

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

Chapter 29, Problem 1ED

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## Problem

Let  $F$  be a field, and  $K$  a field extension of  $F$ . Prove the following:

$[K:F] = 1$  iff  $K = F$ .

## Step-by-step solution

### Step 1 of 3

Consider a field  $F$  and an extension  $K$  of  $F$ . The objective is to prove that  $[K:F] = 1$  if and only if  $K = F$ .

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### Step 2 of 3

Suppose  $[K:F] = 1$ .

Show that  $K = F$ .

$[K:F] = 1$  implies that  $K$  is a vector space over  $F$  of dimension 1.

Then  $\{1\}$  is a basis of  $K$  over  $F$ .

Thus,  $K = F$ .

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### Step 3 of 3

Conversely ,suppose that  $K = F$  .

Show that  $[K : F] = 1$  .

Since  $K = F$  ,  $[K : F] = [F : F] = 1$  .

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