Grades 9-12 Mathematics  
Algebra 2

Introduction to Functions

Stage 1: Desired Results

Catholic Standards

DOC All Grades DOC: Catholic Standards

Life in Christ

Students will be able to

2. Know that we must assume responsibility for the acts we perform (CCC 1781).

6. Seek the common good together (CCC 1905).

7. Assume personal responsibility (CCC 1914).

Targeted Standards

Catholic Identity

DOC All Grades Catholic Identity

The Rights of Children

5. THE RIGHT TO A LEARNING ENVIRONMENT THAT VALUES COOPERATION and challenges its members to critical and reflective thinking in their search for truth.

8. THE RIGHT TO LEARN RESPONSIBILITY for themselves and their actions.

Summary

This unit will extend the concept of functions to include linear, absolute value, quadratic, and radical families of functions. Students will recognize the relationship between algebraic and graphical representations of functional data and will combine and transform functions.

Unit Goals

1. Understand patterns, relations, and functions.
2. Represent and analyze mathematical situations and structures using algebraic symbols.
3. Use mathematical models to represent and understand quantitative relationships and to analyze change.

Big Ideas

1. Functions Represent Real Data
2. Useful Operations with Functions
3. Change Represented by Transformations of Functions
4. Families of Functions
5. Modeling Real-Life Problems with Functions

Enduring Understandings

1. The way that a function can modelsituations in the real worldhelps me recognize and appreciate the inherent order and beauty of Gods creation.
2. I will be ableto use various functions to help me in the workplace and in everyday life.
3. The universal language of functionshelps meto communicate about problems andtheir solutionseffectively across disciplines and cultures.

Content

1. Definitions of Relations, Functions, Domain, and Range
2. Vertical and Horizontal Line Tests
3. Using a Rule to Create a Graph
4. Transformations of the Graph by Transforming the Rule
5. Linear, Absolute Value, Radical, and Quadratic Families of Functions
6. Operations with Functions, Including Composition
7. Inverses of Functions
8. Modeling Data with Families of Functions
9. Problem Solving and Estimating Unknown Value with Functions

Skills

1. Identify the domain and range of relations and functions. (11P3)
2. Determine whether a relation is a function. (10P1)
3. Write functions using function notation. (10P1)
4. Evaluate and graph functions.
5. Apply transformations to relations and functions. (11P11) (10G9)
6. Identify the symmetry of a graph. (11P3)
7. Interpret transformations of real world data.
8. Identify slope as a rate of change.
9. Identify parent functions from graphs and equations. (11P5)(10P2)
10. Add, subtract, multiply and divide functions.
11. Write and evaluate composite functions.
12. Determine whether the inverse of a function is a function. (11P6)
13. Write rules for inverses of functions. (11P6)
14. Use parent functions to model real-life data and make estimates for unknown values. (11P5)

Essential Questions

1. How does an understanding of functions allow me to order data from real life?
2. To what extent do the families of functions represent values found in real life?
3. To what extent can I use these functions to solve problems in my life and at my work?
4. How can using the language of functions help me to communicate those solutions better?

Stage 2: Assessment Evidence

Diagnostic: Diagnostic

Pretest on Linear Functions Students will complete a written test on linear functions including basic concepts about these functions, in order to determine student knowledge and understanding as the unit begins. Activity: Graphing Real Life Data Students will be given meaningful real life data to graph on a coordinate plane and will discuss trends and trend line.

Summative: Project

Problem Solving by Predicting Future Values Mathematical Processes Addressed: Apply mathematical modeling to workplace and consumer situations, including problem formulation, identification of a mathematical model, interpretation of solution within the model, and validation to original problem situation.

Summative: Test

Unit Test A summative written assessment will evaluate students learning of standards addressed in this unit.

Formative: Project

Stat Plots and Regression Students will be given real life data, create regressions for this data, compare appropriateness of the models created, and use the models to predict future values.

Formative: Homework

Discussions and Demonstrations Daily homework assignments provided needed practice of new skills. Students will demonstrate their understanding of the concepts by presented selected problems to the class and by participating in classroom discussions of the work.

