Assignment 3.1

D V K M Rishab
AI20MTECH14004

Download the python code, latex file and the pdf doc from

https://github.com/Rishab9991/EE5609/tree/master/Assignments/Assignment3.1

Solution:
Consider Fig. 1

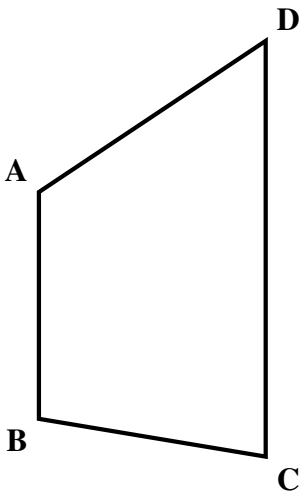

Fig. 1: Quadrilateral ABCD

AB is the smallest and CD is the largest side in the quadrilateral.

The sides AB, BC, CD and DA of the quadrilateral will be represented as direction vectors $\mathbf{m_{AB}}$, $\mathbf{m_{BC}}$, $\mathbf{m_{CD}}$ and $\mathbf{m_{DA}}$ which are obtained from Vectors $\mathbf{A}$, $\mathbf{B}$, $\mathbf{C}$ and $\mathbf{D}$ which belong in the $\mathbb{R}^2$ space.

$$\mathbf{m_{AB}} = \mathbf{A} - \mathbf{B} \tag{1}$$
$$\mathbf{m_{BC}} = \mathbf{B} - \mathbf{C} \tag{2}$$
$$\mathbf{m_{CD}} = \mathbf{C} - \mathbf{D} \tag{3}$$
$$\mathbf{m_{DA}} = \mathbf{D} - \mathbf{A} \tag{4}$$

Consider Fig. 2 with diagonal AC.

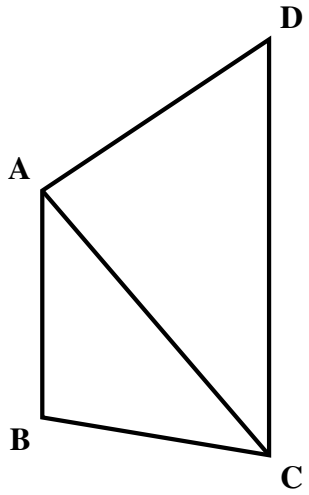

Fig. 2: Quadrilateral ABCD with diagonal AC

In Triangle ABC,

$$\|\mathbf{B} - \mathbf{C}\| > \|\mathbf{A} - \mathbf{B}\| \tag{5}$$
$$\implies \angle BAC > \angle ACB \tag{6}$$

Similarly, In Triangle CDA

$$\|\mathbf{C} - \mathbf{D}\| > \|\mathbf{D} - \mathbf{A}\| \tag{7}$$
$$\implies \angle CAD > \angle DCA \tag{8}$$

Where $\|\mathbf{A} - \mathbf{B}\|$, $\|\mathbf{B} - \mathbf{C}\|$, $\|\mathbf{C} - \mathbf{D}\|$, $\|\mathbf{D} - \mathbf{A}\|$ are magnitudes of sides AB, BC, CD and DA.

From adding (6) and (8) on LHS and RHS separately, we get

$$\angle A > \angle C \tag{9}$$

Consider Fig. 3 with diagonal BD.

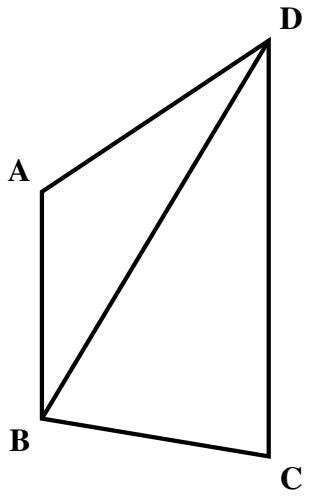

Fig. 3: Quadrilateral ABCD with diagonal BD

In Triangle BAD,

$$\|\mathbf{A}-\mathbf{D}\| > \|\mathbf{A}-\mathbf{B}\| \tag{10}$$

$$\implies \angle ABD > \angle BDA \tag{11}$$

Similarly, In Triangle DCB

$$\|\mathbf{C}-\mathbf{D}\| > \|\mathbf{B}-\mathbf{C}\| \tag{12}$$

$$\implies \angle CBD > \angle CDB \tag{13}$$

From adding (11) and (13) on LHS and RHS separately, we get

$$\angle B > \angle D \tag{14}$$

From (9) and (14)

Hence Proved.