Course Number
Instructor
Date

Section 2.5 The Fundamental Theorem of Algebra

Objective: In this lesson you learned how to determine the number of zeros of polynomial functions and find them.

Important Vocabulary Define each term or concept.

Fundamental Theorem of Algebra If $f(x)$ is a polynomial of degree n, where $n > 0$, then f has at least one zero in the complex number system.

Linear Factorization Theorem If $f(x)$ is a polynomial of degree n, where $n > 0$, f has precisely n linear factors $f(x) = a_n(x - c_1)(x - c_2) \ldots (x - c_n)$ where $c_1, c_2, \ldots, c_n$ are complex numbers.

I. The Fundamental Theorem of Algebra (Pages 182–183)

What you should learn
How to determine the number of zeros of polynomial functions and how to find all zeros of polynomial functions, including complex zeros

In the complex number system, every nth-degree polynomial function has ____precisely n____ zeros.

Example 1: How many zeros does the polynomial function $f(x) = 5 - 2x^2 + x^3 - 12x^5$ have?
5

An nth-degree polynomial can be factored into ____precisely n____ linear factors.

Example 2: List all of the zeros of the polynomial function $f(x) = x^3 - 2x^2 + 36x - 72$.
2, $6i$, $-6i$

II. Conjugate Pairs (Page 184)

What you should learn
How to find conjugate pairs of complex zeros

Let $f(x)$ be a polynomial function that has real coefficients. If $a + bi$, where $b \neq 0$, is a zero of the function, then we know that ____$a - bi$____ is also a zero of the function.

III. Factoring a Polynomial (Pages 184–186)

> ***What you should learn***
> How to find zeros of polynomials by factoring

To write a polynomial of degree $n > 0$ with real coefficients as a product without complex factors, write the polynomial as . . .

the product of linear and/or quadratic factors with real coefficients, where the quadratic factors have no real zeros.

A quadratic factor with no real zeros is said to be

irreducible over the reals.

Example 3: Write the polynomial $f(x) = x^4 + 5x^2 - 36$

(a) as the product of linear factors and quadratic factors that are irreducible over the reals, and

(b) in completely factored form.

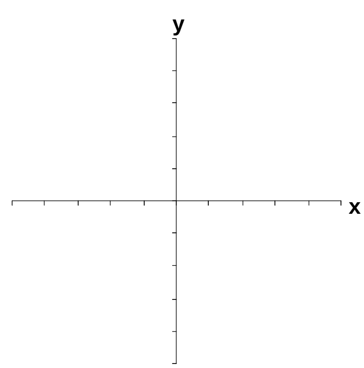
(a) $f(x) = (x + 2)(x - 2)(x^2 + 9)$

(b) $f(x) = (x + 2)(x - 2)(x + 3i)(x - 3i)$

Explain why a graph cannot be used to locate complex zeros.

Real zeros are the only zeros that appear as x-intercepts on a graph. A polynomial function's complex zeros must be found algebraically.

Additional notes



Homework Assignment

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