

# Assignment 1 ICSE 2019 10

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## 1 QUESTION 5C

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 plot section.
- Now to get points of reflections of

$$B = \begin{pmatrix} 3 \\ 0 \end{pmatrix} \quad (1.0.1)$$

$$C = \begin{pmatrix} 1 \\ 0 \end{pmatrix} \quad (1.0.2)$$

$$D = \begin{pmatrix} 1 \\ -5 \end{pmatrix} \quad (1.0.3)$$

about  $y$  axis, we will use the below equation

$$R = P + 2 \frac{c - \mathbf{n}^T \mathbf{P}}{\|\mathbf{n}\|^2} \mathbf{n} \quad (1.0.4)$$

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

$$\mathbf{n}^T \mathbf{x} = c \quad (1.0.5)$$

- For  $y$  axis ,

$$\mathbf{n} = \begin{pmatrix} 1 \\ 0 \end{pmatrix} \quad (1.0.6)$$

$$c = 0 \quad (1.0.7)$$

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

$$B' = B + 2 \frac{c - \mathbf{n}^T \mathbf{B}}{\|\mathbf{n}\|^2} \mathbf{n} \quad (1.0.8)$$

$$= \begin{pmatrix} 3 \\ 0 \end{pmatrix} + 2 \frac{0 - (1 \ 0) \begin{pmatrix} 3 \\ 0 \end{pmatrix}}{\left\| \begin{pmatrix} 1 \\ 0 \end{pmatrix} \right\|^2} \begin{pmatrix} 1 \\ 0 \end{pmatrix} \quad (1.0.9)$$

$$= \begin{pmatrix} 3 \\ 0 \end{pmatrix} - \begin{pmatrix} 6 \\ 0 \end{pmatrix} \quad (1.0.10)$$

$$= \begin{pmatrix} -3 \\ 0 \end{pmatrix} \quad (1.0.11)$$

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

$$C' = \begin{pmatrix} -1 \\ 0 \end{pmatrix} \quad D' = \begin{pmatrix} -1 \\ -5 \end{pmatrix} \quad (1.0.12)$$

- 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'.

PLOT:

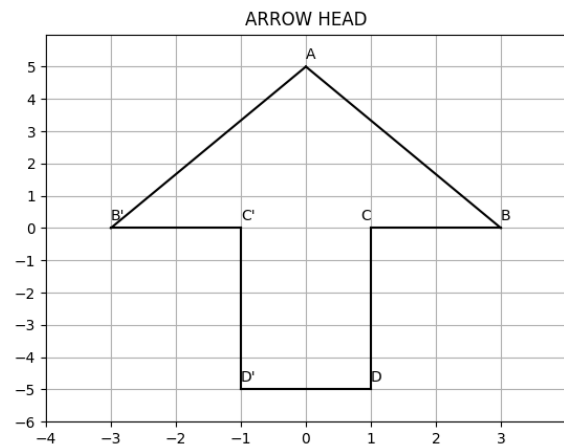


Fig. 5. Arrow Head