A Book of Abstract Algebra | (2nd Edition)

Problem

A polygon is called *constructible* iff its vertices are constructible points. Prove the following:

The regular *n*-gon is constructible iff the angle $2\pi/n$ is constructible.

Step-by-step solution

Step 1 of 3

Here, objective is to prove that the regular *n*-gon is constructible if and only if the angle $\frac{2\pi}{n}$ is constructible.

Comment

Step 2 of 3

Constructible point:

The point is either the end point of given unit segment or it is the intersection of two lines determined by previous constructible points.

Regular *n*-gon has *n* equal length of sides and all angles are equal.

Comment

Step 3 of 3

Polygon is constructible if and only if its vertices are constructible.

The angle at each vertex

$$= \pi - \frac{2\pi}{n}$$

if the angle $\frac{2\pi}{n}$ is constructible, then $\pi - \frac{2\pi}{n}$ is constructible.

Then each vertex of *n*-gon is constructible, which implies Polygon is constructible.

Therefore,

Regular *n*-gon is constructible if and only if the angle $\frac{2\pi}{n}$ is constructible.

Hence, proved.

Comment

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