I. Unit Summary/Enduring Understanding/Essential Questions

- This unit will examine linear functions and their applications, including the appropriate function notation. It will expand to solving and interpreting systems of linear equations and inequalities.

- Essential Questions
  - What is the general equation of a linear function?
  - When would it be useful and/or necessary to solve an equation for another variable within that equation?
  - How is solving an inequality similar to solving an equation?
  - How do you represent the solutions to an inequality in interval notation?
  - Why is it possible to have no solution or infinitely many solutions to an equation or an inequality?
  - How would you describe the solution of a system of linear equations and inequalities?
  - How do you determine the best method to solve a system of linear equations?
  - How do you know how many solutions a system will have?
  - How does “infinitely many solutions” differ from “all real numbers”?
  - How can you use a system of linear equations or inequalities to model a real-world situation?
  - How do you determine the domain and the range of a function and what situations require you to look for restrictions on the domain and the range?
  - How can you determine if a relation is a function?
  - How can you describe a function using its key features?
  - (Given a verbal description) How would you sketch a graph of this function?

II. Skills/Concepts

Students will be able to...

- construct linear functions (writing the equation of a line)
- identify the domain and range in function notation
- construct a linear function given a graph, a description of a relationship, or two input-output pairs
- interpret the parameters in a linear function in terms of a context
- solve systems of linear equations exactly and approximately (i.e. with graphs) focusing on pairs of linear equations in two and three variables
- create equations and inequalities in one variable and use them to solve problems
III. Selected Terms and Symbols:

- function notation f(x)
- slope-intercept form: \( y = mx + b \)
- point-slope form: \( y - y_1 = m(x - x_1) \)
- standard form: \( Ax + By = C \)
- parameter - in relation to the context of the problem
- domain, input
- range, output
- interval notation
- inequalities, compound inequalities
- solving systems algebraically using substitution & elimination

IV. End of Unit Common Tasks

- Internal Documents

V. Suggested Formative Assessment Practice:

- Internal Document

VI. Learning Progressions (Before, During, After):

**Before:** These topics have addressed in Algebra I. In Algebra I, the unit built upon students’ prior experiences with linear data. They used graphical representations and knowledge of the context to make judgments about the appropriateness of linear models. Additionally, they created and solved equations, inequalities, and systems of linear equations. They also were exposed to basic function notation.

**After:** Upon completion of this unit, students will have mastered linear functions. Students will represent and analyze functions in several ways, analyze characteristics of functions (exponential, logarithmic, and trigonometric), and apply knowledge of functions to interpret situations.

VII. Misconceptions:

- Domain being y instead of x-values; Range being x instead of y-values, input-output
- Infinite solutions vs. no solution
- Function notation (i.e. treating \( f(x) \) as \( f \) multiplied by \( x \))
- Misuse of input value in function notation
- Misinterpreting the parameters in a linear function in terms of a context.
- The inequality always points in the direction to shade a solution set.
- Transition from 2x2 to a 3x3 system of equations

VIII. Resources:

- Algebra II Holt Textbook:
• Algebra II and Trigonometry: Structure and Method Book 2 – McDougal Littell
• Online resources
  o Khan Academy
  o Sumdog
  o Holt website
  o YouTube
  o Cosmeo
  o Schoology
  o Poll everywhere

IX. **Standards**: Aligned to the following Common Core State Standards…

• F-IF.4
• F-LE.2
• F-LE.5
• A-CED.1
• A-REI.6
Algebra II

Unit 2 - Basic Functions

X. Unit Summary/Enduring Understanding/Essential Questions

• This unit will explore transformations of basic functions (quadratic, cubic, abs. value, square root). This unit will build new functions from existing functions (shifts and translations). Functions (quadratic, cubic, abs. value, square root) that arise in applications in terms of a context will be analyzed, constructed and compared amongst each other.

• Essential Questions:
  o How do you graph various types of functions (linear, quadratic, cubic, absolute value, square root), and what are the key features of the graphs of these functions?
  o How would you describe a transformation that occurred to a basic function?
  o How would you write a function based on given transformations?
  o How would you compare basic functions to one another using equations, graphs, tables or verbal descriptions?

