

# AI1110 Assignment 1

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**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  $1cm = 1unit$  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:**

First we will plot the points A, B, C and D which is shown in the Fig 0.1 . Now to get points of reflections of

$$\mathbf{B} = \begin{pmatrix} 3 \\ 0 \end{pmatrix} \quad (0.1)$$

$$\mathbf{C} = \begin{pmatrix} 1 \\ 0 \end{pmatrix} \quad (0.2)$$

$$\mathbf{D} = \begin{pmatrix} 1 \\ -5 \end{pmatrix} \quad (0.3)$$

about y axis, we will use the below equation

$$\mathbf{R} = \mathbf{P} + 2 \frac{c - \mathbf{n}^T \mathbf{P}}{\|\mathbf{n}\|^2} \mathbf{n} \quad (0.4)$$

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

$$\mathbf{n}^T \mathbf{x} = c \quad (0.5)$$

For y axis ,

$$\mathbf{n} = \begin{pmatrix} 1 \\ 0 \end{pmatrix} \quad (0.6)$$

$$c = 0 \quad (0.7)$$

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

$$\mathbf{B}' = \mathbf{B} + 2 \frac{c - \mathbf{n}^T \mathbf{B}}{\|\mathbf{n}\|^2} \mathbf{n} \quad (0.8)$$

$$= \begin{pmatrix} 3 \\ 0 \end{pmatrix} + 2 \frac{0 - (1 \ 0) \begin{pmatrix} 3 \\ 0 \end{pmatrix}}{\left\| \begin{pmatrix} 1 \\ 0 \end{pmatrix} \right\|^2} \begin{pmatrix} 1 \\ 0 \end{pmatrix} \quad (0.9)$$

$$= \begin{pmatrix} 3 \\ 0 \end{pmatrix} - \begin{pmatrix} 6 \\ 0 \end{pmatrix} \quad (0.10)$$

$$= \begin{pmatrix} -3 \\ 0 \end{pmatrix} \quad (0.11)$$

$$\therefore \mathbf{B}' = \begin{pmatrix} -3 \\ 0 \end{pmatrix} \quad (0.12)$$

By substituting C and D in the equation (0.4),

$$\Rightarrow \mathbf{C}' = \begin{pmatrix} -1 \\ 0 \end{pmatrix} \quad (0.13)$$

$$\Rightarrow \mathbf{D}' = \begin{pmatrix} -1 \\ -5 \end{pmatrix} \quad (0.14)$$

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'.

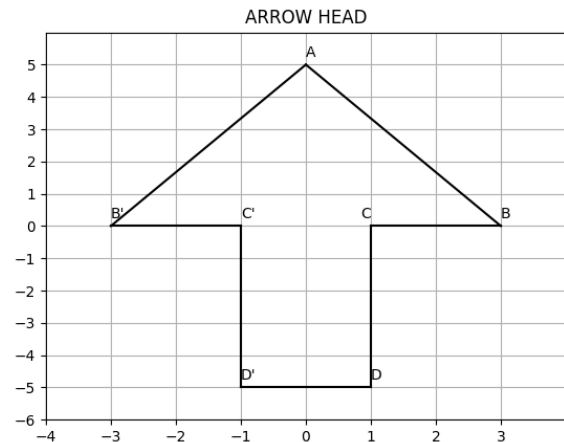


Fig. 0.1. Arrow Head