Diagnostic: Book Report

Stage 3: Learning Plan

Learning Experiences

1. The pretest on linear functions will assess previous knowledge of this very common function and will indicate the extent of remediation necessary.
2. The opening activity will require students to graph data from real life to illustrate how and where data can be represented by the families of functions that we will be studying. Included in this will be an opening exploration of how transformations can change the data and ultimately the graph.
3. Students will practice the concepts of this unit in regular homework practices. Students will be expected to give and explain solutions and to demonstrate the work to all in the class. The teacher can use these activities to assess understanding and to plan future instructional activities.
4. Once students have a working knowledge of the four families of functions, they will practice writing these functions in a small group activity. Each group will create a series of functions in a particular family and will demonstrate the differences and similarities among the functions.
5. In a class activity, students will use sets of data to create functions using stat plots and regression lines.
6. The unit test will assess individual proficiency with functions while the small group activity will demonstrate how the team can use functions to estimate future solutions to real-life applications.

Technology Integration

1. Graphing calculators (TI 83 or 84) will be used to plot points, to graph functions, to create stat plots, and to find regressions for sets of data.

The teacher will instruct students how to use the y = graphing feature to graph functions, to create and graph stat plots (stat menu), and to find regressions for the data using the calc menu in the stat menu.

Resources

Websitesthat may be usefulin developing lesson plans:

1. Ohio Department of Education [www.ode.state.oh.us](http://www.ode.state.oh.us/)
2. NCTM [www.nctm.org](http://www.nctm.org/)
3. NCISLA www.wcer.wise,edu/ncisla/publications
4. Education World [www.education-world.com](http://www.education-world.com/)
5. Interactivate [www.shodor.org](http://www.shodor.org/)
6. Algebra Lab [www.algebralab.org](http://www.algebralab.org/)
7. Interactive Mathematics"Learn math by playing with it!" [www.intmath.com](http://www.intmath.com/)

Grades 9-12 Mathematics  
Algebra 2

Quadratic Functions

Stage 1: Desired Results

Catholic Standards

DOC All Grades DOC: Catholic Standards

Life in Christ

Students will be able to

2. Know that we must assume responsibility for the acts we perform (CCC 1781).

6. Seek the common good together (CCC 1905).

7. Assume personal responsibility (CCC 1914).

Targeted Standards

Catholic Identity

DOC All Grades Catholic Identity

The Rights of Children

4. THE RIGHT TO WORK ACTIVELY TOWARD THEIR OWN EMPOWERMENT through the development of their gifts and talents.

Summary

This unit is the study ofquadratic functions, equations, and inequalities. Included in the unit are the four ways to solve quadratic equations, graphing of quadratic functions and inequalities and operations with complex numbers.

Unit Goals

1. Use patterns, relations and functions to model, represent and analyze problem situations that involve variable quantities.
2. Analyze, model and solve problems using various representations such as tables, graphs and equations.
3. Use mathematical processes and knowledge to solve problems.

Big Ideas

1. Quadratic functions
2. Quadratic equations and inequalities
3. Complex Numbers

Enduring Understandings

1. Understanding quadratics helps me recognize and appreciate the inherent order and beauty of God's creation.
2. The ability to solve quadratic equations will help in the workplace and everyday life.
3. The universal language of complex numbers allows me to communicate effectively across disciplines and cultures.
4. Mathematics is the fuel for technology and progress.

Content

1. Graphing quadratic functions and inequalities
2. Four ways to solve quadratic equations(factoring, finding square roots, completing the square, formula)
3. Complex numbers
4. Quadratic formula and discriminants
5. Modeling with quadratic functions

Skills

1. Solve quadratic equations with real roots by graphing, factoring, finding square roots, completing the square, using the quadratic formula and with technology.(9P10)
2. Use quadratic formula to solve quadratic equations with complex roots.(11P8)
3. Represent and compute with complex numbers.(11N7)
4. Analyze quadratic functions by investigating its discriminant, intercepts, zeroes, and global behavior.(11P3)
5. Solve quadratic inequalities in one variable.(9P6)

Essential Questions

1. How does graphing quadratic functions help me solve real-life problems?
2. To what extent does solving quadratic equations helpme model real life quantities?
3. Why are complex numbers considered part of the universal language of mathematics?

