AI1110: Assignment 1

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Download all python codes from

and latex-tikz codes from

QUESTION 7.2

Use a graph paper for this question (Take $2cms = 1unit$ 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 labebled with A,B,C,D

(2) This is general formula for image of point P in line with equation:

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

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

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

$$\mathbf{B}' = \mathbf{B} + 2\frac{c - \mathbf{n}^\top \mathbf{B}}{\|\mathbf{n}\|^2}\mathbf{n}$$

$$= \begin{pmatrix} 2 \\ 3 \end{pmatrix} + 2\frac{0 - \begin{pmatrix} 1 & 0 \end{pmatrix}\begin{pmatrix} 2 \\ 3 \end{pmatrix}}{1^2}\begin{pmatrix} 1 \\ 0 \end{pmatrix}$$

$$= \begin{pmatrix} 2 \\ 3 \end{pmatrix} - \begin{pmatrix} 4 \\ 0 \end{pmatrix}$$

$$= \begin{pmatrix} -2 \\ 3 \end{pmatrix}$$

'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:
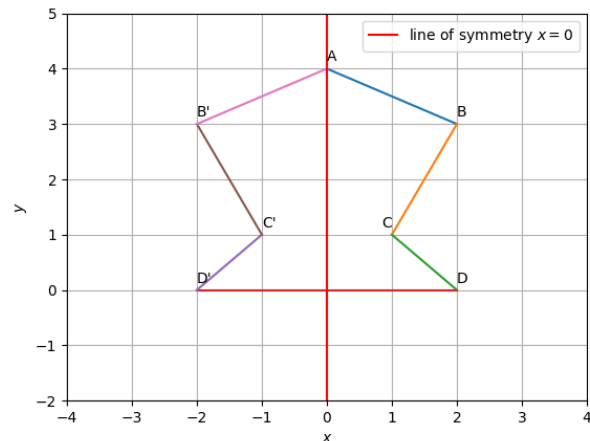
$$x = 0.$$

PLOT:

Fig. 3. Plot of all points and figure formed