PARALLELOGRAM

Soundarya Naru

narusoundarya2002@gmail.com

FWC22012 IITH Future Wireless Communication (FWC) ASSIGN-5

Contents

1 Problem

In a parallelogram ABCD, E and F are the mid-points of sides AB and CD respectively (see Fig. 8.31). Show that the line segments AF and EC trisect the diagonal BD.

2 Solution1

The input parameters for this construction are

Symbol	Value
b	6
r	5
θ	$\frac{\pi}{3}$

$$\mathbf{A} = \begin{pmatrix} 0 \\ 0 \end{pmatrix}$$

$$\mathbf{D} = \begin{pmatrix} r\cos\theta \\ r\sin\theta \end{pmatrix}$$

$$\mathbf{B} = \begin{pmatrix} 0 \\ b \end{pmatrix}$$

$$\mathbf{C} = \mathbf{B} + \mathbf{C}$$

$$\mathbf{E} = (\mathbf{A} + \mathbf{B})/2$$

$$\mathbf{F} = (\mathbf{C} + \mathbf{D})/2$$

To Prove: PQ=QB=DP

$$\mathbf{P} = (\mathbf{2D} + \mathbf{B})/3$$

$$\mathbf{Q} = (\mathbf{2B} + \mathbf{D})/3$$

The distance between P and Q is $\|\mathbf{P} - \mathbf{Q}\|$

The distance between Q and B is $\|\mathbf{Q} - \mathbf{B}\|$

The distance between D and P is $\|\mathbf{D} - \mathbf{P}\|$

if $\|\mathbf{P} - \mathbf{Q}\| = \|\mathbf{Q} - \mathbf{B}\| = \|\mathbf{D} - \mathbf{P}\|$

then PQ=QB=DP..........(1)

From equation (1) we can say that

The line segments AF and EC trisect the diagonal BD.

3 Solution2

In ΔDQC

F is midpoint of line DC

$$\mathbf{F} = (\mathbf{D} + \mathbf{C})/2 \tag{1}$$

By converting midpoint theorem

P is mid point of line DQ

$$\mathbf{P} = (\mathbf{D}+\mathbf{Q})/2 \tag{2}$$

then,

The distance between D and P is $\|\mathbf{D}-\mathbf{P}\|$

The distance between P and Q is $\|\mathbf{P}-\mathbf{Q}\|$

if $\|\mathbf{D}-\mathbf{P}\|$=$\|\mathbf{P}-\mathbf{Q}\|$

$$DP = PQ \tag{3}$$

In ΔAPB

E is midpoint of line AB

$$\mathbf{E} = (\mathbf{A}+\mathbf{B})/2 \tag{4}$$

By converting of mid point theorem

Q is midpoint of BP

$$\mathbf{Q} = (\mathbf{B}+\mathbf{P})/2 \tag{5}$$

then,

The distance between P and Q is $\|\mathbf{P}-\mathbf{Q}\|$

The distance between Q and B is $\|\mathbf{Q}-\mathbf{B}\|$

if $\|\mathbf{P}-\mathbf{Q}\|$=$\|\mathbf{Q}-\mathbf{B}\|$

$$PQ = QB \tag{6}$$

$$\|\mathbf{D}-\mathbf{P}\| = \|\mathbf{P}-\mathbf{Q}\| = \|\mathbf{Q}-\mathbf{B}\|$$

$\therefore$ from (5),(8)

$$DP = PQ = QB \tag{7}$$

from equation (9) we can say that the

The line segments AF and EC trisect the diagonal BD.

AF and EC trisect BD.

The below python code realizes the above construction:

```
https://github.com/soundaryanaru/FWC−assignments/tree
/main/Matrix/Line_assignment/code
```

4 Construction