Stage 2: Assessment Evidence

Diagnostic: Teacher Observation

Pretest on qraphing linear equations and inequalities with and without technology

Formative: Technology Project

investigating the properties of parabolas determining how the vertex moves left or right, up or down

Formative: Homework

practice graphing quadratic functions and inequalities, solving by the 4 methods

Formative: Lab Assignment

solve quadratic using zero function on calculator

Formative: Quiz

quiz each method of solving

Summative: Test

unit test with and without technology

Stage 3: Learning Plan

Learning Experiences

1. Students may need to review graphing with and without the calculator as well as solving mult-step equations of degree one before graphing and solving the quadratic by finding the square root.
2. Investigating parabolas has the students examine the characteristics of the parabola. (open up, vertex, axis of symmetry etc.)
3. Develop each method of solving, factoring etc. and then connect the answers to the zeroes on the graph and thecomplex number system.
4. Practicing each method through homework problems allows the students to draw conclusions about which method is the easiest and most effective.

Technology Integration

1. Graphing calculators allow the students to easily graph the quadratic equations and inequalities.
2. The max, min, zero andTable functions allow the student to verify their paper and pencil answers.

Resources

Websitesthat may be usefulin developing lesson plans:

1. Ohio Department of Education [www.ode.state.oh.us](http://www.ode.state.oh.us/)
2. NCTM [www.nctm.org](http://www.nctm.org/)
3. NCISLA www.wcer.wise,edu/ncisla/publications
4. Education World [www.education-world.com](http://www.education-world.com/)

Grades 9-12 Mathematics  
Algebra 2

Polynomials

Stage 1: Desired Results

Catholic Standards

DOC All Grades DOC: Catholic Standards

Life in Christ

Students will be able to

1. Understand that we shape our own life as a result of free will (CCC 1731).

2. Know that we must assume responsibility for the acts we perform (CCC 1781).

6. Seek the common good together (CCC 1905).

Targeted Standards

Catholic Identity

DOC All Grades Catholic Identity

The Rights of Children

3. THE RIGHT TO BE RESPECTED AS INDIVIDUALS with human dignity.

4. THE RIGHT TO WORK ACTIVELY TOWARD THEIR OWN EMPOWERMENT through the development of their gifts and talents.

5. THE RIGHT TO A LEARNING ENVIRONMENT THAT VALUES COOPERATION and challenges its members to critical and reflective thinking in their search for truth.

Summary

This unit develops the concepts, notation, and properties associated with polynomials. Students will present polynomials in real-world contexts. The work with graphs assumes the use of graphing technology and the general properties of functions, rather than relying solely on the plotting of points. Relating the graphs of polynomial function, the zeros of those functions, the solutions of corresponding polynomial equations, and the factors of the polynomial.

Unit Goals

1. Use patterns, relations and functions to model, represent and analyze problem situations that involve variable quantities.
2. Analyze, model and solve problems using various representations such as tables, graphs and equations.

Big Ideas

1. Introduction to polynomials
2. Polynomials and geometry
3. Factoring special cases
4. Estimating solutions to polynomial equations
5. The factor theorem
6. Factoring quadratic trinomials and related polynomials
7. The rational-zero theorem
8. Solving all polynomial equations
9. Finite differences
10. Modeling data with polynomials

Enduring Understandings

1. Understanding how to expand an expression to yield a polynomial of nth degree helps me recognize and appreciate the inherent order and beauty of God's creation.
2. Describing the degree and leading coefficient of the polynomial is the fuel for technology, progress, invention, discovery and creativity.
3. Being able to factor an expanded polynomial using the following tools: monomial factoring, difference of squares factoring, and binomial square factoring plays a central role in the cultural, recreational, and aesthetic aspects of my life.
4. The universal language of a prime quadratic expression and how to make the determination allows me to communicate effectively across disciplines and cultures.

Content

1. Describe and compare characteristics of the following families of functions:

a. quadratics with complex roots

b. Polynomials of any degree

c. general shape

d. number of roots

e. domain and range

f. asymptotic behavior

Skills

1. Identify quadratics with complex roots(11P8)
2. Determine polynomials of any degree(11P3)
3. Identify general shapes of functions(11P3)
4. Determine the number of roots(11P3)
5. Identify the domain and range of function(11P3)
6. Interpret asymptotic behavior(11P3)
7. Identify the maximum and minimum points of polynomial,rationaland trigonometric functions graphically and with technology(11P4)

Essential Questions

1. How will understanding, what is a polynomial function of degree n, and how will this give me opportunities to make the world a better place?
2. To what extent is being able to factor an expanded polynomial using tools satisfying, enjoyable, and confidence building?
3. Why is a prime quadratic expression considered part of the universal language of mathematics?

