Essential Topic 3: Factoring, Quadratic Equations, Non-Linear Functions, and Transformations

Content Area: **Mathematics**
Course(s): **Generic Course, Algebra 1**
Time Period: **Semester 2**
Length: **12 weeks**
Status: **Published**

Standards

MA.F-IF.A.1	Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$.
MA.F-IF.A.2	Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
MA.F-IF.B.4	For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.
MA.A-SSE.B.3a	Factor a quadratic expression to reveal the zeros of the function it defines.
MA.F-IF.C.7a	Graph linear and quadratic functions and show intercepts, maxima, and minima.
MA.F-IF.C.7b	Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
MA.A-APR.B	Understand the relationship between zeros and factors of polynomials
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.F-IF.C.8a	Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
MA.F-IF.C.8b	Use the properties of exponents to interpret expressions for exponential functions.
MA.F-IF.C.9	Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions).
MA.F-BF.A.1	Write a function that describes a relationship between two quantities.
MA.F-BF.A.1a	Determine an explicit expression, a recursive process, or steps for calculation from a context.
MA.A-CED.A.1	Create equations and inequalities in one variable and use them to solve problems.
MA.A-CED.A.2	Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
MA.F-BF.B.3	Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $kf(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology.
MA.A-REI.A.1	Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
MA.A-REI.B.4	Solve quadratic equations in one variable.
MA.F-LE.A.1	Distinguish between situations that can be modeled with linear functions and with

	exponential functions.
MA.F-LE.A.1a	Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.
MA.F-LE.A.1b	Recognize situations in which one quantity changes at a constant rate per unit interval relative to another.
MA.F-LE.A.1c	Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
MA.F-LE.A.2	Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).
MA.F-LE.A.3	Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.
MA.A-REI.C.7	Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.
MA.F-LE.B.5	Interpret the parameters in a linear or exponential function in terms of a context.

Enduring Understandings

1. Non-Linear functions can be used to model and solve real world problems.
2. Real-world situations can be represented symbolically and graphically.
3. Different forms of quadratic functions reveal different properties.
4. Different transformations can be applied to all functions.

Essential Questions

1. How are functions analyzed and evaluated?
2. What are the various methods to factoring polynomials, and when is each appropriate?
3. How is a quadratic equation graphed and understood?
4. What properties do different forms of quadratic functions reveal?
5. How do quadratic functions and their solutions model real world problems?
6. How is an exponential function graphed and understood?
7. How are exponential functions used in real-world problems?
8. What are the differences between linear, quadratic, and exponential functions?
9. How does changing the equation of a function affect its graph?

Knowledge and Skills

Factoring, Quadratic Equations, and Quadratic Functions:

- Factor polynomials completely using various methods
- Solve quadratic equations by factoring, taking square roots, completing the square, and using the quadratic formula
- Graph quadratic equations in factored form and vertex form and identify key points of importance
- Convert between standard form and vertex form of a quadratic function

Exponential Functions:

- Compare linear, quadratic, and exponential models
- Graph exponential functions and identify key points of importance
- Write and use exponential models

Absolute Value:

- Graph absolute value functions
- Determine domain and range of absolute value functions

Transformations:

- Graph functions with transformations, including horizontal and vertical shifts, reflections, and horizontal and vertical stretches and shrinks
- Identify and describe specific function transformations from equations

Transfer Goals

In this unit, students will be able to understand non-linear expressions and equations. Students will be able to model real-world problems with non-linear equations and functions.

Students will be able to evaluate specific points and find maximums/minimums of quadratic equations as well as understand the importance of these skills.

Resources

Holt Algebra 1 by Nichols Holt/1992 ISBN:0-03-005419-2
Algebra Structure and Method Book 1 by Brown McDougal Little/2000 ISBN:0-395-97722-3

graphing calculators

Khan Academy

PurpleMath

KutaSoftware

CK-12

Quizlet

Albert I/O

Desmos

Problem-Attic

Classkick