

A Book of Abstract Algebra | (2nd Edition)

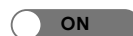


Chapter 30, Problem 5EG



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Problem

Prove each of the following:

The line $ax + by + c = 0$ is constructible if $a, b, c \in \mathbb{D}$.

Step-by-step solution

Step 1 of 4

Here, objective is to prove that the line $ax + by + c = 0$ is constructible, if $a, b, c \in \mathbb{D}$.

Consider $a \in \mathbb{D}$ if and only if the point $(a, 0)$ is constructible from $\{O, I\}$

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Step 2 of 4

A line is constructible if it is passing through two constructible points..

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Step 3 of 4

Find the two points on the line:

Consider the line $ax + by + c = 0$

put $x = 0$

$$by + c = 0$$

$$y = -\frac{c}{b}$$

put $y = 0$

$$ax + c = 0$$

$$x = -\frac{c}{a}$$

So, the line $ax + by + c = 0$ is passing through $\left(0, -\frac{c}{b}\right), \left(-\frac{c}{a}, 0\right)$

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Step 4 of 4

The two points $\left(0, -\frac{c}{b}\right), \left(-\frac{c}{a}, 0\right)$ are constructible if and only if $a, b, c \in D$

If the two points $\left(0, -\frac{c}{b}\right), \left(-\frac{c}{a}, 0\right)$ are constructible, then the line $ax + by + c = 0$ is also constructible

Therefore,, the line $ax + by + c = 0$ is constructible, if $a, b, c \in D$.

Hence, proved

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