Stage 2: Assessment Evidence

Diagnostic: Diagnostic

Pretest on polynomials that assess previous knowledge of what a polynomial is.(including expanding each expression)

Summative: Unit Exam

Unit test-assess individual proficiency with polynomials. project: small group activities to relate information to real -life applications: ~Modeling population ~Proving that certain nthroots are irrational ~Factoring using trial and error ~etc.

Formative: Homework

Discuss and demonstrate examples: ~Definition of polynomial ~Polynomial function ~Polynomials and Area ~Factoring special cases ~Estimating solutions ~The factor theorem ~Factoring quadratic trimonials and related polynomials ~The rational-zero theorem

Stage 3: Learning Plan

Learning Experiences

1. The pretest on polynomials will assess previous knowledge of what a polynomial is and indicates how to graph a polynomial function and finding the value at a given number.
2. Students will practice the concepts of this unit in homework. Students are expected to give examples and learn definitions and be able to explain solutions and demonstrate the work in class.
3. The unit test will assess individual proficiency with polynomials while projects will assess small group ability to relate information to real-life applications.

Technology Integration

1. TI-83 or -84 graphing calculator(graph function to determine/describe solutions)

Resources

Websites that may be useful in developing lesson plans:

1. Ohio Department of Education [www.ode.state.oh.us](http://www.ode.state.oh.us/)
2. NCTM [www.nctm.org](http://www.nctm.org/)
3. NCISLA www.wcer.wise,edu/ncisla/publications
4. Education World [www.education-world.com](http://www.education-world.com/)

Grades 9-12 Mathematics  
Algebra 2

Rational Functions

Stage 1: Desired Results

Catholic Standards

DOC All Grades DOC: Catholic Standards

Life in Christ

Students will be able to

2. Know that we must assume responsibility for the acts we perform (CCC 1781).

4. Sustain the Christian life through the practice of the gifts of the Holy Spirit (CCC 1831).

7. Assume personal responsibility (CCC 1914).

Targeted Standards

Catholic Identity

DOC All Grades Catholic Identity

The Rights of Children

9. THE RIGHT TO MAKE RESPONSIBLE DECISIONS founded on religious conviction.

Summary

This unit is about rational expressions, functions, and equations. How to simplify and perform operations with rational expressions, graph rational functions and solve rational equations will also be included, as well as, using variation and rational models in real-life situations.

Unit Goals

1. Understand patterns, relations, and functions; represent and analyze mathematical situations and structures using algebraic symbols.
2. Use mathematical models to represent and understand quantitative relationships; analyze change in various contexts.
3. Develop and evaluate inferences based on algebraic models.
4. Understand the meanings of operations; and how they relate to one another.

Big Ideas

1. Rational Equations
2. Rational Functions

Enduring Understandings

1. Working with variations will help me in the workplace and in everyday life.
2. Rational models give me the power to make informed decisions.
3. Operations with rational expressions allows me to communicate effectively across disciplines.

Content

1. Inverse and joint variation
2. Rational functions
3. Rational expressions
4. Complex fractions
5. Rational Equations

Skills

1. Analyze rational functions by investigating rates of change, intercepts, zeros, asymptotes and end behavior.(11P3)
2. Perform operations with rational expressions.(9P12)
3. Simplify complex fractions.
4. Analyze and graph rational functions with and without a calculator.(11P3)
5. Use rational expressions to model real-life quantities.(11MP-H)
6. Solve rational equations.
7. Construct algorithms for multi-step and non-routine problems.(11MP-A)
8. Use rational equations to solve real-life problems.(11MP-J)

Essential Questions

1. How can working with variations help me in the workplace and everyday life?
2. To what extent can rational models give me the power to make informed decisions?
3. How can the knowledge of rational functions help me in my other classes?

