

Core Concept

The Fundamental Theorem of Algebra

Theorem If $f(x)$ is a polynomial of degree n where $n > 0$, then the equation $f(x) = 0$ has at least one solution in the set of complex numbers.

Corollary If $f(x)$ is a polynomial of degree n where $n > 0$, then the equation $f(x) = 0$ has exactly n solutions provided each solution repeated twice is counted as two solutions, each solution repeated three times is counted as three solutions, and so on.

Short Summary:

The highest degree is a polynomial is the number of zeroes/solutions the polynomial has

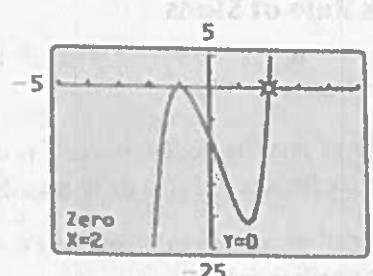
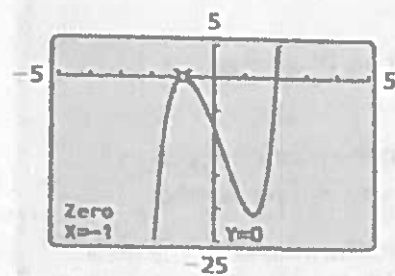
Ex: $X^4 + 6X^3 + 12X^2 + 8X$

Since the polynomial degree is 4, there are 4 roots (-2, -2, -2, and 0)

Make sure to count repeat solutions

Equation	Degree	Solution(s)	Number of solutions
$2x - 1 = 0$	1	$\frac{1}{2}$	1
$x^2 - 2 = 0$	2	$\pm\sqrt{2}$	2
$x^3 - 8 = 0$	3	$2, -1 \pm i\sqrt{3}$	3
$x^3 + x^2 - x - 1 = 0$	3	$-1, -1, 1$	3

The graph of f and the real zeros are shown. Notice that only the *real zeros* appear as x -intercepts. Also, the graph of f touches the x -axis at the repeated zero $x = -1$ and crosses the x -axis at $x = 2$. Real zeroes are x -intercepts



$2i$ and $-2i$ are complex conjugate. Every imaginary root has a complex conjugate. Radicals too

Core Concept

The Complex Conjugates Theorem

If f is a polynomial function with real coefficients, and $a + bi$ is an imaginary zero of f , then $a - bi$ is also a zero of f .

Ex: $f(x) = x^2 + 4$

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

Solutions: $(2i, -2i)$

The first part of the document discusses the importance of maintaining accurate records of all transactions. It emphasizes that every entry should be supported by a valid receipt or invoice. This ensures transparency and allows for easy verification of the data.

In the second section, the author details the various methods used to collect and analyze the data. This includes both primary and secondary research techniques. The primary research involved direct observation and interviews with key stakeholders, while the secondary research focused on reviewing existing literature and industry reports.

The third section presents the findings of the study. It highlights several key trends and patterns observed in the data. These findings are then used to draw conclusions and provide recommendations for future research and practice.

The final part of the document is a conclusion that summarizes the main points of the study. It reiterates the significance of the findings and offers suggestions for how the information can be applied in real-world scenarios. The author also acknowledges the limitations of the study and suggests areas for further investigation.

Overall, the document provides a comprehensive overview of the research process, from the initial problem statement to the final conclusions. It is a valuable resource for anyone interested in the field of study.

Practice:

1) Identify the number of solutions or zeroes

A) $x^4 + 2x^3 - 4x^2 + x = 0$ 4

B) $9t^6 - 14t^3 + 4t - 1 = 0$ 6

A) Use Descartes's rule of Signs to find the total number of possible zeroes in the equation

$-x^5 - 2x^4 - x^3 + 2x^2 + 7x - 1$

$f(x) = -x^5 - 2x^4 - x^3 + 2x^2 + 7x - 1$

$f(-x) = x^5 - 2x^4 + x^3 + 2x^2 - 7x + 1$

Positive Real Zeroes	Negative Real Zeroes	Imaginary Zeroes	Total Zeroes
1	4	0	5
1	2	2	5
1	0	4	5

2) Write a polynomial function f of least degree that has rational coefficients, and the given zeroes

-3i and 2-i

$(x-3i)(x+3i)(x-2+i)(x+2-i)$

$(x^2-9i^2)(x-2-i)^2$

$(x^2+9)(x^2-4x+4+1)$

$x^4 - 4x^3 + 5x^2 + 9x^2 - 36x + 45$

$x^4 - 4x^3 + 14x^2 - 36x + 45$

3) Given f(x) $2x^4 + x^3 + 5x^2 + 4x - 12$

A) Use Descartes's Rule of Signs to find the possible Zeroes

Positive Real Zeroes	Negative Real Zeroes	Imaginary Zeroes	Total Zeroes
1	3	0	4
1	1	2	4

$f(x) = 2x^4 + x^3 + 5x^2 + 4x - 12$

$f(-x) = 2x^4 - x^3 + 5x^2 - 4x - 12$

