

# MATRICES USING PYTHON

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IITH Future Wireless Communication (FWC)

ASSIGN-5

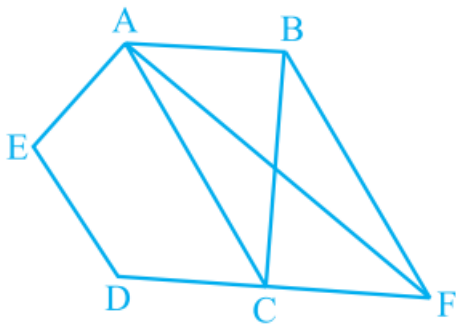
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## 1 Problem

ABCDE is a pentagon. A line through B parallel to AC meets DC produced at F. Show that

- (i)  $\text{ar}(\triangle ACB) = \text{ar}(\triangle ACF)$
- (ii)  $\text{ar}(\triangle AEDF) = \text{ar}(\triangle ABCDE)$



## 2 Solution

### Theory:

In pentagon ABCDE,  $AC \parallel BF$

**To Prove:**  $\text{Ar}(\triangle ACB) = \text{Ar}(\triangle ACF)$

$\triangle ACB$  and  $\triangle ACF$  lie on the same base AC and are between the same parallel lines AC and BF.

**Theorem:** Two triangles on the same base (or equal bases) and between the same parallels are equal in area.

$$\therefore \text{Ar}(\triangle ACB) = \text{Ar}(\triangle ACF) \dots (1)$$

Hence, Proved

**To Prove:**  $\text{Ar}(\triangle AEDF) = \text{Ar}(\triangle ABCDE)$

Add  $\text{Ar}(\triangle AEDC)$  to (1) both sides

$$\text{Ar}(\triangle ACB) + \text{Ar}(\triangle AEDC) = \text{Ar}(\triangle ACF) + \text{Ar}(\triangle AEDC)$$

$$\therefore \text{Ar}(\triangle ABCDE) = \text{Ar}(\triangle AEDF)$$

Hence, Proved

termux commands :

```
python3 matrix.py
```

The input parameters for this construction are

Symbol	Value	Description
r1	4	DC
r2	8	DB
r3	6.5	DA
r4	4	DE
$\theta_1$	$17\pi/36$	$\angle BDC$
$\theta_2$	$53\pi/180$	$\angle ADC$
$\theta_3$	$2\pi/3$	$\angle EDC$
D	$\begin{pmatrix} 0 \\ 0 \end{pmatrix}$	Point D

**To Prove:**  $\text{Ar}(\triangle ACB) = \text{Ar}(\triangle ACF)$

$$F = C - A + B$$

$$v1 = C - A$$

$$v2 = C - F$$

Area of the triangle  $\triangle ACF$  is given by

$$\text{Ar}(\triangle ACF) = \frac{1}{2} \|v1 \times v2\| \dots (2)$$

$$v3 = A - C$$

$$v4 = A - B$$

Area of the triangle  $\triangle ACB$  is given by

$$\text{Ar}(\triangle ACB) = \frac{1}{2} \|v3 \times v4\| \dots (3)$$

**To Prove:**  $\text{Ar}(\triangle AEDF) = \text{Ar}(\triangle ABCDE)$

$$\text{Ar}(\triangle AED) = \frac{1}{2} \|A \times E\| \dots (5)$$

$$\text{Ar}(\triangle ADC) = \frac{1}{2} \|A \times C\| \dots (6)$$

$$\text{Ar}(\triangle AEDC) = \text{Ar}(\triangle AED) + \text{Ar}(\triangle ADC)$$

$$\therefore \text{Ar}(\triangle AEDF) = \text{Ar}(\triangle AEDC) + \text{Ar}(\triangle ACF) \dots (7)$$

$$\therefore \text{Ar}(\triangle ABCDE) = \text{Ar}(\triangle AEDC) + \text{Ar}(\triangle ACB) \dots (8)$$

The below python code realizes the above construction:

[https://github.com/velicharlagokulkumar/FWC\\_module1/tree/main/matrices/lines/codes/matrix.py](https://github.com/velicharlagokulkumar/FWC_module1/tree/main/matrices/lines/codes/matrix.py)

## 3 Construction

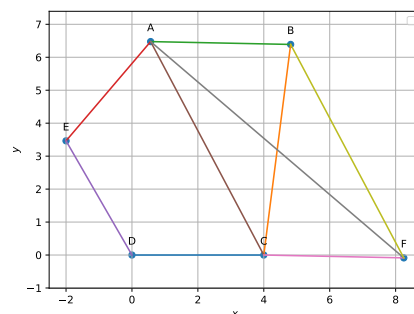


Figure of construction