Stage 2: Assessment Evidence

Diagnostic: Test

students need to have a background in direct variations, multiplication and factoring of polynomials and finding real zeros of the function

Formative: Homework

practice graphing and solving

Formative: Lab Assignment

students verify their results on the graphing calculator

Formative: Teacher Observation

boardwork- students write variation models

Formative: Comparative Study

group work where the students set up, solve, and discuss the problems and their solutions

Summative: Unit Exam

written exam-testing the students knowledge of rational equations and functions Mathematical Processes contruct algorithms for multi-step and non routine problems use formal mathematical language and notation to represent ideas apply mathematical modeling to workplace and consumer situations

Stage 3: Learning Plan

Learning Experiences

1. A pre-test should indicate the amount of review the students will need for direct variation problems and well as their skills in finding the zeros of a function.
2. Investigating graphs of rational functions using the graphing calculator aids in thestating of domain and range as well in drawing asymptotes.
3. Teacher demonstration may be required in learning the operations of rational expressions as well as practice homework problems.
4. Group work is an effective activity for students when setting up and solving word problems, it allows for discussion and assessment of the solutions.

Technology Integration

1. Graphing calculator

Resources

Websitesthat may be usefulin developing lesson plans:

1. Ohio Department of Education [www.ode.state.oh.us](http://www.ode.state.oh.us/)
2. NCTM [www.nctm.org](http://www.nctm.org/)
3. NCISLA www.wcer.wise,edu/ncisla/publications
4. Education World [www.education-world.com](http://www.education-world.com/)

Grades 9-12 Mathematics  
Algebra 2

Powers,Roots and Radicals

Stage 1: Desired Results

Catholic Standards

DOC All Grades DOC: Catholic Standards

The Profession of Faith

Students will be able to

1. Recognize God in the world's order, beauty, and goodness (CCC 32).

Life in Christ

Students will be able to

2. Know that we must assume responsibility for the acts we perform (CCC 1781).

6. Seek the common good together (CCC 1905).

Targeted Standards

Catholic Identity

DOC All Grades Catholic Identity

The Rights of Children

4. THE RIGHT TO WORK ACTIVELY TOWARD THEIR OWN EMPOWERMENT through the development of their gifts and talents.

5. THE RIGHT TO A LEARNING ENVIRONMENT THAT VALUES COOPERATION and challenges its members to critical and reflective thinking in their search for truth.

6. THE RIGHT TO DEVELOP POSITIVE, RESPONSIBLE AND CARING ATTITUDES AND BEHAVIORS TOWARD OTHERS and to recognize the rights of others to be safe and free from harassment and abuse.

Summary

This unit extends expressions with powers, rational exponents, roots and radicals. Opening a wide range of mathematical and real world problems that can be modeled, analyzed, and interpreted by the students. Students will solve equations with radicals, mentally as well as calculator computations.

Unit Goals

1. Students demonstrate number sense, including an understanding of number systems and operations and how they relate to one another.
2. Students compute fluently and make reasonable estimates using paper and pencil, technology-supported and mental methods.
3. Students use patterns, relations and functions to model, represent and analyze problem situations that involve variable quantities.
4. Students analyze, model and solve problems using various representations such as tables graphs and equations.

Big Ideas

1. Properties and representations of powers
2. Analysis of functions
3. Understanding of systems, roots, and intercepts
4. Composition of Functions and properties
5. Composite of a function and its inverse
6. Identity Function I(x) = x.

Enduring Understandings

1. Understand the operations and characteristics of power functions and how they compare to other functions will give me opportunities to make the world a better place.
2. Model and solve real world problems with power functions helps me recognize and appreciate the inherent order and beauty of God's creation.
3. Representation of a Composite Functionandits properties is the fuel for technology, progress, invention, discovery and creativity.
4. Learning to rationalize an irrational denominator and the nature of a conjugate is satisfying, enjoyable, and gives me self-confidence.
5. The universal language of solving equations with radicals allows me to communicate effectively across disciplines and cultures.

Content

1. Apply factorials and exponents, including fractional exponents, to solve practical problems.
2. Generalize and explain patterns and sequences in order to find the next term and the nth term.
3. Analyze functions by investigating rates of change, intercepts, zeros, asymptotes, and local and global behavior.
4. Use recursive functions to model and solve problems; e.g., home mortgages, annuities.

