# Spanish Fork High School
# Resource Secondary Math II

## Unit 1: Extending the number system (2-3 weeks)

**U1 Cluster 1: Extend the properties of exponents to rational exponents**

- I can extend the properties of integer exponents to rational exponents.
- I can define rational exponents.
- I can simplify expressions involving radicals and rational exponents.

**U1 Cluster 2: Use properties of rational and irrational numbers**

- I can explain why sums and products of rational numbers are rational.
- I can explain why the sum of a rational and an irrational number is irrational.
- I can explain why the product of a nonzero rational number and an irrational number is irrational.
- I can calculate the sums and products of rational and irrational numbers from real world applications.

**U1 Cluster 3: Perform arithmetic operations with complex numbers**

- I can define a complex number.
- I can explain the form of a complex number ($a + bi$ where $a$ and $b$ are real numbers).
- I can apply the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers.

**U1 Cluster 4: Perform arithmetic operations on polynomials**

- I can add, subtract, and multiply polynomials.
- I can explain why the result of adding, subtracting or multiplying polynomials, is always a polynomial.

## Unit 2: Quadratic Functions and Modeling (9-11 weeks)

**U2 Cluster 1: Interpret functions that arise in application in terms of a context**

- I can determine if a set of data represents a linear, exponential or quadratic function.
- I can use tables and graphs to explain relationships (linear, exponential or quadratic) between two quantities.
- I can interpret key features (intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior) of a quadratic function.
- I can compare and contrast key features of quadratic functions with linear and exponential functions.
- I can graph key features of a quadratic function from a verbal description of the relationship.
- I can determine the appropriate domain of a relationship in the context of a problem. (i.e. I can determine if the domain is restricted given the context.)
- I can calculate the average rate of change of a function over a specified interval using an equation or a table.
- I can interpret the average rate of change of a function.
- I can estimate the average rate of change from a graph.

**U2 Cluster 2: Analyze functions using different representations**

- I can graph linear and quadratic functions (with or without technology) given an equation, and show key features such as intercepts, maxima and minima.
- I can graph square root, cube root, step (or greatest integer), absolute value and piecewise defined functions.
- I can compare and contrast key features of various functions including differences in domain and range, intercepts, and rates of change.
- I can write a quadratic function in an equivalent appropriate form (i.e. standard form, vertex form, and intercept form) to highlight items of interest (zeros, extreme values, and symmetry).
- I can factor quadratic functions to determine the zeros, extreme values, and symmetry.
- I can complete the square in a quadratic function to determine roots, extreme values, and symmetry.
- I can interpret expressions for exponential functions using the properties of exponents to classify them as representing exponential growth or exponential decay.
- I can compare and contrast two functions (linear, exponential and/or quadratic) when each is represented differently (algebraically, graphically, numerically in tables, or by verbal description).
- I can explain the relationship between the roots and the coefficients of a quadratic function.

- I can explain the relationship between the roots and the factors of a quadratic function.

**U2 Cluster 3: Build a function that models a relationship between two quantities**

- I can write a function (linear, quadratic or exponential) that describes a relationship between two quantities.
- I can determine an explicit expression, recursive process, or steps for calculation from a context.
- I can combine standard function types by adding, subtracting, multiplying and composing.
- I can combine functions to model real world situations.

**U2 Cluster 4: Build new functions from existing functions**

- I can identify and explain the effect of a constant "*k*" on the parent graph of f(x) (i.e: $f(x) + k$, $kf(x)$, $f(kx)$, and $f(x + k)$) using various representations.
- I can use technology to illustrate and explain the effects of "*k*" on a graph.
- I can find the value of "*k*" given the parent graph and a graph of the transformed function.
- I can recognize even and odd functions from their graphs and algebraic expressions.
- I can find the inverse of linear, quadratic, and absolute value functions and restrict the domain when necessary.

**U2 Cluster 5: Construct and compare linear, quadratic and exponential models and solve problems**

- I can compare linear, quadratic, and exponential growth by using different representations of the functions.
- I can explain why a quantity increasing exponentially will eventually exceed a quantity increasing linearly or quadratically.
- I can construct and compare linear, quadratic and exponential models and use them to solve problems.

