

# Assignment 1

Vishal Vijay Devadiga (CS21BTECH11061)

## Question:

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

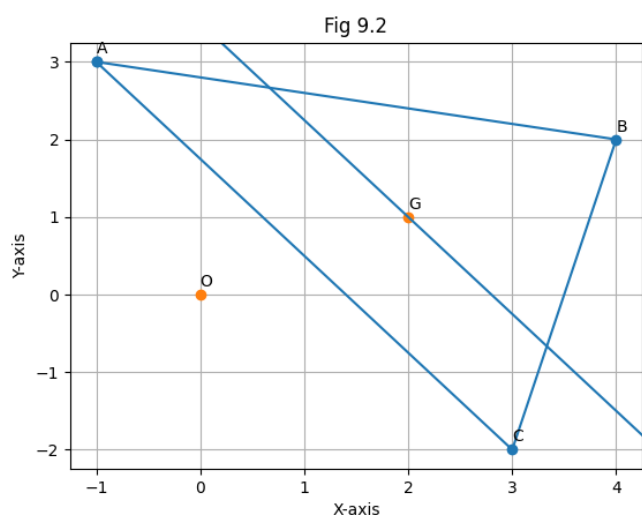
- Find the coordinates of the centroid G of the triangle
- Find the equation of the line through G and parallel to AC.

## Solution:

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

$$\begin{aligned}\hat{AC} &= \frac{\vec{C} - \vec{A}}{|\vec{C} - \vec{A}|} \\ &= \frac{\begin{bmatrix} 3 \\ -2 \end{bmatrix} - \begin{bmatrix} -1 \\ 3 \end{bmatrix}}{\left| \begin{bmatrix} 3 \\ -2 \end{bmatrix} - \begin{bmatrix} -1 \\ 3 \end{bmatrix} \right|} \\ &= \frac{\begin{bmatrix} 4 \\ -5 \end{bmatrix}}{\left| \begin{bmatrix} 4 \\ -5 \end{bmatrix} \right|} \\ &= \frac{\begin{bmatrix} 4 \\ -5 \end{bmatrix}}{\sqrt{41}} \\ L &= \begin{bmatrix} 2 \\ 1 \end{bmatrix} + \frac{k}{\sqrt{41}} \begin{bmatrix} 4 \\ -5 \end{bmatrix}\end{aligned}$$

Thus, Line L is  $\begin{bmatrix} 2 \\ 1 \end{bmatrix} + m \begin{bmatrix} 4 \\ -5 \end{bmatrix}$



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

$$\vec{A} = \begin{bmatrix} -1 \\ 3 \end{bmatrix}, \vec{B} = \begin{bmatrix} 4 \\ 2 \end{bmatrix}, \vec{C} = \begin{bmatrix} 3 \\ -2 \end{bmatrix}$$

Using centroid formula, the desired point vector  $\vec{G}$  is given by:

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

$\vec{G}$  is the point vector  $\begin{bmatrix} 2 \\ 1 \end{bmatrix}$