10 Quadratic Functions and Equations

Content Area: **Mathematics**
Course(s):
Time Period: **Week1**
Length: **1 Week**
Status: **Published**

Stage 1: Desired Results

MA.9-12.A-REI.B.4	Solve quadratic equations in one variable.
MA.9-12.F-TF.B.5	Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.
MA.9-12.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.9-12.F-TF.B.6	Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.
MA.9-12.F-BF.B.5	Use the inverse relationship between exponents and logarithms to solve problems involving logarithms and exponents.
MA.9-12.N-Q.A.2	Define appropriate quantities for the purpose of descriptive modeling.
MA.9-12.F-BF.A.1	Write a function that describes a relationship between two quantities.
MA.9-12.N-Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
MA.9-12.F-TF.C	Prove and apply trigonometric identities
MA.9-12.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.9-12.A-SSE.B	Write expressions in equivalent forms to solve problems
MA.9-12.F-BF.A.1b	Combine standard function types using arithmetic operations.
MA.9-12.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.9-12.F-BF.A	Build a function that models a relationship between two quantities
MA.9-12.F-IF.B.5	Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.
MA.9-12.A-SSE.B.3a	Factor a quadratic expression to reveal the zeros of the function it defines.
MA.9-12.A-REI.C.7	Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.
MA.9-12.A-CED.A	Create equations that describe numbers or relationships
MA.9-12.A-SSE.B.3b	Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.
MA.9-12.F-IF.B.6	Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.
MA.9-12.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.9-12.A-CED.A.1	Create equations and inequalities in one variable and use them to solve problems.
MA.9-12.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.9-12.A-CED.A.3	Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.
MA.9-12.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.9-12.A-CED.A.4	Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.
MA.9-12.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.9-12.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.9-12.A-REI.A	Understand solving equations as a process of reasoning and explain the reasoning
MA.9-12.F-BF.B	Build new functions from existing functions
MA.9-12.F-IF.C.7a	Graph linear and quadratic functions and show intercepts, maxima, and minima.
MA.9-12.A-SSE.A.1	Interpret expressions that represent a quantity in terms of its context.
MA.9-12.F-IF.C.7b	Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
MA.9-12.A-SSE.A.1a	Interpret parts of an expression, such as terms, factors, and coefficients.
MA.9-12.S-ID.B.6	Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.
MA.9-12.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.9-12.F-BF.B.4	Find inverse functions.
MA.9-12.A-REI.D.11	Explain why the x-coordinates of the points where the graphs of the equations y = f(x) and y = g(x) intersect are the solutions of the equation f(x) = g(x); find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where f(x) and/or g(x) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.
MA.9-12.S-ID.B.6a	Fit a function to the data (including with the use of technology); use functions fitted to data to solve problems in the context of the data.
MA.9-12.F-IF.C.8	Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
MA.9-12.S-ID.B.6b	Informally assess the fit of a function by plotting and analyzing residuals, including with the use of technology.
MA.9-12.A-SSE.A.1b	Interpret complicated expressions by viewing one or more of their parts as a single entity.

Unit Overview/ Rationale

In this unit students will solve quadratic equations using a variety of methods.

Big Ideas - Students will understand that...

-The family of quadratic functions models certain situations where the rate of change is not constant. These functions are graphed by a symmetric curve with a highest or lowest point corresponding to a maximum or minimum value.

-In the quadratic function $y=ax^2+bx+c$, the value of b translates the position of the axis of symmetry.

-Quadratic equations can be solved by a variety of methods, including graphing and finding the square root, using the Zero-Product Property, writing the equation in the form m2 =n, or using the Quadratic Formula.

-Linear, quadratic, or exponential functions can be used to model various sets of data.

-Systems of linear and quadratic equations can be solved graphically and algebraically. This type of system can have two solutions, one solution, or no solutions.

Essential Questions - What provocative questions will foster inquiry and transfer of learning

-What are the characteristics of quadratic functions?

-How can you solve a quadratic equation?

