MATRICES USING PYTHON

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FWC22008   IITH Future Wireless Communication (FWC)   ASSIGN-4

Contents

1 Problem

ABCD is a rhombus.show that the diagonal AC bisects angle A as well as angle C and diagonal BD bisects angle B as well as angle D.

2 Solution

Theory:

Given ABCD is a rhombus

To Prove: Diagonals bisects angles

In rhombus
$\|\mathbf{A} - \mathbf{B}\| = \|\mathbf{B} - \mathbf{C}\| = \|\mathbf{C} - \mathbf{D}\| = \|\mathbf{D} - \mathbf{A}\|$
$\|\mathbf{C} - \mathbf{O}\| = \|\mathbf{O} - \mathbf{A}\|$
$\|\mathbf{B} - \mathbf{O}\| = \|\mathbf{O} - \mathbf{D}\|$

Termux commands :

```
python3 rhombus1.py
```

The input parameters for this construction are

Symbol	Value	Description
O	$\begin{pmatrix} 0 \\ 0 \end{pmatrix}$	Point O
Z1	2	Point Z1
Z2	2	Point Z2

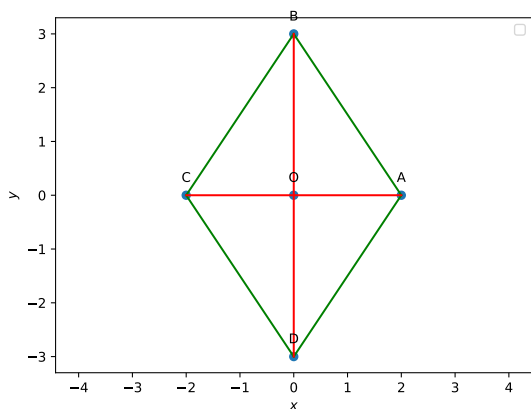**To Prove:**
$\angle$ BCA= $\angle$DCA
$\angle$ DAC= $\angle$BAD

$$\mathbf{P2} = \mathbf{C} - \mathbf{B} \tag{1}$$
$$\mathbf{P3} = \mathbf{C} - \mathbf{D} \tag{2}$$
$$\mathbf{P5} = \mathbf{C} - \mathbf{A} \tag{3}$$

'Angle between vectors P2,P5 is given by

$$\cos\theta = \frac{(\mathbf{C} - \mathbf{B})^T(\mathbf{C} - \mathbf{A})}{\|(\mathbf{C} - \mathbf{B})\|\|(\mathbf{C} - \mathbf{A})\|} \tag{4}$$

$$\mathbf{P5} = \mathbf{C} - \mathbf{A} \tag{5}$$
$$\mathbf{P3} = \mathbf{C} - \mathbf{D} \tag{6}$$

'Angle between vectors P5,P3 is given by

$$\cos\theta_1 = \frac{(\mathbf{C} - \mathbf{A})^T(\mathbf{C} - \mathbf{D})}{\|(\mathbf{C} - \mathbf{A})\|\|(\mathbf{C} - \mathbf{D})\|} \tag{7}$$

$$\|\mathbf{C} - \mathbf{B} + \mathbf{A} - \mathbf{C}\|^2 \tag{8}$$

$$\|\mathbf{C} - \mathbf{B}\|^2 + \|\mathbf{A} - \mathbf{C}\|^2 + 2(\mathbf{C} - \mathbf{B})^T(\mathbf{A} - \mathbf{C}) = \|(\mathbf{A} - \mathbf{B})\|^2 \tag{9}$$

$$\|\mathbf{C} - \mathbf{A} + \mathbf{D} - \mathbf{C}\|^2 \tag{10}$$

$$\|\mathbf{C} - \mathbf{A}\|^2 + \|(\mathbf{D} - \mathbf{C})\|^2 + 2(\mathbf{C} - \mathbf{A})^T(\mathbf{D} - \mathbf{C}) = \|(\mathbf{D} - \mathbf{A})\|^2 \tag{11}$$

by using equations 9 and 11 we get

$$(\mathbf{C} - \mathbf{B})^T(\mathbf{C} - \mathbf{A}) = (\mathbf{C} - \mathbf{A})^T(\mathbf{C} - \mathbf{D}) \tag{12}$$

$$cos\theta_1 = cos\theta \tag{13}$$

$\therefore$ diagonals of a rhombus bisects the angles

3 Construction

Figure of Construction

The below python code realizes the above construction:
https://github.com/ballepu1994/matricesline