Assignment 4

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Download all python codes from

https://github.com/kavyakamal66/IITH–INTERNSHIP/blob/main/Assignment4/code4.py

and latex-tikz codes from

https://github.com/kavyakamal66/IITH–INTERNSHIP/blob/main/Assignment4/assignment4.tex

1 Question No. 2.11 - Vectors

Find the condition on $\mathbf{x}$ such that the points $\mathbf{x}, \begin{pmatrix}1\\2\end{pmatrix}, \begin{pmatrix}7\\0\end{pmatrix}$ are collinear.

2 Solution

The parametric equation of the line is

$$\mathbf{x} = \mathbf{P} + \lambda\mathbf{m}$$

where $\mathbf{m}$ is the direction vector and $\mathbf{P}$ is any point on the line.

$$\implies \mathbf{x} - \mathbf{P} = \lambda\mathbf{m} \tag{2.0.1}$$

Let

$$\mathbf{A} = \begin{pmatrix}1\\2\end{pmatrix}, \mathbf{B} = \begin{pmatrix}7\\0\end{pmatrix} \tag{2.0.2}$$

Then direction vector, $\mathbf{m}$ of line AB is

$$\mathbf{B} - \mathbf{A} = \begin{pmatrix}6\\-2\end{pmatrix} \tag{2.0.3}$$

$$\tag{2.0.4}$$

For $\mathbf{x}, \mathbf{A}$ and $\mathbf{B}$ to be collinear

$$\mathbf{x} - \mathbf{A} = \lambda(\mathbf{B} - \mathbf{A}) \tag{2.0.5}$$

$$\implies \mathbf{x} - \begin{pmatrix}1\\2\end{pmatrix} = \lambda\begin{pmatrix}6\\-2\end{pmatrix} \tag{2.0.6}$$

$$\implies \mathbf{x} = \lambda\begin{pmatrix}6\\-2\end{pmatrix} + \begin{pmatrix}1\\2\end{pmatrix} \tag{2.0.7}$$

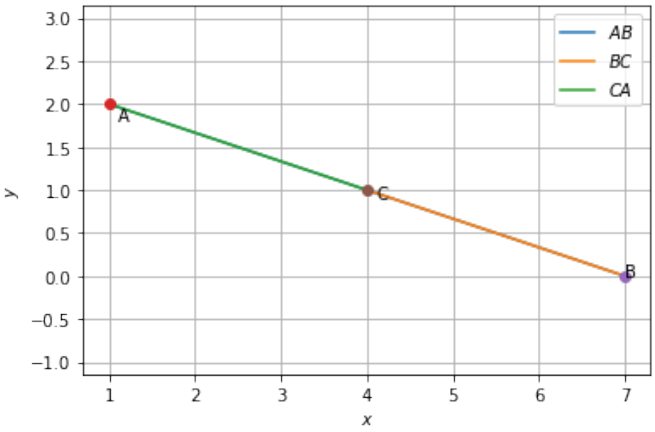

Fig. 0: Plot of given points

Now we can find $\mathbf{x}$ by substituting values for λ.
Let $\mathbf{C}$ be a point collinear to $\mathbf{A}$ and $\mathbf{B}$
For $\lambda = 1/2$

$$\mathbf{C} = \begin{pmatrix}4\\1\end{pmatrix} \tag{2.0.8}$$

Points A,B and C are plotted and is seen to be collinear.