Matrices Assignment - Line

Dukkipati Vijay Sai

Get Python code for the figure from

https://github.com/dukkipativijay/Fwciith2022/tree/main/Assignment%201/Codes/src

Get LaTex code from

https://github.com/dukkipativijay/Fwciith2022/tree/main/Assignment%201%20-%20Assembly/Codes

1 Question

Class 9, Exercise 9.2, Q(1)

In the Figure, ABCD is a parallelogram, $AE \perp DC$ **and** $CF \perp AD$**. If** $AB = 16cm$**,** $AE = 8cm$**, and** $CF = 10cm$**, find AD.**

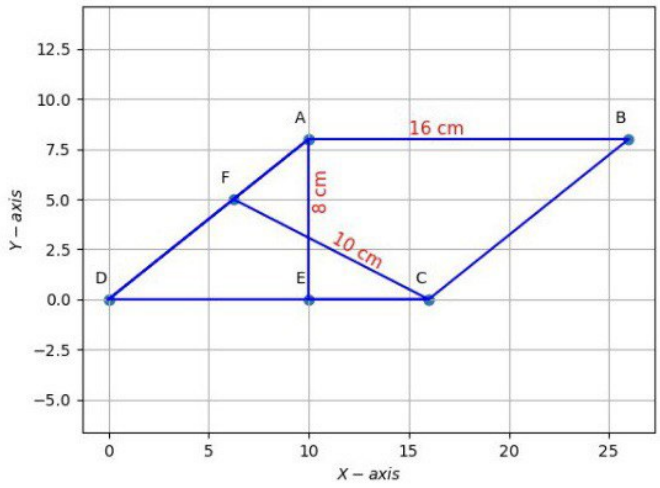

Figure 1 - Parallelogram ABCD

2 Construction

Symbol	Value	Description
D	Origin (0,0)	Vertex D
AB	16cm	$\| \mathbf{B} - \mathbf{A} \|$
CD	16cm	$\| \mathbf{D} - \mathbf{C} \| = \| \mathbf{B} - \mathbf{A} \|$
C	(16,0)	Vertex C ($\because CD = 16cm$)
AE	8cm	$\| \mathbf{E} - \mathbf{A} \|$
CF	10cm	$\| \mathbf{F} - \mathbf{C} \|$
A	(10,8)	$Ay = Dy + \lvert\overrightarrow{AE}\rvert$ $Ax = \sqrt{\frac{CF^2}{AB^2 - CF^2}}$
B	(26,8)	$By = Dy + \lvert\overrightarrow{AE}\rvert$ $Bx = Ax + AB$
F	(6.25,5)	$Fy = 0.8\ X\ Fx$
E	(10,0)	Ex = Ax, Ey=0

3 Solution

From the properties of Parallelogram we know that, Opposite sides are equal in length. Hence, we can write,

$$| \overrightarrow{CD} | = | \overrightarrow{AB} |$$

$$\text{Hence, } \| \mathbf{D} - \mathbf{C} \| = \| \mathbf{B} - \mathbf{A} \| = 16cm$$

We also know that,

$$\text{Area of a Parallelogram} = \text{Base x Height}$$

Since, it is given that $\overrightarrow{AE} \perp \overrightarrow{CD}$ from the figure 1 we can write,

$$\text{Area of Parallelogram ABCD} = | \overrightarrow{CD} | \, x \, | \overrightarrow{AE} | \quad (1)$$

$$= \| \mathbf{D} - \mathbf{C} \| \, x \, \| \mathbf{E} - \mathbf{A} \|$$

But it is also given that $\overrightarrow{CF} \perp \overrightarrow{AD}$. Hence we can similarly write,

$$\text{Area of Parallelogram ABCD} = | \overrightarrow{AD} | \, x \, | \overrightarrow{CF} | \quad (2)$$

$$= \| \mathbf{D} - \mathbf{A} \| \, x \, \| \mathbf{F} - \mathbf{C} \|$$

Observing Eq. (1) and Eq. (2), we see that both are equal. Hence we get,

$$\| \mathbf{D} - \mathbf{C} \| \, x \, \| \mathbf{E} - \mathbf{A} \| = \| \mathbf{D} - \mathbf{A} \| \, x \, \| \mathbf{F} - \mathbf{C} \|$$

$$| 16 | \, x \, | 8 | = \| \mathbf{D} - \mathbf{A} \| \, x \, | 10 |$$

$$128 = \| \mathbf{D} - \mathbf{A} \| \text{ x } 10$$

$$\| \mathbf{D} - \mathbf{A} \| = \frac{128}{10}$$

$$\therefore \mathbf{| \overrightarrow{AD} | = 12.8 \text{ cm}}$$

Hence, This is the required value of AD.