Matrix-Lines

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CONTENTS

I. PROBLEM STATEMENT

Let A(2,-3) and B(-2, 3) be vertices ofa triangle ABC. If the centroid of this triangle moves on the line 2x+3y =1, then the locus of the vertex C is the line.

II. CONSTRUCTION

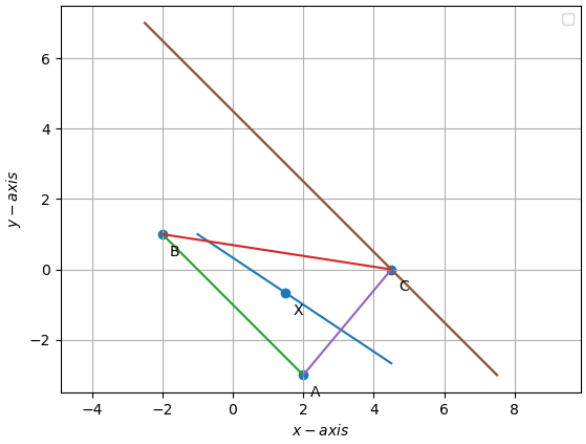

Fig. 1. Triangle

Symbol	Value	Description
A	$\begin{pmatrix} 2 \\ -3 \end{pmatrix}$	Vertex A
B	$\begin{pmatrix} -2 \\ 1 \end{pmatrix}$	Vertex B
C	$\begin{pmatrix} h \\ k \end{pmatrix}$	Vertex C

TABLE I
PARAMETERS

III. SOLUTION

Given the centroid of this triangle moves on the line 2x+3y =1

$$\mathbf{X} = \frac{\mathbf{A}+\mathbf{B}+\mathbf{C}}{3} \tag{1}$$

Equation of line is $\mathbf{n}^\top \mathbf{X} = c$.

$$\mathbf{n}^\top \left(\frac{\mathbf{A}+\mathbf{B}+\mathbf{C}}{3}\right) = 1 \tag{2}$$

$$\mathbf{n}^\top (\mathbf{A}+\mathbf{B}+\mathbf{C}) = 3 \tag{3}$$

$$\mathbf{n}^\top \mathbf{C} = 3 - \mathbf{n}^\top (\mathbf{A}+\mathbf{B}) \tag{4}$$

$$\mathbf{n} = \begin{pmatrix} 2 \\ 3 \end{pmatrix}$$

A and **B** are given

$$c_1 = 3 - \mathbf{n}^\top (\mathbf{A}+\mathbf{B}) \tag{5}$$

$$\mathbf{n}^\top \mathbf{C} = c_1 \tag{6}$$

The locus of the vertex C is the line

IV. SOFTWARE

https://github.com/19pa1a0405/sai1729/blob/main/matrices/p.py

V. Conclusion

We found the equation of a line passing trough a Vertex of $\mathbf{C}$ is

$$\mathbf{n}^\top \mathbf{C} = c_1 \tag{7}$$