XI. Skills/Concepts

Students will be able to…

• identify parent functions and their key features (domain, range, intercepts, extrema, symmetry, and end behavior)
• identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. (i.e. shifts and translations)
• experiment with cases and illustrate an explanation of the effects on the graph using technology
• recognize even and odd functions from their graphs and algebraic expressions
• compare basic functions to one another using equations, graphs, tables or verbal descriptions
• identify the appropriate quantities in the context of each problem

XII. Selected Terms and Symbols:

• domain, range
• intercepts
• extrema
• symmetry
• end behavior
• shifts and translations
• reflections

XIII. End of Unit Common Tasks

• Internal Documents

XIV. Suggested Formative Assessment Practice:

• Internal Documents
XV.  Learning Progressions (Before, During, After):

**Before:** Prior to this, students were exposed to linear, quadratic and absolute values graphs. They also have developed an understanding of the characteristics of a graph (domain, range, intercepts, etc.)

**After:** This topic will also be revisited in future courses and units where students will represent and analyze functions in several ways, analyze characteristics of functions (exponential, logarithmic, and trigonometric), and apply knowledge of functions to interpret situations.

XVI.  Misconceptions:
- Misuse of vertical and horizontal translations
- Confusing a vertical stretch vs. a vertical compression
- Incorrect graphing

XVII.  Resources:
- Algebra II Holt Textbook:
- Algebra II and Trigonometry: Structure and Method Book 2 – McDougal Littell
- Online resources
  - Khan Academy
  - Sumdog
  - Holt website
  - YouTube
  - Cosmeo
  - Schoology
  - Poll Everywhere

XVIII.  Standards: Aligned to the following Common Core State Standards…
- N-Q.2
- F-IF.9
- F-BF.1.b
- F-BF.3
Algebra II

Unit 3 – Polynomial Relationships

Unit Summary/Enduring Understanding/Essential Questions

This unit will expand their knowledge of quadratic equations from Algebra I and will incorporate the complex number system. They will master key features of quadratic equations and connect their knowledge to polynomials. This will include operations with polynomials, such as addition, subtraction, multiplication, and division. Within the unit, students will interpret the structure of the expression and understand the relationship between zeroes and factors of polynomials. This unit will analyze, construct and compare linear, quadratic, and polynomial functions.

Essential Questions:

- What is the general equation of a quadratic function?
- How does the graph of \( g(x) = (x - h)^2 + k \) compare with the graph of \( f(x) = x^2 \)?
- How does the graph of \( g(x) = ax^2 \) differ from the graph of \( f(x) = x^2 \)?
- How can you graph the function \( f(x) = a(x - h)^2 + k \) ?
- How do you convert quadratic functions to the vertex form \( f(x) = a(x - h)^2 + k \)?
- How do you determine where the graph of a quadratic function crosses the x-axis?
- How would you determine vertex, minimums, maximums, intercepts, domain, range and axis of symmetry for a quadratic function?
- How are quadratic models used to solve real world problems?
- What are polynomial functions and how do we graph them?
- What are the zeroes of a polynomial function and how can you find them?
- How do you perform polynomial operations?
- What is the relationship between polynomial division and the Remainder Theorem?
- How can you use polynomial functions to model and solve real-world problems?
- How would you determine the intervals in which a function is increasing, decreasing, and/or constant?
- How does the value of \( n \) affect the behavior of the function \( f(x) = x^n \)?

XIX. Skills/Concepts

Students will be able to…

- identify the key features of quadratic and polynomial equations (domain, range, extrema, zeroes and increasing/decreasing, end behavior, symmetry, etc.)
- perform arithmetic operation with complex numbers
- solve quadratics by completing the square, the quadratic formula, and factoring
- solve polynomial functions using the remainder and factor theorems
- apply the fundamental theorem of algebra
- rewrite rational expressions in different forms (i.e. division algorithm)
- interpret functions (linear, quadratic, polynomial) that arise in applications in terms of a context by analyzing, constructing, and comparing the functions.
- solving a system consisting of a linear and quadratic equation in two variables algebraically and graphically
XX. **Selected Terms and Symbols:**

