2024-2025

Rapid City
Central High School

Algebra 2

RCAS Policies/Procedures:

Students will be required to follow all RCAS policies and procedures. To view the RCAS High School Student Handbook, click handbook.

Course Description:

The purpose of Algebra 2 is to develop and connect learning from Algebra 1. Students will apply methods and extend learning in topics such as set theory; operations with rational and irrational expressions; factoring of rational expressions; linear equations and inequalities; quadratic equations; solving systems of linear and quadratic equations; graphing quadratic equations; properties of higher-degree equations and rational exponents

Textbook:

Envision AGA Algebra 2

Required Resources:

"Limited Choice" Resources: (students will be asked to choose at least one title from this list)

Student Choice:

Will student be asked to choose additional reading material from the classroom or school library?

No

Essential Learning:

1. What are the ways in which functions can be used to represent and solve problems

involving quantities?

2. How do you use quadratic functions to model situations and solve problems?

3. What can the rule for a polynomial function reveal about its graph, and what can the graphs of polynomial functions reveal about the solutions of polynomial equations?

4. How do you calculate with functions defined as quotients of polynomials, and what are the key features of their graphs?

5. How are rational exponents and radical equations used to solve real-world problems?

6. How do you use exponential and logarithmic functions to model situations and solve problems?

7. What questions can you answer by using statistics and normal distributions?

* OPTIONAL *

* How are trigonometric functions used to solve real-world problems?

* How do trigonometric identities and equations help you solve problems involving real or

complex numbers?

* How do geometric properties of conic sections relate to their algebraic representations?

Essential Learning Intentions:

1. Linear Functions and Systems

• The key features of a graph – including the domain, range, and intercepts – reveal the relationship between two quantities

• A function of the form $f(x) = a \cdot f[b(x - h)] + k$ is transformed by changing the values of a, b, h, or k • A piecewise-defined function is used to model situations in which there are different rules for different parts of the domain of the

function

• An arithmetic sequence is a sequence of numbers in which the terms have a common difference. An arithmetic series is the sum of the terms in a finite arithmetic sequence and can be found using an explicit definition for the sum.

• To solve an equation or inequality by graphing, set each expression equal to y and graph the two equations on the same grid. Their intersection represents the solution

• The solution of a system of linear equations or inequalities is the set of ordered pairs that satisfy all the equations or inequalities in the system. Systems of equations or inequalities can also be represented by a matrix.

• A matrix can be used to represent a system of linear equations. Row operations can be applied to the matrix to convert it to the identity matrix with an additional column that indicates the solution of the original system of equations.

2. Quadratic Functions and Equations

• All quadratic functions are transformations of the parent function $f(x) = x$^2. The vertex form of a quadratic function highlights the key features of the function's graph and shows how the graph of the parent function can be transformed.

• A quadratic function in vertex form can be rewritten in standard form to high light different features of the function's graph. The key features are used to interpret values in context.

• The factored form of a quadratic function is used to find the zeros of the function by identifying the values that make one or both of the factors equal zero.

• A complex number contains both real and imaginary parts. The four basic operations can be applied to complex numbers.

• Many real-world problem situations can be represented with a mathematical model, but that model might not represent the real-world situation exactly.

• A quadratic equation can be solved by completing the square to transform the equation to an equivalent equation, $(x - p)$^2 = q.

• The Quadratic Formula can be used to solve any quadratic equation, including those with complex solutions.

• A linear-quadratic system consists of a linear equation and a quadratic equation. The points of intersection are the solutions.

3. Polynomial Functions

• A polynomial function is a function whose rule is either a monomial or a sum of monomials. The key features of the graph of a polynomial function – such as its end behavior, intercepts, and turning points – can be used to sketch a graph of the function.

• Just as with real numbers, the properties of operations can be used to add, subtract, and multiply polynomials. Polynomial functions can be used to represent and compare real-world situations.

• Polynomial identities and the Binomial Theorem are helpful tools for efficiently rewriting expressions and describing mathematical relationships.

• Polynomial expressions can be divided by linear factors using long division or synthetic division. The Remainder Theorem is used to determine the remainder of a division problem.

• The zeros of a polynomial function can be determined using factoring or synthetic division. The zeros of a function can b used to sketch its graph.

