

3.4.5

AI25BTECH11036-SNEHAMRUDULA

Question:

3.4.5 Construct a rhombus whose side is of length 3.4 cm and one of its angles is 45° .

Solution:

Let the side length be

$$s = 3.4 \quad (0.1)$$

and the given angle be

$$\theta = 45^\circ. \quad (0.2)$$

We now place the vertices of the rhombus as follows:

$$\mathbf{A} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \quad (0.3)$$

$$\mathbf{B} = s \begin{pmatrix} 1 \\ 0 \end{pmatrix}, \quad (0.4)$$

$$\mathbf{D} = s \begin{pmatrix} \cos \theta \\ \sin \theta \end{pmatrix}. \quad (0.5)$$

The fourth vertex is obtained using the parallelogram law:

$$\mathbf{C} = \mathbf{B} + \mathbf{D} - \mathbf{A}. \quad (0.6)$$

Thus, the coordinates of the rhombus are

$$\mathbf{A} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \quad (0.7)$$

$$\mathbf{B} = \begin{pmatrix} 3.4 \\ 0 \end{pmatrix}, \quad (0.8)$$

$$\mathbf{D} = \begin{pmatrix} \frac{3.4}{\sqrt{2}} \\ \frac{3.4}{\sqrt{2}} \end{pmatrix}, \quad (0.9)$$

$$\mathbf{C} = \begin{pmatrix} 3.4 + \frac{3.4}{\sqrt{2}} \\ \frac{3.4}{\sqrt{2}} \end{pmatrix}. \quad (0.10)$$

Verification of equal sides:

$$\|\mathbf{B} - \mathbf{A}\| = s, \quad (0.11)$$

$$\|\mathbf{D} - \mathbf{A}\| = s, \quad (0.12)$$

$$\|\mathbf{C} - \mathbf{B}\| = s, \quad (0.13)$$

$$\|\mathbf{C} - \mathbf{D}\| = s. \quad (0.14)$$

Hence, $ABCD$ is a rhombus with side length $s = 3.4$ cm and $\angle DAB = \theta = 45^\circ$.

Rhombus with side = 3.4 cm and angle A = 45°

