Assignment 1

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ICSE 2019 11c

Question: In the given figure, $ABCDE$ is a pentagon inscribed in a circle such that AC is a diameter and side $BC//AE$. If $\angle BAC = 50°$, find giving reasons:

1) $\angle ACB$
2) $\angle EDC$
3) $\angle BDC$

Hence prove that BE is also a diametre. **Solution:**

Fig. 1.
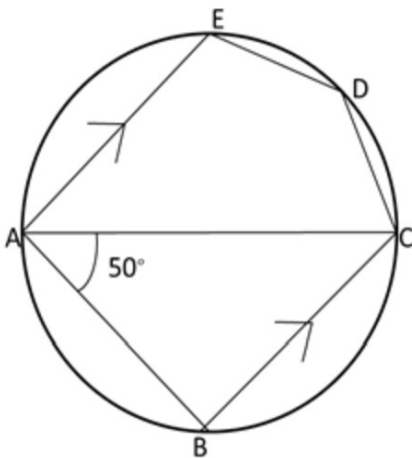
1) $\triangle ABC$, $\angle ABC = 90°$ (angle in a semicircle)

$$\angle CBA + \angle BCA + \angle CAB = 180° \quad (1)$$
$$90° + \angle BCA + 50° = 180° \quad (2)$$
$$\angle BCA = 40° \quad (3)$$

2) $AE\backslash\backslash BC$

$$\angle CAE = \angle ACB = 40°(pair of alternate angles) \quad (4)$$

In cyclic quadrilateral $ACDE$

$$\angle CAE + \angle EDC = 180° \quad (5)$$

opposite angles of a cyclic quadrilateral add upto $180°$

$$40° + \angle EDC = 180° \quad (6)$$
$$\angle EDC = 140° \quad (7)$$

3) $\angle BEC = \angle BAC = 50°$(angles in the same segment)

4) For the proof of diameter

$$\angle AEB = 90° - 50° = 50° \quad (8)$$
$$\angle EBC = 40° \quad (9)$$
$$\angle ECB = 90° \quad (10)$$

$\therefore$ BE is a diameter

Steps for python plot:

1) Let $\mathbf{O}$ be the origin

$$\mathbf{O} = \begin{pmatrix} 0 \\ 0 \end{pmatrix} \quad (11)$$

Draw a circle with centre at $\mathbf{O}$ and radius $r = 1$ Without losing generality lets assume AC to be along $x - axis$.This gives points $\mathbf{A}$ and $\mathbf{C}$.

$$\mathbf{A} = \begin{pmatrix} -1 \\ 0 \end{pmatrix} \quad (12)$$

$$\mathbf{C} = \begin{pmatrix} 1 \\ 0 \end{pmatrix} \quad (13)$$

Plot the points A,B,O and join them.

2) The angle between OA and OB is $80°$. So, coordinates of $\mathbf{B}$ are

$$\mathbf{B} = \begin{pmatrix} -\cos(80°) \\ -\sin(80°) \end{pmatrix} \quad (14)$$

Plot B.

3) The angle between OC and OE is $80°$ So,cordinates of **E** are

$$\mathbf{E} = \begin{pmatrix} \cos(80°) \\ \sin(80°) \end{pmatrix} \qquad (15)$$

Plot E.

4) **D** can be anywhere between **E** and **C** lets plot the symmetric point then angle between OD and OC is $40°$.

$$\mathbf{D} = \begin{pmatrix} \cos(40°) \\ \sin(40°) \end{pmatrix} \qquad (16)$$

Plot D.

5) Now join AB BC CD DE EA and BE.

The python figure obtained from following the above steps is

6) The parameters required o construct the figure in python are given in the below table .

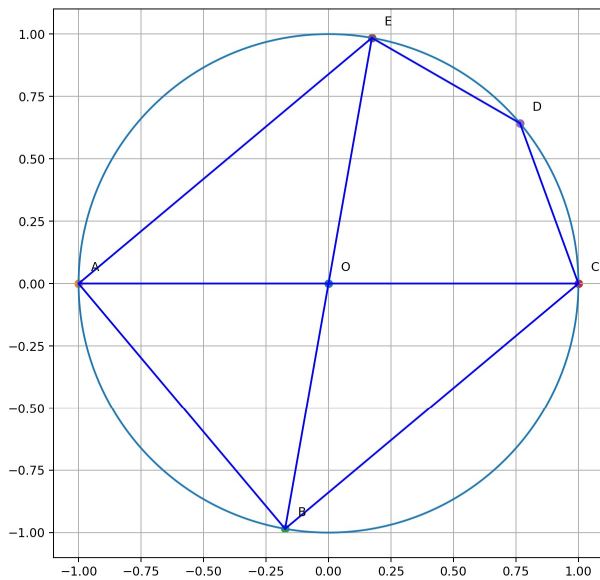| Symbol	Value	description
r	1	value of r does not change our results
θ	$40°$	$\angle EAC$,calculated
A	$\begin{pmatrix} -1 \\ 0 \end{pmatrix}$	assumed
C	$\begin{pmatrix} 1 \\ 0 \end{pmatrix}$	assumed
B	$\begin{pmatrix} -r\cos(2\theta) \\ -r\sin(2\theta) \end{pmatrix}$	calculated
E	$\begin{pmatrix} r\cos(2\theta) \\ r\sin(2\theta) \end{pmatrix}$	calculated
D	$\begin{pmatrix} r\cos(\theta) \\ r\sin(\theta) \end{pmatrix}$	calculated

Fig. 2.