ASSIGNMENT-2

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1 QUESTION No. 2.43

Construct DEAR where $DE = 4, EA = 5, AR = 4.5, \angle E = 60°$ and $\angle A = 90°$.

2 SOLUTION

1) Let us assume vertices of given quadrilateral $DEAR$ as $\mathbf{D},\mathbf{E},\mathbf{A}$ and $\mathbf{R}$.
2) Let us generalize the given data:

$$\angle E = 60° = \theta \qquad (2.0.1)$$
$$\angle A = 90° = \alpha \qquad (2.0.2)$$
$$\|\mathbf{D} - \mathbf{E}\| = 4 = a \qquad (2.0.3)$$
$$\|\mathbf{E} - \mathbf{A}\| = 5 = b \qquad (2.0.4)$$
$$\|\mathbf{A} - \mathbf{R}\| = 4.5 = c \qquad (2.0.5)$$

- For this quadrilateral $DEAR$ we have,

$$\angle E + \angle A = 60° + 90° = 150° \qquad (2.0.6)$$

- Let,

$$\mathbf{E} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \mathbf{A} = \begin{pmatrix} 5 \\ 0 \end{pmatrix} \qquad (2.0.7)$$

Lemma 2.1. *The coordinates of $\mathbf{D}$ and $\mathbf{R}$ can be written as follows:*

$$\mathbf{D} = a\mathbf{e} \quad \left(\because \mathbf{E} = \begin{pmatrix} 0 \\ 0 \end{pmatrix} \right) \qquad (2.0.8)$$

$$\mathbf{R} = \mathbf{A} + c\mathbf{a} \qquad (2.0.9)$$

Let us define e,a as:

$$\mathbf{e} = \begin{pmatrix} \cos E \\ \sin E \end{pmatrix} \mathbf{a} = \begin{pmatrix} \cos A \\ \sin A \end{pmatrix} \qquad (2.0.10)$$

- For finding coordinates of D:-
Putting (2.0.1) and (2.0.3) in (2.0.8) we get,

$$\implies \mathbf{D} = 4 \begin{pmatrix} \cos 60° \\ \sin 60° \end{pmatrix} \qquad (2.0.11)$$

$$\implies \mathbf{D} = \begin{pmatrix} 2 \\ 3.46 \end{pmatrix} \qquad (2.0.12)$$

- For finding coordinates of R:-
Putting (2.0.2) and (2.0.5) in (2.0.9) we get,

$$\implies \mathbf{R} = \begin{pmatrix} 5 \\ 0 \end{pmatrix} + 4.5 \begin{pmatrix} \cos 90° \\ \sin 90° \end{pmatrix} \qquad (2.0.13)$$

$$\implies \mathbf{R} = \begin{pmatrix} 5 \\ 0 \end{pmatrix} + \begin{pmatrix} 0 \\ 1 \end{pmatrix} \qquad (2.0.14)$$

$$\implies \mathbf{R} = \begin{pmatrix} 5 \\ 1 \end{pmatrix} \qquad (2.0.15)$$

Now,the vertices of given Quadrilateral DEAR can be written as,

$$\mathbf{D} = \begin{pmatrix} 2 \\ 3.46 \end{pmatrix}, \mathbf{E} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \mathbf{A} = \begin{pmatrix} 5 \\ 0 \end{pmatrix}, \mathbf{R} = \begin{pmatrix} 5 \\ 1 \end{pmatrix} \qquad (2.0.16)$$
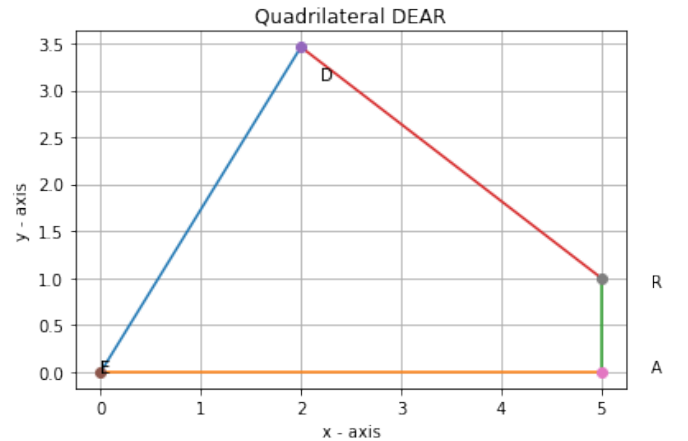
3) On constructing the quadrilateral $DEAR$ we get:

Fig. 2.1: Quadrilateral DEAR