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 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 polynomial functions, 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 graph quadratic functions and inequalities in two variables and use them to solve problems.
- 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 recognize whether two events are independent.
- I can describe independent events 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 goalie at the end of a game, etc.)

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

US 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.

US 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.
  - 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.

US 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.

US 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.

US 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.

US 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 lies 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.