## Unit 3: Expressions and Equations (6-7 weeks)

**U3 Cluster 1: Interpret the structure of expressions**

- I can interpret the terms, factors, and coefficients of quadratic and exponential expressions.
- I can interpret complicated expressions by viewing one or more of their parts as a single entity.
- I can use the structure of a quadratic or exponential expression to identify ways to rewrite it.

**U3 Cluster 2: Write expressions in equivalent forms to solve problems**

- I can factor a quadratic expression to find the zeros of a function.
- I can complete the square in a quadratic expression and use it to find the maximum or minimum value of a function.
- I can use the properties of exponents to transform exponential functions to equivalent forms.

**U3 Cluster 3: Create equations that describe numbers or relationships**

- I can create quadratic equations and inequalities in one variable and use them to solve problems.
- I can create quadratic equations and inequalities in two variables and use them to solve problems.
- I can graph quadratic functions and inequalities in two variables, using appropriate labels and scales.
- I can solve a formula involving squared variables for a given variable.

**U3 Cluster 4: Solve equations and inequalities in one variable**

- I can transform any quadratic equation in x into an equation in the form $(x - p)^2 = q$ by completing the square and show that it has the same solutions.
- I can derive the quadratic formula by completing the square from the standard form of a quadratic equation ($ax^2+bx+c = 0$).
- I can recognize the appropriate method to solve a quadratic equation: by inspection, taking the square root, completing the square, using the quadratic formula, and factoring.
- I can use the discriminant to recognize when the quadratic formula gives complex solutions and write in the correct form. (i.e. $a \pm bi$ and for real numbers $a$ and $b$).

**U3 Cluster 5: Use complex numbers in polynomial identities and equations**

- I can solve quadratic equations with real coefficients that have complex solutions.
- I can extend quadratic identities to complex numbers
- I can explain the Fundamental Theorem of Algebra.
- I can show that the Fundamental Theorem of Algebra is true for quadratic polynomials.
- I can factor quadratic equations with complex roots.

**U3 Cluster 6: Solve systems of equations**

- I can solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically.

## Unit 4: Applications of Probability (3-4 weeks)

**U4 Cluster 1: Understand independence and conditional probability and use them to interpret data**

- I can describe events as subsets of a sample space using the characteristics or categories of the outcomes.
- I can describe events as unions, intersections or complements of events.
- I can determine the complement of an event ("not").
- I can use models, such as Venn diagrams, to represent independent and conditional probability.
- I can recognize whether two events A & B are independent.
- I can describe independent events in my own words.
- I can calculate the probability that two independent events will both occur by finding the product of their individual probabilities.
- I can explain the concept of conditional probability in my own words.
- I can calculate conditional probability using the formula.
- I can construct and interpret two-way frequency tables of data.
- I can use two-way frequency tables to decide if events are independent.
- I can use two-way frequency tables to approximate conditional probabilities.

**U4 Cluster 2: Use the rules of probability to compute probabilities of compound events in a uniform probability model**

- I can use a model to find and interpret conditional probability.
- I can apply the Addition Rule: $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$, and interpret the results.
- I can apply the general Multiplication Rule: $(A \text{ and } B) = P(A)P(B|A) = P(B)P(A|B)$ and interpret the results.
- I can use permutations and combinations to compute probabilities and solve problems.

**U4 Cluster 3: Use probability to evaluate outcomes of decisions**

- I can use probability to make fair decisions using various methods. (e.g. drawing lots, random number generators, etc.)
- I can analyze decisions and strategies using probability concepts. (e.g. product testing, medical testing, pulling a hockey goalies at the end of a game, etc.)

## Unit 5: Similarity, Right Triangle Trigonometry and Proof (5-6 weeks)

**U5 Cluster 1: Understand similarity in terms of similarity transformations**

- I can verify experimentally the properties of dilations given a center and a scale factor.
- I can determine whether two figures are similar by using the definition of similarity in terms of transformations.
- I can explain similarity of triangles using equality of corresponding angles and proportionality of corresponding pairs of sides.
- I can use properties of similarity transformations to establish the AA criterion for two triangles to be similar.

