

# Assignment 4

Kavya Kamal

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>

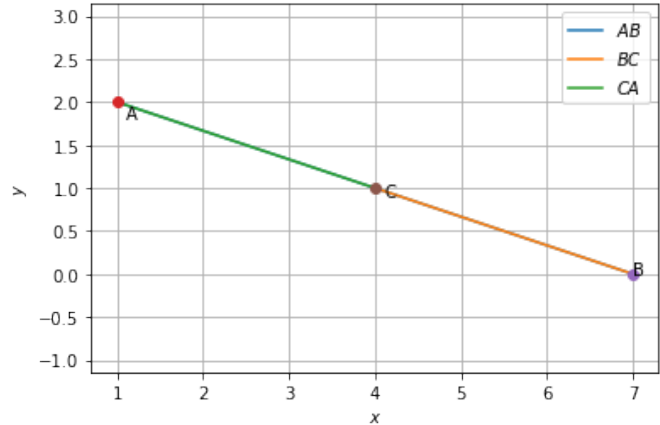


Fig. 0: Plot of given points

## 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

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.

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 direction vector,  $\mathbf{m}$  of line AB and  $\mathbf{x}$  are

$$\mathbf{B} - \mathbf{A} = \begin{pmatrix} 6 \\ -2 \end{pmatrix} \quad (2.0.2)$$

$$\mathbf{x} - \mathbf{A} = \mathbf{x} - \begin{pmatrix} 1 \\ 2 \end{pmatrix} \quad (2.0.3)$$

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

$$k(\mathbf{x} - \mathbf{A}) = \mathbf{B} - \mathbf{A} \quad (2.0.4)$$

$$\Rightarrow \mathbf{x} - \begin{pmatrix} 1 \\ 2 \end{pmatrix} = 1/k \begin{pmatrix} 6 \\ -2 \end{pmatrix} \quad (2.0.5)$$

$$\Rightarrow \mathbf{x} = 1/k \begin{pmatrix} 6 \\ -2 \end{pmatrix} + \begin{pmatrix} 1 \\ 2 \end{pmatrix} \quad (2.0.6)$$

Now we can find  $\mathbf{x}$  by substituting values for  $k$

Let  $\mathbf{C}$  be a point collinear to  $\mathbf{A}$  and  $\mathbf{B}$

For  $k = 1/2$

$$\mathbf{C} = \begin{pmatrix} 4 \\ 1 \end{pmatrix} \quad (2.0.7)$$

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