- quadratic equation
- complex numbers
- polynomial
- operations with polynomials
- zeroes, roots, intercepts
- domain
- range
- extrema
- increasing/decreasing
- symmetry
- quadratic formula
- completing the square
- factoring
- rational expressions
- remainder theorem
- factor theorem
- rewriting simple rational expressions (division algorithm)
- fundamental theorem of algebra

XXI. **End of Unit Common Tasks**

- Internal Documents

XXII. **Suggested Formative Assessment Practice:**

- Internal Documents

XXIII. **Learning Progressions (Before, During, After):**

*Before:* Prior to this, students were introduced to quadratic and polynomial functions. They will be able to perform arithmetic operations and will be able to factor polynomials using a variety of methods. Students have also compared the key characteristics of quadratic functions to those of linear and polynomial functions. Students learned to anticipate the graph of a quadratic function by interpreting various forms of quadratic expressions. In particular, they identified the real solutions of a quadratic equation as the zeroes of a related quadratic function. Students learned how to solve quadratic equation by completing the square, quadratic formula and factoring.

*After:* This topic will also be revisited in future courses and units where students will represent and analyze functions in several ways, analyze characteristics of functions (exponential, logarithmic, and trigonometric), and apply knowledge of functions to interpret situations.

XXIV. **Misconceptions:**

- Misuse of vertical and horizontal translations
- Confusing a vertical stretch vs. a vertical compression
- Incorrect graphing

XXV. **Resources:**
- Algebra II Holt Textbook:
- Algebra II and Trigonometry: Structure and Method Book 2 – McDougal Littell
- Online resources
  - Khan Academy
  - Sumdog
  - Holt website
  - YouTube
  - Cosmeo
  - Schoology
  - Poll everywhere

XXVI. **Standards**: Aligned to the following Common Core State Standards…
- A-SSE.2
- F-IF.4
- F-IF.6
- N-Q.2
- A-SSE.4
- F-IF.7.c
- N-CN.1
- N-CN.2
- A-APR.2
- A-APR.3
- A-APR.4
- F-IF.9
- N-CN.7
- A-APR.6
- A-CED.1
- A-REI.4.b
- A-REI.7
- F-LE.4
- A-REI.11
Algebra II

Unit 4 – Rational and Radical Relationships

- Unit Summary/Enduring Understanding/Essential Questions
  - In this unit we will be solving simple rational and radical equations and make connections to rational exponents. This unit will interpret functions (linear, quadratic, polynomial, rational and radical) that arise in applications in terms of a context by analyzing, constructing, and comparing functions. This unit will allow for the use of a graph, table, or technology to find approximate solutions of these functions.
  - Essential Questions:
    - What is the connection between radical equation and rational exponents?
    - What characteristics make up a rational function?
    - What are the domain, range, and intercepts of radical functions?
    - What real-world situation could be modeled by a radical function?

XXVII. Skills/Concepts

Students will be able to...

- solve simple rational and radical equations
- analyze rational exponents
- simply rational expressions
- analyze functions using tables, technology, graphs, lines, equations
- represent and solve equations and inequalities graphically
- create equations that describe numbers or relationships in regards to real-world problems (i.e. job rate)
- Interpret rational and radical equations that arise in applications in terms of a context by analyzing, constructing, and comparing the functions.

XXVIII. Selected Terms and Symbols:

- radical expressions
- radical equations
- rational expressions
- rational equations
- rational exponents

XXIX. End of Unit Common Tasks

- Internal Documents

XXX. Suggested Formative Assessment Practice:
XXXI. Learning Progressions (Before, During, After):

**Before:** Prior to this, students were exposed to radical equations and the graphs of radical equations. Students were exposed to rational functions and operations involving rational functions.

**After:** This topic will also be revisited in future courses, where students will represent and analyze functions in several ways, analyze characteristics of functions and apply knowledge of functions to interpret situations.

