Assignment 4

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Find Python Codes from below link

https://github.com/raghavendra60/Internship/tree/main/Assignment4

and Latex codes from below link

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1 Examples 2

1.1 Question 13

Prove(by shewing that the area of the triangle formed by them is zero) that the following sets of three points are in a straight line $(a, b+c), (b, c+a)$ and $(c, a+b)$

1.2 Solution

Rank of matrix method:
If rank of matrix is not full matrix after row reduction, then points are said to be collinear

$$\begin{pmatrix} \mathbf{A}-\mathbf{B} & \mathbf{A}-\mathbf{C} \end{pmatrix}^{\top} \tag{1.2.1}$$

Let $\mathbf{A} = \begin{pmatrix} a \\ b+c \end{pmatrix}, \mathbf{B} = \begin{pmatrix} b \\ c+a \end{pmatrix}, \mathbf{C} = \begin{pmatrix} c \\ a+b \end{pmatrix}$

$$\mathbf{A}-\mathbf{B} = \begin{pmatrix} a \\ b+c \end{pmatrix} - \begin{pmatrix} b \\ c+a \end{pmatrix} \tag{1.2.2}$$

$$= \begin{pmatrix} a-b \\ b-a \end{pmatrix} \tag{1.2.3}$$

$$\mathbf{A}-\mathbf{C} = \begin{pmatrix} a \\ b+c \end{pmatrix} - \begin{pmatrix} c \\ a+b \end{pmatrix} \tag{1.2.4}$$

$$= \begin{pmatrix} a-c \\ c-a \end{pmatrix} \tag{1.2.5}$$

From (1.2.1)
Let

$$\mathbf{M} = \begin{pmatrix} a-b & a-c \\ b-a & c-a \end{pmatrix} \tag{1.2.6}$$

$$\mathbf{M} = \begin{pmatrix} a-b & b-a \\ a-c & c-a \end{pmatrix} \tag{1.2.7}$$

Row Reduction on $\mathbf{M}$
$R_2 \longleftrightarrow R_2 \times (a-b) - R_1 \times (a-c)$

$$\mathbf{M} = \begin{pmatrix} a-b & b-a \\ 0 & 0 \end{pmatrix}$$

Since the rank of matrix $\mathbf{M}$ is 1, which is not full rank,
therefore the given points are collinear.