MATRICES USING PYTHON

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FWC22040 IITH Future Wireless Communication (FWC) ASSIGN-5

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1 Problem

ABC and BDE are two equilateral triangles such that D is the mid-point of BC. If AE intersects BC at F, show that

(i) ar(BDE) =1/4 ar(ABC)

(ii)ar(BDE) =1/2 ar(BAE)

(iii)ar(ABC) =2 ar(BEC)

(iv)ar(BFE) = ar(AFD)

(v)ar(BFE) =2ar(FED)

(vi)ar(FED) =1/8 ar(AFC)

[Hint : Join EC and AD. Show that BE AC abd DE AB, etc.]

2 Solution

Theory:

To Prove: ar(BDE)=1/4 ar(ABC)

ABC and BDE are two equilateral triangles such that D is the mid-point of BC.If AE intersets BC at F

termux commands :

```
python3 matrix.py
```

The input parameters for this construction are

Symbol	Value	Description
r	5	AB
$\mathbf{A}$	$r\begin{pmatrix}\cos\theta\\ \sin\theta\end{pmatrix}$	Point A
$\mathbf{E}$	$\begin{pmatrix}\frac{r}{2}\cos\theta\\ \frac{r}{2}\sin\theta\end{pmatrix}$	Point E
$\mathbf{B}$	$\begin{pmatrix}0\\ 0\end{pmatrix}$	Point B
$\mathbf{C}$	$\begin{pmatrix}r\\ 0\end{pmatrix}$	Point C
$\mathbf{D}$	$\begin{pmatrix}r/2\\ 0\end{pmatrix}$	Point D
$\mathbf{F}$	$\begin{pmatrix}\frac{2}{3}r\cos\theta\\ 0\end{pmatrix}$	Point F
θ_1	$\pi/3$	∠ABC

To Prove: ar(BDE)=1/4 ar(ABC)

$$\mathbf{v1} = \mathbf{A} - \mathbf{B}$$
$$\mathbf{v2} = \mathbf{A} - \mathbf{C}$$
$$ar(\Delta ABC) = \tfrac{1}{2}\|\mathbf{v1}\times\mathbf{v2}\| ....(1)$$
$$\mathbf{v3} = \mathbf{B} - \mathbf{D}$$
$$\mathbf{v4} = \mathbf{B} - \mathbf{E}$$
$$ar(\Delta BDE) = \tfrac{1}{2}\|\mathbf{v3}\times\mathbf{v4}\| ....(2)$$
$$ar(BDE) = \tfrac{1}{4}ar(ABC)$$

To Prove: ar(BDE)=1/2 ar(BAE)

$$\mathbf{v5} = \mathbf{A} - \mathbf{E}$$
$$\mathbf{v6} = \mathbf{A} - \mathbf{B}$$

$$ar(\Delta BAE) = \frac{1}{2}\|\mathbf{v5} \times \mathbf{v6}\|...............(3)$$

$$ar(BDE) = \frac{1}{2}ar(BAE)$$

To Prove: ar(ABC)=2 ar(BEC)

$$\mathbf{v7} = \mathbf{B} - \mathbf{C}$$

$$\mathbf{v8} = \mathbf{B} - \mathbf{E}$$

$$ar(\Delta BEC) = \frac{1}{2}\|\mathbf{v7} \times \mathbf{v8}\|...............(4)$$

$$ar(ABC) = 2ar(BEC)$$

To Prove: ar(BFE)=ar(AFD)

$$\mathbf{v9} = \mathbf{B} - \mathbf{F}$$

$$\mathbf{v10} = \mathbf{B} - \mathbf{E}$$

$$\mathbf{v11} = \mathbf{A} - \mathbf{D}$$

$$\mathbf{v12} = \mathbf{A} - \mathbf{F}$$

$$ar(\Delta BFE) = \frac{1}{2}\|\mathbf{v9} \times \mathbf{v10}\|...............(4)$$

$$ar(\Delta AFD) = \frac{1}{2}\|\mathbf{v11} \times \mathbf{v12}\|...............(4)$$

ar(BFE)=ar(AFD)

To prove : ar(BFE) =2ar(FED)

$$\mathbf{v13} = \mathbf{F} - \mathbf{E}$$

$$\mathbf{v14} = \mathbf{F} - \mathbf{D}$$

$$ar(\Delta FED) = \frac{1}{2}\|\mathbf{v13} \times \mathbf{v14}\|...............(4)$$

$$ar(BFE) = 2ar(FED)$$

To prove : $ar(FED) = \frac{1}{8}ar(AFC)$

$$\mathbf{v15} = \mathbf{A} - \mathbf{F}$$

$$\mathbf{v16} = \mathbf{A} - \mathbf{C}$$

$$ar(\Delta AFC) = \frac{1}{2}\|\mathbf{v15} \times \mathbf{v16}\|...............(4)$$

$$ar(FED) = \frac{1}{8}ar(AFC)$$

The below python code realizes the above construction:

https://github.com/Vamsi9849/iithfwc/blob/main/ Matrix_line/codes/matrix.py

3 Construction

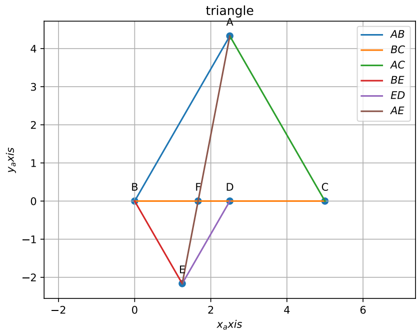

Figure of construction