

# 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>

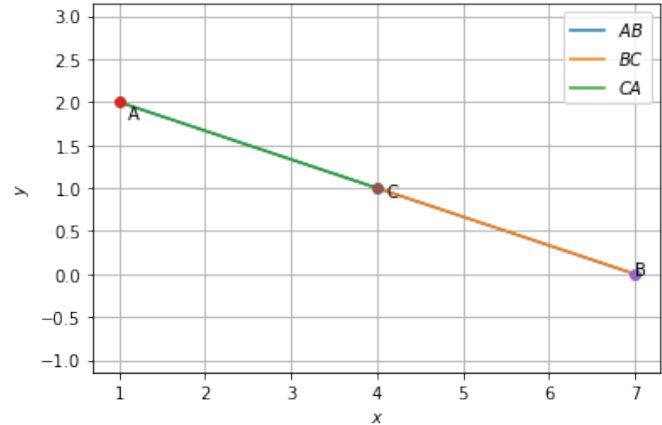


Fig. 0: Plot of given points

## 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

Let

$$\mathbf{A} = \begin{pmatrix} 1 \\ 2 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} 7 \\ 0 \end{pmatrix}, \mathbf{x} = \begin{pmatrix} x_1 \\ x_2 \end{pmatrix} \quad (2.0.1)$$

Then

$$\mathbf{B} - \mathbf{A} = \begin{pmatrix} 6 \\ -2 \end{pmatrix}, \mathbf{x} - \mathbf{A} = \begin{pmatrix} x_1 - 1 \\ x_2 - 2 \end{pmatrix} \quad (2.0.2)$$

and

$$\mathbf{M} = (\mathbf{B} - \mathbf{A} \quad \mathbf{C} - \mathbf{A})^T \quad (2.0.3)$$

$$= \begin{pmatrix} 6 & -2 \\ x_1 - 1 & x_2 - 2 \end{pmatrix} \quad (2.0.4)$$

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

$$\implies \text{rank}(\mathbf{M}) = 1 \quad (2.0.5)$$

$$\implies R_1 = kR_2 \quad (2.0.6)$$

ie

$$6 = k(x_1 - 1) \quad (2.0.7)$$

$$-2 = k(x_2 - 2) \quad (2.0.8)$$

Solving (2.0.7) and (2.0.8)

$$\mathbf{x} = \begin{pmatrix} 7 - 3x_2 \\ x_2 \end{pmatrix} \quad (2.0.9)$$

To plot the points,

Let  $x_2 = 1$

$$\mathbf{C} = \begin{pmatrix} 4 \\ 1 \end{pmatrix} \quad (2.0.10)$$