-How can you use functions to model real-world situations?

Content - Students will know...

Key Vocabulary

Axis of symmetry, completing the square, discriminant, maximum, minimum, parabola, quadratic equation, quadratic formula, quadratic function, root of an equation, vertex

Skills - Students will be able to...

-Graph quadratic functions on the coordinate plane.

-Use the discriminant of a quadratic equation to analyze the number of times a function crosses the x-axis.

-Solve quadratic equations by graphing.

-Solve quadratic equations by factoring.

-Solve quadratic equations by completing the square.

-Solve quadratic equations by using the quadratic formula.

-Use quadratic functions that represent real world situations.

-Decide if linear, quadratic, or exponential functions appropriately model a set of data.

Stage 2: Assessment Evidence

Assessment

Stage 3: Learning Plan

Learning Activities

Activities:

Students will graph quadratic functions, label the axis of symmetry and the vertex. Students will give examples of a quadratic functions that match given descriptions.

Formative Assessment:

Teacher observation of student work in small-group and independent practice.

Closure:

Students will be asked to give the vertex of a quadratic function.

Example:

What is the graph of $y=x^{2+6x-2?}$

Sample Solution:

X=-b/2a =-6/2(1)=-3

Y=(-3)2+6(-3)-2

Y=-11

The vertex is (-3,-11).

Activities:

Students will solve quadratic equations using the Zero-Product Property and by factoring.

Formative Assessment:

Teacher observation of student work in small-group and independent practice.

Closure:

Students will be asked to give the solution of quadratic equations.

Example:

What are the solutions of $2x^{2-72=0?}$

Sample Solution:

2x2-72=0

X2=36

X=±√36

X=±6

Activities:

Students will solve quadratic equations by completing the square.

Formative Assessment:

Teacher observation of student work in small-group and independent practice.

Closure:

Students will be asked to solve quadratic equations by completing the square.

Example:

What are the solutions of $x^{2+8x=513?}$

Sample Solution:

x2+8x+16=513+16

(x+4)2=±√529

$X+4=\pm 23$

$X+4=23$ or $x+4=-23$

$X=19$ or $x=-27$

Activities:

Students will find the number of real number solutions of quadratic equations. Students will solve quadratic equations using the quadratic formula.

Formative Assessment:

Teacher observation of student work in small-group and independent practice.

Closure:

Students will be asked to find the number of real number solutions of quadratic equations and to solve quadratic equations using the quadratic formula.

Example:

How many real number solutions does the equation $x^2+3=2x$ have?

Sample Solution:

$x^2-2x+3=0$

$b^2-4ac=(-2)2-4(1)(3)$

$=-8$

Because the discriminant is negative, the equation has no real number solutions.

Activities:

Students will be asked to decide if linear, quadratic, or exponential functions appropriately model a set of data. Students will write equations to model x and y data given in tables.

Formative Assessment:

Teacher observation of student work in small-group and independent practice.

Closure:

Students will be asked to graph a set of points and decide if linear, quadratic, or exponential functions appropriately model a set of data.

Example:

Graph the points (1,4)(4,2)(2,3)(5,3.5) and (6,5)

Sample Solution:

A quadratic model is most appropriate given the shape of the points.

Activities:

Students will solve systems of linear, quadratic equations by graphing and algebraically.

Formative Assessment:

Teacher observation of student work in small-group and independent practice.

Closure:

Students will be asked to will solve systems of linear, quadratic equations by graphing and algebraically.

Example:

What are the solutions of the system?

$Y=x^2-7x-40$

$Y=-3x+37$

Sample Solution:

$Y=x^2-7x-40$

-(Y=-3x+37)

0=x2-4x-77

0=(x-11)(x+7)

X-11=0 or x+7=0

X=11 or x=-7

Y=-3(11) +37=4

Y=-3(-7)+37=58

The solutions are (11,4) and (-7,58)

Resources

Pearson Algebra 1 c 2012

Chapter 9