

# MATRICES USING PYTHON

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IITH Future Wireless Communication (FWC)

ASSIGN-4

## Contents

### 1 Problem

### 2 Construction

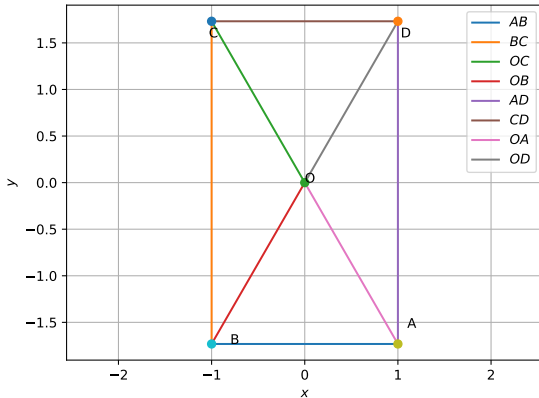
### 3 Solution

## 1 Problem

If diagonals of a parallelogram are equal then show that it is a rectangle

## 2 Construction

Figure of Construction



The input parameters for this construction are

Symbol	Value	Description
r	6	AC
k	4	AB
$\theta$	$\arccos(k/r)$	$\angle AC$
<b>A</b>	$\begin{pmatrix} 0 \\ 0 \end{pmatrix}$	Point A

## 3 Solution

Termux commands :

```
python3 matrixline.py
```

To Prove: ABCD is a rectangle

Given: ABCD is a parallelogram

$$\mathbf{B} - \mathbf{A} = \mathbf{D} - \mathbf{C} \quad (1)$$

We can write this as

$$\mathbf{A} - \mathbf{C} = \mathbf{B} - \mathbf{D} \quad (2)$$

And, Diagonals of the parallelogram are equal.

$$\mathbf{C} - \mathbf{A} = \mathbf{D} - \mathbf{B} \quad (3)$$

If we take a point on the intersection of diagonals then we can write

$$\|\mathbf{O} - \mathbf{D}\| = \|\mathbf{O} - \mathbf{C}\| = \|\mathbf{O} - \mathbf{B}\| = \|\mathbf{O} - \mathbf{A}\| \quad (4)$$

Then we can say that diagonals bisect each other. And,

$$\cos \theta_1 = \frac{(\mathbf{B} - \mathbf{A})^T (\mathbf{A} - \mathbf{D})}{\|(\mathbf{B} - \mathbf{A})\| \|(\mathbf{A} - \mathbf{D})\|} \quad (5)$$

$$(\mathbf{B} - \mathbf{A})^T (\mathbf{A} - \mathbf{D}) = 0 \quad (6)$$

$$\Rightarrow \cos \theta = 0 \quad (7)$$

$$\theta = 90 \quad (8)$$

$\therefore$  It is a rectangle

The below python code realizes the above construction:

[https://github.com/Rahulraj00/Assignments/tree/main/Assignments/assg\\_4](https://github.com/Rahulraj00/Assignments/tree/main/Assignments/assg_4)