*Unit 3 Polynomial Functions

Content Area: **Mathematics**
Course(s): **Trigonometry and Analytical Geometry**
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Enduring Understandings

Functions can be written in many ways- some forms can be helpful under different circumstances.

Functions families have common characteristics.

We can use algebra to help graph functions.

Technology is a resource for discoveries and investigations.

There is a difference between using technology to find the answer compared to using technology to aid in supporting the answer.

Essential Questions

What is the relationship between a polynomial equation and its corresponding functions?

What are three different methods for determining the zeros of a quadratic equation and the ways in which the solutions might differ?

How can the discriminant be used to describe the nature of the roots of a quadratic equation?

Content

Vocabulary:

Roots

Fundamental Theorem of Algebra

Rational Root Theorem

Quadratic

Discriminant

Factor

Rational

Irrational

Intercept

Maxiumum

Minimum

Skills

Determine roots of polynomial equations

Apply the fundamental theorem of algebra

Solve quadratic equations

Use the discriminant to describe the roots of quadratic equations

Graph quadratic equations and inequalities

Find the factors of polynomials using the remainder and factor theorems

Identify all possible rational roots of a polynomial equation using the rational root theorem

Approximate the real zeros of a polynomial function

Graph polynomial functions

Resources

Content Vocabulary

Practices quizzes

Teacher website

www.KhanAcademy.org

www.Desmos.com

Standards

The Complex Number System N -CN

C. Use complex numbers in polynomial identities and equations.

7. Solve quadratic equations with real coefficients that have complex solutions.

Seeing Structure in Expressions A-SSE

A. Interpret the structure of expressions

1. Interpret expressions that represent a quantity in terms of its context.

a. Interpret parts of an expression, such as terms, factors, and coefficients.

B. Write expressions in equivalent forms to solve problems

3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

a. Factor a quadratic expression to reveal the zeros of the function it defines.

Arithmetic with Polynomials and Rational Expressions A -APR

B. Understand the relationship between zeros and factors of polynomials

2. Know and apply the Remainder Theorem: For a polynomial p(x) and a number a, the remainder on division by x – a is p(a), so p(a) = 0 if and only if (x – a) is a factor of p(x).

3. Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.

Reasoning with Equations and Inequalities A -REI

B. Solve equations and inequalities in one variable

4. Solve quadratic equations in one variable.

a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form (x – p) 2 = q that has the same solutions. Derive the quadratic formula from this form.

b. Solve quadratic equations by inspection (e.g., for x2 = 49), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a ± bi for real numbers a and b.

Interpreting Functions F-IF

C. Analyze functions using different representations

7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.□

a. Graph linear and quadratic functions and show intercepts, maxima, and minima.

c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.

MP1 Make sense of problems and persevere in solving them.

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, “Does this make sense?” They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

MP6 Attend to precision.

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time

they reach high school they have learned to examine claims and make explicit use of definitions.

MP8 Look for and express regularity in repeated reasoning.

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation (y – 2)/(x – 1) = 3. Noticing the regularity in the way terms cancel when expanding (x – 1)(x + 1), (x – 1)(x2 + x + 1), and (x – 1)(x3 + x2 + x + 1) might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

MA.A-SSE	Seeing Structure in Expressions
MA.F-IF	Interpreting Functions
MA.A-SSE.A	Interpret the structure of expressions
MA.A-SSE.A.1	Interpret expressions that represent a quantity in terms of its context.
MA.A-SSE.A.1a	Interpret parts of an expression, such as terms, factors, and coefficients.
MA.A-SSE.B	Write expressions in equivalent forms to solve problems
MA.A-SSE.B.3	Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.
MA.A-SSE.B.3a	Factor a quadratic expression to reveal the zeros of the function it defines.
MA.N-CN	The Complex Number System
MA.F-IF.C	Analyze functions using different representations
MA.F-IF.C.7	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
MA.F-IF.C.7a	Graph linear and quadratic functions and show intercepts, maxima, and minima.
MA.A-APR	Arithmetic with Polynomials and Rational Expressions
MA.F-IF.C.7c	Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.
MA.A-APR.B	Understand the relationship between zeros and factors of polynomials
MA.A-APR.B.2	Know and apply the Remainder Theorem: For a polynomial □(□) and a number □, the remainder on division by □ – □ is □(□), so □(□) = 0 if and only if (□ – □) is a factor of □(□).
MA.A-APR.B.3	Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.
MA.N-CN.C	Use complex numbers in polynomial identities and equations.
MA.N-CN.C.7	Solve quadratic equations with real coefficients that have complex solutions.
MA.A-REI	Reasoning with Equations and Inequalities
MA.A-REI.B	Solve equations and inequalities in one variable

MA.A-REI.B.4	Solve quadratic equations in one variable.
MA.A-REI.B.4a	Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form.
MA.A-REI.B.4b	Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b.