XXXII. Misconceptions:
- Incorrectly reducing/cancelling when simplifying
- Extraneous roots
- Incorrect use of squaring terms
- Misunderstanding a common denominator

XXXIII. Resources:
- Algebra II Holt Textbook:
- Algebra II and Trigonometry: Structure and Method Book 2 – McDougal Littell
- Online resources
  - Khan Academy
  - Sumdog
  - Holt website
  - YouTube
  - Cosmeo
  - Schoology
  - Poll everywhere

XXXIV. Standards: Aligned to the following Common Core State Standards…

- N-RN.1
- N-RN.2
- F-IF.4
- N-Q.2
- F-IF.7.a
- F-IF.7.b
- F-IF.7.c
- F-IF.7.d
- F-IF.7.e
- F-IF.9
- A-CED.1
- A-REI.1
- A-REI.2
- A-REI.11
Unit Summary/Enduring Understanding/Essential Questions

- This unit will cover exponential functions, including growth and decay. A discussion of inverses will lead into basic logarithmic functions, including but not limited to solving exponential functions. Equations and inequalities will be represented and solved graphically. This unit will interpret functions (linear, polynomial, rational, radical, exponential and logarithmic) that arise in applications in terms of a context by analyzing, constructing, and comparing the functions.

- Essential Questions
  - What is the general equation of an exponential function?
  - What is the general equation of a logarithmic function?
  - How does changing the values of a, h, and k affect the graph of an exponential growth/decay function?
  - How does changing the values of a, h, and k affect the graph of a logarithmic function \( f(x) = a \log_b(x-h)+k \)?
  - What are the properties of logarithms?
  - What is the general process for solving exponential and logarithmic equations?
  - What is the relationship between logarithmic and exponential functions? Include the domain and range of each and the relationships of their graphs.

Skills/Concepts

Students will be able to…

- solve and graph exponential functions
- graph logarithmic functions
- solving equations using logs
- interpret functions (linear, polynomial, rational, radical, exponential and logarithmic) that arise in applications in terms of a context by analyzing, constructing, and comparing the functions.

Selected Terms and Symbols:

- growth
- decay
- exponential functions
- logarithmic functions (e and ln)
- inverses

End of Unit Common Tasks

- Internal Documents
XXXIX.  Suggested Formative Assessment Practice:
   - Internal Documents

XL.  Learning Progressions (Before, During, After):

   **Before:** Prior to this, students were exposed to the concepts of exponential equations and functions. Students learned to evaluate, identify, and graph exponential functions. Students were introduced to basic exponential growth and decay functions.

   **After:** This topic will also be revisited in future courses, where students will represent and analyze exponential and logarithmic functions in several ways, analyze characteristics of functions and apply knowledge of functions to interpret situations.

XLI.  Misconceptions:
   - Misunderstanding the domain and range of exponential and logarithmic functions
   - Process of solving exponentials and logs
   - Inverse notation

XLII.  Resources:
   - Algebra II Holt Textbook:
   - Algebra II and Trigonometry: Structure and Method Book 2 – McDougal Littell
   - Online resources
     o Khan Academy
     o Sumdog
     o Holt website
     o YouTube
     o Cosmeo
     o Schoology
     o Poll everywhere

XLIII.  Standards: Aligned to the following Common Core State Standards…
   - F-IF.4
   - F-IF.6
   - N-Q.2
   - A-SSE.3.c
   - F-IF.7.e
   - F-IF.8.b
   - F-IF.9
   - F-BF.1.a
   - F-BF.4.a
   - F-LE.2
   - F-LE.4
   - F-LE.5
   - A-REI.11
XLIV. **Unit Summary**
- This unit will translate the geometric description and equation for a conic section (parabolas & circles). The derivation of the equations of parabolas and circles will be discussed. This unit will interpret functions (linear, quadratic and circles) that arise in applications in terms of a context by analyzing, constructing, and comparing the functions.
- **Essential Questions:**
  - What is the general form of a circle?
  - What are the key features of a parabola and a circle?
  - How do you find a solution to a system of non-linear and linear functions?

