Presentation

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Assignment 6

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1. Problem

2. Solution
   - Vector Representation
   - Direction Vector
   - For a Rectangle
   - Plot

Problem Statement

Prove that the points (2,-2),(8,4),(5,7), and (-1,1) are at the angular points of a rectangle.

Vector Representation

$$\mathbf{A} = \begin{pmatrix} 2 \\ -2 \end{pmatrix}, \mathbf{B} = \begin{pmatrix} 8 \\ 4 \end{pmatrix}, \mathbf{C} = \begin{pmatrix} 5 \\ 7 \end{pmatrix}, \mathbf{D} = \begin{pmatrix} -1 \\ 1 \end{pmatrix} \tag{3.1}$$

Direction Vector

Direction vector of A and B

$$\mathbf{m}_1 = \begin{pmatrix} 2 \\ -2 \end{pmatrix} - \begin{pmatrix} 8 \\ 4 \end{pmatrix} = \begin{pmatrix} -6 \\ -6 \end{pmatrix} \tag{3.2}$$

Direction vector of B and C

$$\mathbf{m}_2 = \begin{pmatrix} 8 \\ 4 \end{pmatrix} - \begin{pmatrix} 5 \\ 7 \end{pmatrix} = \begin{pmatrix} 3 \\ -3 \end{pmatrix} \tag{3.3}$$

Direction vector of C and D

$$\mathbf{m}_3 = \begin{pmatrix} 5 \\ 7 \end{pmatrix} - \begin{pmatrix} -1 \\ 1 \end{pmatrix} = \begin{pmatrix} 6 \\ 6 \end{pmatrix} \tag{3.4}$$

Direction vector of D and A

$$\mathbf{m}_4 = \begin{pmatrix} -1 \\ 1 \end{pmatrix} - \begin{pmatrix} 2 \\ -2 \end{pmatrix} = \begin{pmatrix} -3 \\ 3 \end{pmatrix} \tag{3.5}$$

These direction vectors are parallel

$$\mathbf{m}_1 = k\mathbf{m}_3 \tag{3.6}$$

These direction vectors are parallel

$$\mathbf{m}_2 = k\mathbf{m}_4 \tag{3.7}$$

For a Rectangle

$$(\mathbf{m}_1)^\top \mathbf{m}_2 = 0 \tag{3.8}$$

$$\begin{pmatrix} -6 \\ -6 \end{pmatrix}^\top \begin{pmatrix} 3 \\ -3 \end{pmatrix} = 0 \tag{3.9}$$

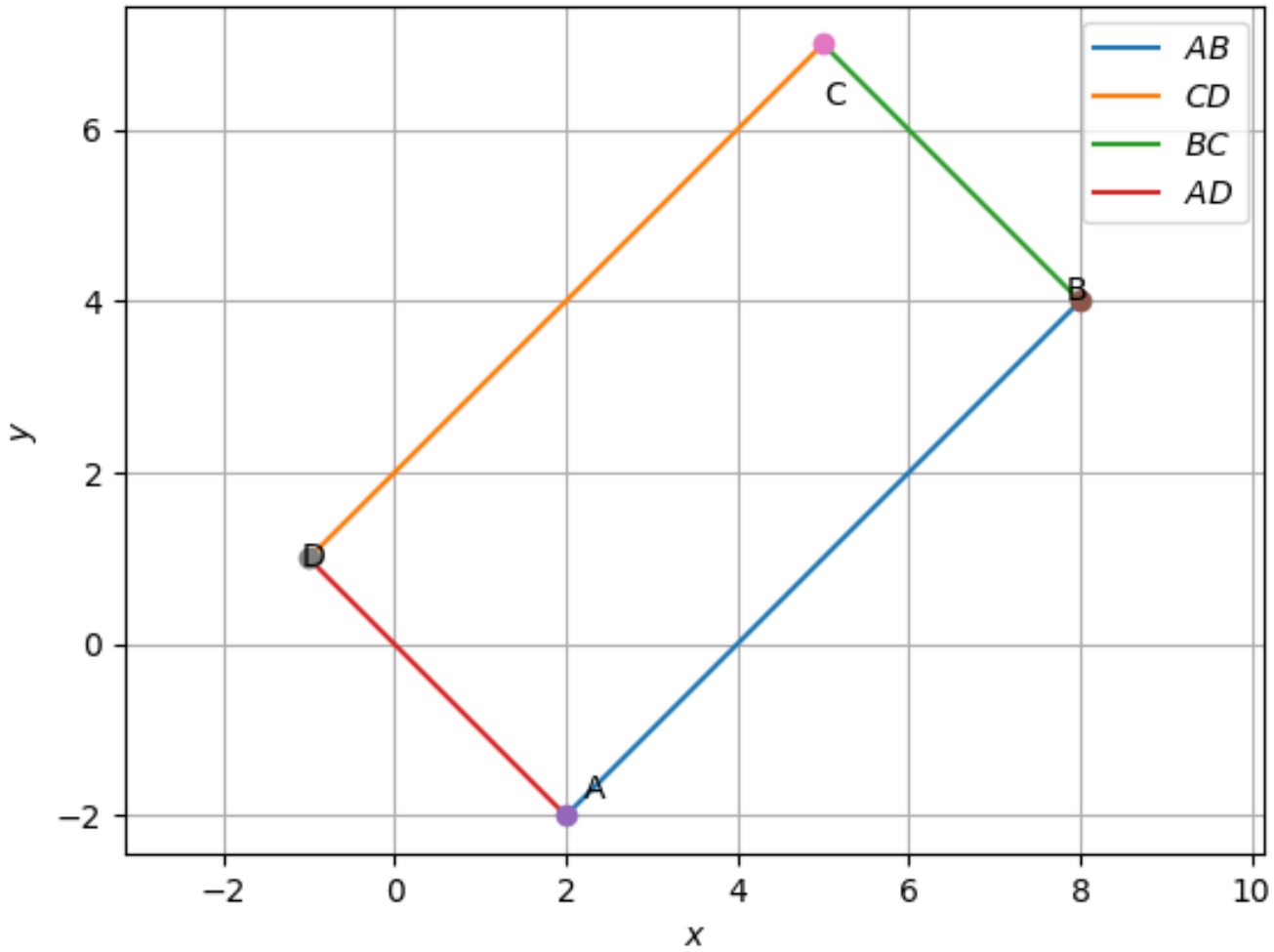
$$\begin{pmatrix} -6 & -6 \end{pmatrix} \begin{pmatrix} 3 \\ -3 \end{pmatrix} = 0 \tag{3.10}$$

$$-18 + 18 = 0$$

$$0 = 0$$

Hence, given points A,B,C and D are the Vector points of a rectangle.

Plot



Figure