

# AI1110: Assignment 1

SADINENI ABHINAY - CS21BTECH11055

Download all python codes from

<https://github.com/karna-rash/AI1110-or-AI1103/blob/main/Assignment1/codes/plot.py>

and latex-tikz codes from

<https://github.com/karna-rash/AI1110-or-AI1103/blob/main/Assignment1/assignment1.tex>

## QUESTION 7.2

Use a graph paper for this question (Take  $2\text{cms} = 1\text{unit}$  on both x and y axis)

- (1) Plot the following points: A(0,4), B(2,3), C(1,1) and D(2,0).
- (2) Reflect points B, C, D on the y-axis and write down their coordinates. Name the images as B', C', D' respectively.
- (3) Join the points A, B, C, D, D', C', B' and A in order, so as to form a closed figure. Write down the equation of the line of symmetry of the figure formed.

## SOLUTION:

- (1) the plot of all points in last plot section labeled with A,B,C,D
- (2) This is general formula for image of point P in line with equation:

$$\mathbf{n}^T \mathbf{x} = c$$

$$\mathbf{R} = \mathbf{P} + 2 \frac{c - \mathbf{n}^T \mathbf{P}}{\|\mathbf{n}\|^2} \mathbf{n}$$

Here in our problem

$$\mathbf{B} = \begin{pmatrix} 2 \\ 3 \end{pmatrix}, \mathbf{C} = \begin{pmatrix} 1 \\ 1 \end{pmatrix}, \mathbf{D} = \begin{pmatrix} 2 \\ 0 \end{pmatrix}$$

$$\mathbf{n} = \begin{pmatrix} 1 \\ 0 \end{pmatrix}, c = 0$$

Substitute B,C,D in the formula

$$\begin{aligned} \mathbf{B}' &= \mathbf{B} + 2 \frac{c - \mathbf{n}^T \mathbf{B}}{\|\mathbf{n}\|^2} \mathbf{n} \\ &= \begin{pmatrix} 2 \\ 3 \end{pmatrix} + 2 \frac{0 - (1 \ 0) \begin{pmatrix} 2 \\ 3 \end{pmatrix}}{1^2} \begin{pmatrix} 1 \\ 0 \end{pmatrix} \\ &= \begin{pmatrix} 2 \\ 3 \end{pmatrix} - \begin{pmatrix} 4 \\ 0 \end{pmatrix} \\ &= \begin{pmatrix} -2 \\ 3 \end{pmatrix} \end{aligned}$$

similarly C' and D' then we get

$$\mathbf{B}' = \begin{pmatrix} -2 \\ 3 \end{pmatrix}, \mathbf{C}' = \begin{pmatrix} -1 \\ 1 \end{pmatrix}, \mathbf{D}' = \begin{pmatrix} -2 \\ 0 \end{pmatrix}$$

- (3) joining the points in order A, B, C, D, D', C', B' and A gives a polygon which is shown below. As u can see y axis cuts the figure equally so line of symmetry equation:

$$x = 0.$$

## PLOT:

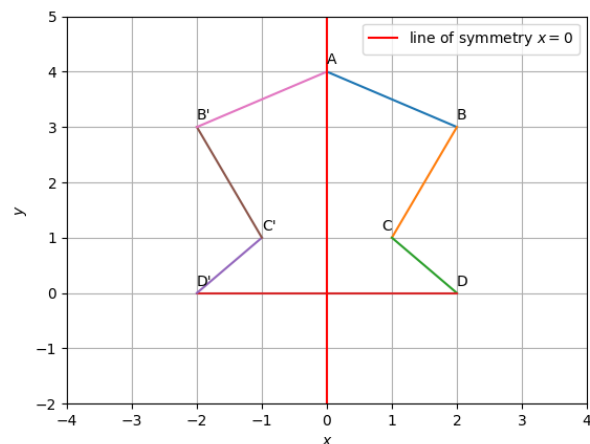


Fig. 3. plot of all points