

# AI1110 Assignment 1

Mannem Charan(AI21BTECH11019)

**Abstract**—This document gives the solution for Assignment 1(ICSE 2019 10 Q.5(c))

**Question 5(c):** Use a graph sheet for this question. (Take  $1\text{cm} = 1\text{unit}$  along both x and y axis.)

- Plot the following points: A(0, 5), B(3, 0), C(1, 0) and D(1, -5)
- Reflect the points B, C and D on the y axis and name them as B', C' and D' respectively.
- Write down the coordinates of B, C' and D'.
- Join the points A, B, C, D, D', C', B', A in order and give a name to the closed figure ABCDD'C'B'.

**Solution:**

1 First we will plot the points A, B, C and D which is shown in the Fig 5.1 .

2 Now to get points of reflections of

$$\mathbf{B} = \begin{pmatrix} 3 \\ 0 \end{pmatrix} \quad (2.1)$$

$$\mathbf{C} = \begin{pmatrix} 1 \\ 0 \end{pmatrix} \quad (2.2)$$

$$\mathbf{D} = \begin{pmatrix} 1 \\ -5 \end{pmatrix} \quad (2.3)$$

about y axis, we will use the below equation

$$\mathbf{R} = \mathbf{P} + 2 \frac{c - \mathbf{n}^\top \mathbf{P}}{\|\mathbf{n}\|^2} \mathbf{n} \quad (2.4)$$

where R is the point of reflection of P about a plane

$$\mathbf{n}^\top \mathbf{x} = c \quad (2.5)$$

3 For y axis ,

$$\mathbf{n} = \begin{pmatrix} 1 \\ 0 \end{pmatrix} \quad (3.1)$$

$$c = 0 \quad (3.2)$$

4 Let us call the points of reflection of B, C, D on y axis as B', C', D' then

$$\mathbf{B}' = \mathbf{B} + 2 \frac{c - \mathbf{n}^\top \mathbf{B}}{\|\mathbf{n}\|^2} \mathbf{n} \quad (4.1)$$

$$= \begin{pmatrix} 3 \\ 0 \end{pmatrix} + 2 \frac{0 - (1 \ 0) \begin{pmatrix} 3 \\ 0 \end{pmatrix}}{\left\| \begin{pmatrix} 1 \\ 0 \end{pmatrix} \right\|^2} \begin{pmatrix} 1 \\ 0 \end{pmatrix} \quad (4.2)$$

$$= \begin{pmatrix} 3 \\ 0 \end{pmatrix} - \begin{pmatrix} 6 \\ 0 \end{pmatrix} \quad (4.3)$$

$$= \begin{pmatrix} -3 \\ 0 \end{pmatrix} \quad (4.4)$$

Similarly substituting C and D in the above equation gives us,

$$\mathbf{C}' = \begin{pmatrix} -1 \\ 0 \end{pmatrix} \quad (4.5)$$

$$\mathbf{D}' = \begin{pmatrix} -1 \\ -5 \end{pmatrix} \quad (4.6)$$

5 Now joining these points in the order of A, B, C, D, D', C', B', A which gives us a 7 sided polygon. We will call it as 'ARROW HEAD'.

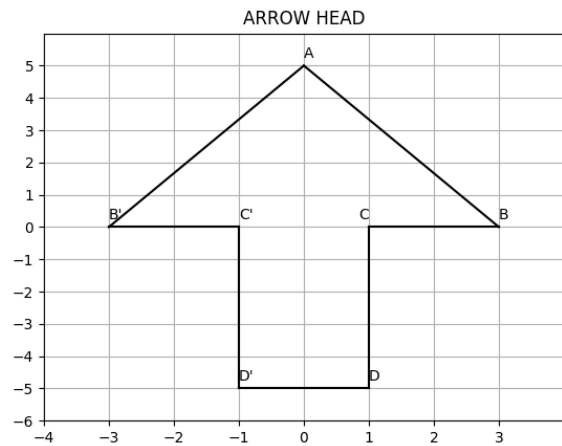


Fig. 5.1. Arrow Head