

# A Book of Abstract Algebra | (2nd Edition)

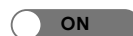


Chapter 30, Problem 1ED



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## 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.

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### 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.

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### 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.

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