• Theorems such as the Rational Root Theorem, the Fundamental Theorem of Algebra, and the Conjugate Root Theorems are helpful tools for determining the roots of a polynomial function.

• Polynomial functions are categorized as even, odd, or neither. Even functions are symmetric about the y-axis, and for all x in the domain, $f(x) = f(-x)$. Odd functions are symmetric about the origin, and for all x in the domain, $f(x) = -f(x)$.

4. Rational Functions

• The reciprocal function is used to model inverse variation, which is a proportional relationship between two variables such that when one variable increases, the other decreases.

• A rational function is any function $R(x) = P(x)/Q(x)$ where $P(x)$ *and* $Q(x)$ are polynomial functions. The domain of a rational function is all real numbers except any x-values for which $Q(x)$ equals zero. The graph of a rational function has one or more asymptotes, which guide the end behavior of the graph.

• Rational expressions form a system similar to the system of rational numbers and can be multiplied and divided by applying the properties of operations as they apply to rational expressions.

• The properties of operations used to add and subtract rational numbers can be applied to adding and subtracting rational expressions.

• Rational equations contain a rational expression and can be solved by multiplying each side of the equation by a common denominator to eliminate the fractions. Any solution that is excluded from the domain of the original equation is extraneous.

5. Rational Exponents and Radical Functions

• Rational exponents and radicals represent the number of roots a polynomial has. The roots of a polynomial are used to simplify expressions and solve equations.

• The properties of integer exponents can be applied to terms with rational exponents, as well as to radials. The properties of exponents and radicals can be used to rewrite radical expressions. When rewriting radical expressions, like radicals, which have the same index, can be added and subtracted.

• The function $g(x) = a\sqrt{(x - ħ)} + k$ represents the transformation of the parent radical function $g(x) = \sqrt{x}$ where a stretches or compresses the graph vertically, ha translates the graph horizontally, and k translates the graph vertically.

• Solving equation that include radicals or rational exponents is similar to solving rational equations.

• Functions can be combined by operations (+, −,×,÷) and by composition. The result of the operation or composition can be described as a single function. The domain of the result may be different from the domains of the original functions.

• The inverse of a function is found by exchanging the roles of the independent and dependent variables. Composition can be used to verify that two functions are inverses.

Exponential and Logarithmic Functions

• The rate of exponential growth or decay is the ratio between two consecutive

output values in an exponential function.

• Exponential models are useful for representing situations in which the rate increases by the same percent for each period of time and for interpreting problems that involve compound interest. Exponential regression can be used to generate exponential models for real-world contexts.

• A logarithmic function is the inverse of an exponential function. Logarithms are found by determining the exponent that must be applied to a base to yield a given result.

• The inverse relationship between exponential and logarithmic functions reveals key features of the graphs of both functions. Logarithmic functions can be used to model several real-world situations.

• Properties of Logarithms can be used to rewrite logarithmic expressions and to evaluate logarithms by changing the base.

• Some exponential equations can be solved by rewriting both sides with a common base. For others, rewriting the equation using logarithms and applying properties of logarithms, is a more efficient method.

• A geometric sequence is a sequence of numbers in which terms are related to the previous term by a common ration, r. A geometric series is the sum of a certain number of terms in a geometric sequence.

7. Data Analysis and Statistics

• A statistical question is a question that can be answered by collecting many pieces of information, or data. The data can be categorical (qualitative) or statistical (quantitative). The data are measured by parameters, which describe the population, and statistics, which describe a sample of the population.

• There are three types of statistical studies: experiments, sample surveys, and observational studies. The way in which samples are chosen for a study affects how well they represent the population. To avoid bias, samples should be random.

• A data distribution can be normal, skewed left, or skewed right. Normal distributions are described using the mean and standard deviation. For skewed distributions, median and quartiles are used to describe the data.

• The normal distribution is used to explain where data values fall within a population. The standard normal distribution allows for a comparison of values across different population distributions.

• Sample statistics tend to be normally distributed and therefore can be used to estimate population parameters. The margin of error gives the maximum expected difference between the sample result and the population parameter.

• A hypothesis and a null hypothesis can be written tested for a statistical question. Statistics are used to compare two data groups and determine which hypothesis the data supports. Graphs and simulations can be used to determine whether differences between parameters are significant.