Skills

1. Use fractional and negative exponents as optional ways of representing and finding solutions for problem situations(11N8)
2. Simplify rational expressions by eliminating common factors and applying properties of integer exponents.
3. Describe and compare characteristics of the following families of functions: square root, cubic, absolute value, and basic trigonometric functions; e.g., general shape, possible number of roots, domain, and range(11P3)
4. Solve real-world problems that can be modeled using linear, quadratic, exponential or square root functions(11Mathematical processes-J)
5. Identify and describe problem situations involving an iterative process that can be represented as a recursive function; e.g., compound interest(11P1)
6. Translate a recursive function into a closed form expression or formula for the nth term to solve a problem situation involving an iterative process; e.g., find the value of an annuity after 7 years(11P2)
7. Identify families of functions with graphs that have rotation symmetry or reflection symmetry about the y-axis, x-axis, or y =x(11P5)
8. Represent the inverse function symbolically and graphically as a reflection about y=x(11P6)
9. Solve equations involving radical expressions and complex roots(11P8)

Essential Questions

1. How will understandinga power function give me opportunities to make the world a better place?
2. How does using properties of functions to compare and contrast help me think mathematically and solve real world problem?
3. To what extent does solving a equation with a radical give me the power to make informed everyday decisions?
4. To what extent is knowing the difference of an Inverse Function and Identity Function the fuel for technology, progress, invention, discovery and creativity?

Stage 2: Assessment Evidence

Diagnostic: Written Assessment

pre-test on powers that assess the students knowledge of positive powers, zero powers, and negative powers. board work - rewriting of square roots with exponents

Summative: Unit Exam

Unit Test Unit project activities: ~local interest rates ~families of equations ~Financing post-high school education ~Musical frequencies etc. Mathematical Processes Addressed: Apply mathematical modeling toworkplace and consumr situations, including problem formulation, identification of a mathematical model, interpretation of solution within the model, and validation to original problem situation.

Formative: Homework

Homework problems-activities on applying properties of powers and to be able to determine acurate solutions based on outcomes. discussion/mentally - solve equations with radicals, mentally as well as calculate computations.

Stage 3: Learning Plan

Learning Experiences

1. The pretest on powers will assess the students have knowledge of properties of positive integral powers, zero powers, and negative integral powers of ten, the rewriting of square roots with exponents.
2. Students will practice concepts of this unit in homework activities by applying properties of powers and tobe able to determine accurate solutions based on outcomes.
3. The unit test/project will asses individual proficiency with the studies of all rational powers, the notations used for nth roots and radical notation.

Technology Integration

1. Graphihg calculator, TI-83 or-84

Resources

Websitesthat may be usefulin developing lesson plans:

1. Ohio Department of Education www.ode.state.oh.us
2. NCTM www.nctm.org
3. NCISLA www.wcer.wise,edu/ncisla/publications
4. Education World www.education-world.com

Grades 9-12 Mathematics  
Algebra 2

Exponential & Logarithmic Functions

Stage 1: Desired Results

Catholic Standards

DOC All Grades DOC: Catholic Standards

Life in Christ

Students will be able to

2. Know that we must assume responsibility for the acts we perform (CCC 1781).

6. Seek the common good together (CCC 1905).

7. Assume personal responsibility (CCC 1914).

Targeted Standards

Catholic Identity

DOC All Grades Catholic Identity

The Rights of Children

3. THE RIGHT TO BE RESPECTED AS INDIVIDUALS with human dignity.

4. THE RIGHT TO WORK ACTIVELY TOWARD THEIR OWN EMPOWERMENT through the development of their gifts and talents.

5. THE RIGHT TO A LEARNING ENVIRONMENT THAT VALUES COOPERATION and challenges its members to critical and reflective thinking in their search for truth.

6. THE RIGHT TO DEVELOP POSITIVE, RESPONSIBLE AND CARING ATTITUDES AND BEHAVIORS TOWARD OTHERS and to recognize the rights of others to be safe and free from harassment and abuse.

Summary

The study of exponential and logarithmic functions includes mastering and practicing the algebraic processes associated with exponents, an examination of the graphs of these functions, including transformations, and finally, the use of these functions to solve real-life problems of growth and decay.

Unit Goals

1. Compute fluently with allexponential/logarithmic expressions.
2. Apply transformations and use symmetry to analyze exponential growth and decay.
3. Use mathematical models (and regressions) to solve real world problems and to analyze exponential change.
4. Develop and evaluate inferences and predictions that are based on exponential data.