**U5 Cluster 2: Prove geometric theorems**

- I can prove the following theorems about lines and angles in multiple ways:
    - Vertical angles are congruent.
    - When a transversal crosses parallel lines, alternate interior angles are congruent.
    - When a transversal crosses parallel lines, corresponding angles are congruent.
    - All points on a perpendicular bisector of a line segment are equidistant from the segment's endpoints.
- I can prove the following theorems about triangles in multiple ways:
    - The sum of the measures of the interior angles of a triangle is 180°.
    - The base angles of isosceles triangles are congruent.
    - The segment joining the midpoints of two sides of a triangle is parallel to the third side and half the length of the third side.
    - The medians of a triangle meet at a point.
- I can prove the following theorems about parallelograms in multiple ways:
    - Opposite sides are congruent.
    - Opposite angles are congruent.
    - The diagonals of a parallelogram bisect each other.
    - Rectangles are parallelograms with congruent diagonals.

**U5 Cluster 3: Prove theorems involving similarity**

- I can prove the following theorems about triangles using similarity:
    - A line parallel to one side of a triangle divides the other two sides proportionally.

    - A line that divides two sides of a triangle proportionally is parallel to the third side of the triangle.
    - The Pythagorean Theorem.
- I can solve problems with geometric figures using congruence and similarity.
- I can prove relationships in geometric figures using congruence and similarity.

**U5 Cluster 4: Use coordinates to prove simple geometric theorems algebraically**

- I can find the point on a directed line segment between two points that divides the segment in a given ratio.

**U5 Cluster 5: Define trigonometric ratios and solve problems involving right triangles**

- I can use similarity to explain that the side ratios (i.e. sine, cosine, tangent, cosecant, secant and cotangent) in right triangles are properties of the angles in the triangle.
- I can define trigonometric ratios for acute angles (sine, cosine, tangent, cosecant, secant, cotangent) using the sides of similar right triangles.
- I can explain the relationship between the sine and cosine of complementary angles.
- I can use the relationship between the sine and cosine of complementary angles to solve problems.
- I can solve right triangles in applied problems using trigonometric ratios and the Pythagorean Theorem.

**U5 Cluster 6: Prove and apply trigonometric identities**

- I can prove the Pythagorean Identity: .
- I can explain the connection between the identity, , the Pythagorean Theorem and the Distance Formula.
- I can use the Pythagorean Identity to find the value of a trigonometric function given the value of another trigonometric function (in Quadrant I only).

## Unit 6: Circles with and without Coordinates (4-5 weeks)

**U6 Cluster 1: Understand and apply theorems about circles**

- I can prove that all circles are similar.
- I can explain the difference between a central angle, an inscribed angle and a circumscribed angle.
- I can explain the relationship between an inscribed angle and the diameter.
- I can explain the relationship between a line tangent to a circle and the radius to the point of tangency.
- I can identify and describe relationships among angles, radii, and chords.
- I can construct the inscribed and circumscribed circles of a triangle.
- I can prove properties of angles for a quadrilateral inscribed in a circle.
- I can construct a tangent line from a point outside a given circle to the circle.

**U6 Cluster 2: Find arc lengths and areas of sectors of circles**

- I can derive using similarity the fact that the length of the arc intercepted by a central angle is proportional to the radius.
- I can explain how the radian measure of the central angle is the constant of proportionality.
- I can derive the formula for the area of a sector.
- I can find arc lengths and areas of sectors of circles.

**U6 Cluster 3: Translate between the geometric description and the equation for a conic section**

- I can use the Pythagorean Theorem to derive the equation of a circle.
- I can find the center and radius of a circle, by completing the square.
- I can derive the equation of a parabola with a vertical axis given the focus and directrix.

**U6 Cluster 4: Use coordinates to prove simple geometric theorems algebraically**

- I can use coordinates to prove the following simple geometric theorems algebraically:
    - Prove that a figure defined by four given points in the coordinate plane is a rectangle.
- I can do the following simple proofs involving circles and coordinates"
    - Prove or disprove that a given point lines on a given circle.

**U6 Cluster 5: Explain the volume formulas and use them to solve problems**

- I can explain the formulas for the circumference of a circle, area of a circle, and volume of a cylinder, pyramid and cone.
- I can explain the relationship between the areas and volumes of similar figures using transformations.
- I can solve problems using the volume formulas for cylinders, pyramids, cones and spheres.