XLV. **Skills/Concepts**
- Students will be able to...
  - derive the equation of a parabola and circle
  - graph and interpret the key features (center, directrix, focus, radius, vertex, etc.) of a parabola and a circle
  - interpret functions (linear, quadratic and circles) that arise in applications in terms of a context by analyzing, constructing, and comparing the functions.

XLVI. **Selected Terms and Symbols:**
- parabola
- circle
- directrix
- focus
- vertex
- axis of symmetry
- center
- radius

XLVII. **End of Unit Common Tasks**
- Internal Documents

XLVIII. **Suggested Formative Assessment Practice:**
- Internal Documents

XLIX. **Learning Progressions (Before, During, After):**
**Before:** Prior to this, students were exposed to parabolas and circles and their equations in Algebra I and Geometry.

**After:** This topic will be revisited in future courses, with an extension in precalculus to ellipses and hyperbolas. In future units students will interpret and analyze linear and nonlinear systems.

L. **Misconceptions:**
- Misunderstanding the domain and range of exponential and logarithmic functions
- Process of solving exponentials and logs
- Inverse notation

LI. **Resources:**
- Algebra II Holt Textbook:
- Algebra II and Trigonometry: Structure and Method Book 2 – McDougal Littell
- Online resources
  - Khan Academy
  - Sumdog
  - Holt website
  - YouTube
  - Cosmeo
  - Schoology
  - Poll everywhere

LII. **Standards:** Aligned to the following Common Core State Standards...

- A-REI.7
- G-GPE.1
- G-GPE.2
- A-REI.11
LIII. **Unit Summary**

- This unit will extend the domain of trigonometric functions using the unit circle with the prior knowledge of right triangle trigonometry from geometry. In this unit the Pythagorean identity will be proven and periodic phenomena will be modeled with trigonometric functions. Interpret trigonometric functions that arise in applications in terms of a context by analyzing, constructing, and comparing the functions.

- **Essential Questions:**
  - What is radian measure?
  - What is an angle of rotation? How is it measured?
  - How can you check that you are using your conversion factor between degrees and radians correctly?
  - How would you find the measure of any angle that is coterminal with a given angle?
  - How can you use a given value of one of the trigonometric ratios to calculate the value of another?
  - How can sine and cosine functions be defined using the unit circle?
  - How do you prove the Pythagorean identity?
  - How can a sine function be used to model and analyze motion of periodic phenomena?

LIV. **Skills/Concepts**

Students will be able to:

- derive and understand all characteristics of the unit circle
- model periodic phenomena with trigonometric functions
- prove the Pythagorean identity
- interpret trigonometry functions that arise in applications in terms of a context by analyzing, constructing, and comparing the functions.

LV. **Selected Terms and Symbols:**

- Pythagorean Identity: \( \sin^2 \theta + \cos^2 \theta = 1 \)
- Unit Circle
- Periodic Phenomena
- sine
- cosine
- tangent
- cotangent
- cosecant
- secant

LVI. **Common Tasks**

- Internal Documents

LVII. **Suggested Formative Assessment Practice:**
LVIII. Learning Progressions (Before, During, After):

Before: Prior to this, students were exposed to basic right triangle trigonometry in Geometry.

After: This topic will be revisited in future courses, with an extension in pre-calculus, which will elaborate to inverses of trigonometric functions, law of sines, cosines, double-angle and half-angle identities. In future units students will interpret and analyze linear and nonlinear systems.

LIX. Misconceptions:
- Misunderstanding the domain and range of exponential and logarithmic functions
- Process of solving exponentials and logs
- Inverse notation

LX. Resources:
- Algebra II Holt Textbook:
- Trigonometry Textbook
- Online resources
  - Khan Academy
  - Sumdog
  - Holt website
  - YouTube
  - Cosmeo
  - Schoology
  - Poll everywhere

LXI. Standards: Aligned to the following Common Core State Standards...

- F-IF.4
- F-IF.6
- N-Q.2
- F-IF.7.e
- F-TF.1
- F-TF.2
- F-TF.5
- F-TF 8
LXII. **Unit Summary**
- This unit will determine the explicit and recursive rule for arithmetic and geometric sequences. The derivation for the sum of a finite geometric series will be determined.
- **Essential Questions:**
  - How do you determine between an arithmetic and geometric sequence?
  - How do you determine the explicit and recursive rule for a given arithmetic or geometric sequence?
  - How do you find the sum of a finite geometric series?