Big Ideas

1. Exponential Functions
2. Logarithmic Functions
3. Equations and Inequalities
4. Modeling and Growth and DecayApplications

Enduring Understandings

1. Understanding exponential growth and decay gives me the power to make informed everyday decisions in order to live more effectively in the world.
2. Knowing how to use exponential and logarithmic functions to predict growth and decay will give me opportunities to make the world a better place.
3. Exponential functions can be used to advance technology, invention, and creativity.

Content

1. Exponential Functions
2. Growth and Decay
3. Inverses of Functions
4. Logarithmic Functions
5. Properties of Logarithms
6. The Natural Base e
7. Exponential and Logarithmic Equations and Inequalities
8. Transformations of Exponential and Logarithmic Functions
9. Curve Fitting with Exponential and Logarithmic Models

Skills

1. Write and evaluate exponential expressions to model growth and decay situations. (11P1)
2. Graph exponential functions and their inverses. (11P3)
3. Write equivalent forms for exponential and logarithmic functions. (11N8)
4. Write, evaluate, and graph logarithmic functions.
5. Use properties of logarithms to simplify logarithmic expressions.
6. Solve exponential, logarithmic equations and inequalities.
7. Use exponential and logarithmic equations to solve problem situations.
8. Use the number e to write and graph natural logarithmic and exponential functions.
9. Use natural logarithms to solve real world problems.
10. Transform exponential and logarithmic functions by changing parameters, and discuss the effects of such changes on the graphs of these functions. (11P3)
11. Model data and find regression equations for exponential and logarithmic functions. (11D4)
12. Use exponential and logarithmic models to analyze and predict future values in problem situations. (11P1)

Essential Questions

1. To what extent can I use exponential and logarithmic functions to make decisions about my future?
2. How can these functions be used to make the world a better place?
3. How can these functions be used to make new progress in technology and in invention?

Stage 2: Assessment Evidence

Diagnostic: Observation

Activity: Using Exponent Properties Teacher will observe student proficiency at using previously learned exponent properties. This can be done by giving students a variety of sample problems and then asking them to simplify each, individually, at the board, using white boards, etc.

Summative: Test

Written Test A written assessment will measure student learning.

Formative: Observation

Drills with Exponential to Logarithmic Forms, Properties of Logarithms Frequent drills (using pencil and paper, chalk or white boards, oral drills, etc) will solidify student understanding.

Formative: Homework

Daily Homework Demonstrations Individual demonstrations of homework problems allows the teacher to assess student understanding and the student to address any difficulties that he may be having with the work.

Formative: Performance

Team Equation Solving A game with two teams completing for bonus points is a good way for students to practice solving logarithmic and exponential equations.

Stage 3: Learning Plan

Learning Experiences

1. The opening activity will allow the teacher to observe how proficient students are with the exponent properties that are essential in using exponential and logarithmic functions. Re-teaching and review will follow as needed.
2. Daily practice with these functions is important so that students can easily perform the algebraic processes required. Students will demonstrate and explain solutions daily, so that the teacher can assess understanding.
3. White boards and chalkboards can be used to drill these skills regularly during this unit.
4. A competitive game requiring teams to solve exponential and logarithmic equations will encourage peer tutoring and discussion of the processes used.
5. An activity that involves use of these functions in a real life setting will make these concepts relevant to students. One example would be an activity where students need to compare growth rates to make decisions (e.g. salary choices, business growth, etc.).
6. A written test will assess student proficiency at the skills required for using exponential and logarithmic functions.
7. The final project will require students to examine world population growth, to project numbers of future populations, and to examine how this information could be used to improve the lives of these people and what decisions will need to be made based on this information.

Technology Integration

1. Students will use TI-83 or 84 for graph functions and to examine various transformations of these functions and the effects that the changes in the rule have on the graph.
2. The calculators will also be used to do regressions for exponential and logarithmic dat

Resources

Websitesthat may be usefulin developing lesson plans:

1. Ohio Department of Education [www.ode.state.oh.us](http://www.ode.state.oh.us/)
2. NCTM [www.nctm.org](http://www.nctm.org/)
3. NCISLA www.wcer.wise,edu/ncisla/publications
4. Education World [www.education-world.com](http://www.education-world.com/)