}{\sqrt{41}}\end{aligned}$$

$$L = 2\hat{i} + \hat{j} + k\left(\frac{4\hat{i} - 5\hat{j}}{\sqrt{41}}\right)$$

Thus, Line L is $2\hat{i} + \hat{j} + m(4\hat{i} - 5\hat{j})$



- Let $\vec{A}, \vec{B}, \vec{C}$ be the vectors OA, OB, OC respectively, where O is the origin. Thus,

$$\vec{A} = -\hat{i} + 3\hat{j}, \vec{B} = 4\hat{i} + 2\hat{j}, \vec{C} = 3\hat{i} - 2\hat{j}$$

Using centroid formula, the desired point G is given by:

$$\begin{aligned}\vec{G} &= \frac{1}{3}(\vec{A} + \vec{B} + \vec{C}) \\ &= \frac{1}{3}(-\hat{i} + 3\hat{j} + 4\hat{i} + 2\hat{j} + 3\hat{i} - 2\hat{j}) \\ &= \frac{1}{3}(6\hat{i} + 3\hat{j}) \\ &= 2\hat{i} + \hat{j}\end{aligned}$$

G is the point (2, 1)