LXIII. **Skills/Concepts**

Students will be able to:
- determine the explicit and recursive rule for an arithmetic and geometric sequence (use them to model situations)
- derive the formula for the sum of a finite geometric series and use the formula to solve problems

LXIV. **Selected Terms and Symbols:**
- sequences (arithmetic and geometric)
- finite geometric series
- explicit
- recursive

LXV. **End of Unit Common Tasks**
- Internal Documents

LXVI. **Suggested Formative Assessment Practice:**
- Internal Documents

LXVII. **Learning Progressions (Before, During, After):**

**Before:** Prior to this, students were exposed to sequences and series in Geometry.

**After:** This topic will be revisited in calculus, where students will master more elaborate sequences and series.

LXVIII. **Misconceptions:**
- Incorrect use of the explicit and recursive rule
LXIX. **Resources:**
- Algebra II Holt Textbook:
- Algebra II Honors Textbook
- Online resources
  - Khan Academy
  - Sumdog
  - Holt website
  - YouTube
  - Cosmeo
  - Schoology
  - Poll everywhere

LXX. **Standards:** Aligned to the following Common Core State Standards...
- F-IF.3
- A-SSE.4
- F-BF.1.a
- F-BF.2
- F-LE.2
LXXI. Unit Summary

- This unit explores the random processes underlying statistical experiments and make inferences and justifications from sample surveys, experiments and observational studies. This unit will explore independent and conditional probability and use both to interpret data. Rules of probability will be used to compute probability of compound events.
- Essential Questions:
  - What are the different methods for gathering data about a population?
  - What is a probability distribution? How is it displayed?
  - What kinds of statistical research are there? Which ones can establish cause-and-effect relationships between variables?
  - What are the similarities and differences between experimental and theoretical probability?
  - How could you use a frequency table and probability distribution to draw conclusions about a given situation?
  - How could you determine whether two events are dependent or independent?
  - What is an example of mutually exclusive events? How can you find the probability of these events?
  - How can tables, tree diagrams, and formulas be used to find conditional probability?

LXXII. Skills/Concepts

Students will be able to:

- Understand and evaluate random processes underlying statistical experiments
- Make inferences and justify conclusions from sample surveys, experiments and observational studies
- Use the rules of probability in regards to independent, conditional probability and compound events.
- Represent and interpret data on one and two categorical and quantitative variables.

LXXIII. Selected Terms and Symbols:

- independent and conditional probability
- discrete and continuous data
- data collection
- sample surveys, experiments, and observational studies
- population parameter vs. sample statistic
- independent vs. dependent events
- exclusive and mutually exclusive events
• correlation and random sample
• Fundamental Counting Principle, Combinations, and Permutations (+) [Honors]
• simulation

LXXIV.  **End of Unit Common Tasks**

• Internal Documents

LXXV.  **Suggested Formative Assessment Practice:**
  Internal Documents

LXXVI.  **Learning Progressions (Before, During, After):**

**Before:** Prior to this, students were exposed to univariate statistics. Students learned to summarize, represent, and interpret data on a single variable. Additionally, students represented and interpreted data on one categorical and quantitative variables.

**After:** This topic will be revisited in future courses, where students will master more elaborate statistical studies.

LXXVII.  **Misconceptions:**

• Interpretation of data

LXXVIII.  **Resources:**

• Algebra II Holt Textbook
• Honors Algebra II Textbook
• Elementary Statistics Textbook
• Online resources
  o Khan Academy
  o Sumdog
  o Holt website
  o YouTube
  o Cosmeo
  o Schoology
  o Poll everywhere

LXXIX.  **Standards:** Aligned to the following Common Core State Standards…

• S-IC.1
• S-IC.2
• S-IC.3
• S-IC.4
• S-IC.5
• S-IC.6
• S-CP.1
• S-CP.2
• S-CP.3
• S-CP.4
• S-CP.5
• S-CP.6
• S-CP.7