

**Algebra I Mathematics Standards**  
**Fayette County Public Schools**  
**Number/Computation Strand**

**HIGH SCHOOL MATHEMATICS EXIT PERFORMANCE STANDARD 1:**

**Student will apply number sense and order relations in problem solving situations to perform estimations and/or calculations with equations, matrices, and sequences involving complex numbers (counting numbers, whole numbers, integers, rational numbers, irrational numbers, real numbers, etc.) with and without calculators and will communicate the reasoning used in solving these problems.**

*Based on Kentucky's Core Content for Mathematics Assessment, the Kentucky Program of Studies, and Academic Expectations: 1.5-1.9 Mathematical Communication & Reasoning, 1.16 Technology, 2.7 Number, 2.8 Procedures, 2.11 Change, 2.12 Structure; Goal 5 Think & Solve Problems; & Goal 6 Connect & Integrate Knowledge*

**Algebra I: Number/Computation Standards**

- \* NC/A1.1 Show number sense by interpreting, modeling and using appropriate mathematical notation and operations ( $\%$ ,  $!$ ,  $\pi$ , square roots-taking a root, scientific notation, absolute value, exponents-raising to a power, opposite, reciprocal, factorial, significant digits, ordered pairs, number line) for real numbers and by comparing and contrasting various subsets of the real number systems (counting numbers, whole numbers, integers, rational numbers, irrational numbers).
- \* NC/A1.2 Select and apply appropriate concrete (algebra tiles), pictorial (diagrams), and abstract models (symbolic notation) and strategies to simplify and solve two-variable multi-step linear equations and inequalities using order of operations, field properties (commutative, associative, distributive, inverse, identity, equality) and simple matrices with real numbers; and evaluate expressions containing radicals and absolute values in real world situations.
- \* NC/A1.3 Select and apply appropriate concrete (algebra tiles), pictorial (diagrams), and abstract models (symbolic notation) and strategies to simplify second and simple third degree polynomials including finding a common factor to all terms, factoring by grouping, recognizing difference of two squares, and factoring trinomials.
- \* NC/A1.4 Recognize, create and use variables to generalize numeric and geometric patterns by giving the rule for the  $n$ th term and defending the generalization.

**Skills, Concepts & Relationships**

- \*\*Review adding, subtracting, multiplying, and dividing integers (1-1)
  - \*Add & subtract matrices, and use scalar multiplication to solve practical problems (1-1)
  - \*Evaluate algebraic expressions involving substitutions (2-2)
  - \*\*Review using variables to describe numeric and geometric patterns (linear, simple quadratic) and situations and characterize in terms of properties of the  $n$ th stage (painted cube problem) (2-2,3-1)
  - \*Use spreadsheet formulas to represent patterns and to perform calculations (1-1,2-2,2-3,4-3,&9-2)
  - \*\*Review using order of operations with  $()$ 's and exponents (2-3)
  - \*Use the distributive property and recognize that combining like terms, with and without algebra tiles, involves applying the distributive property (simplify algebraic expressions) (2-3)
  - \*\*Review solving linear equations using mental math (guess & check, open sentences), pictorial (drawings or graphs), and formal (symbolic) methods (inverse operations, properties of equality) (4-1&4-2)
  - \*Use a graphing calculator to solve linear equations (4-1)
  - \*Solve equations with variables on both sides (balance scale, open sentences, algebra tiles, algeblocks, cups & counters) (4-3)
  - \*Solve inequalities using the properties of inequalities and graph and interpret the solutions (4-3)
  - Introduce matrix multiplication (6-2)
  - \*Recognize absolute value as a measure of distance, find the absolute value of a given number, and solve one-variable equations and inequalities involving absolute values symbolically and graphically (7-1)
  - \*Simplify, evaluate, & approximate square roots (use geometric models), recognizing when the radical's value is rational or irrational (7-2)
  - Introduce solving equations using square roots, graphing square root functions, recognizing the effect of parameters on graphs (7-2)
  - \*Recognize and use terms and definitions associated with polynomial expressions and functions (Expressions: monomial-1term, binomial-2terms, trinomial-3terms; Functions: linear-degree1, quadratic-degree2, cubic-degree3,etc.) (8-1)
  - \*Recognize and determine standard and scientific notation of large and small numbers including negative exponents (8-1)
  - \*Understand significant digits and precision (supplement)
  - \*Use Laws of Exponents including properties of powers and quotients of powers (8-1)
  - \*Add, subtract, multiply, and divide monomials and polynomials using concrete (algebra tiles, etc.) and abstract methods in the context of practical applications (use algebra tiles to conceptualize FOIL) (8-1&8-2)
  - \*Apply basic factoring techniques (GCF) to polynomials including finding a common factor to all the terms in a polynomial, factoring by grouping, recognizing the difference of two squares, and factoring trinomials(8-2)
  - Introduce solving quadratic equations by factoring (Principle of Zero Products) (9-2)
  - Introduce solving quadratic equations using square roots and interpreting the solutions in a real context (compound interest) (9-3)
  - Introduce solving quadratic equations using the quadratic formula and evaluating the discriminant (9-3)
  - \*\*Review comparing and contrasting various subsets of the real number system (counting numbers, whole numbers, integers, rational numbers, & irrational numbers) (10-1)
  - Introduce using the properties of real numbers to simplify rational and radical expressions, and to solve related equations (Principle of Squaring, extraneous solutions) (10-1)
- SFAW-Focus on Algebra in ( )**

**Geometry/Measurement Strand**

**HIGH SCHOOL MATHEMATICS EXIT PERFORMANCE STANDARD 2:**

Student will apply properties of measurement (ratio measures including slope, rate, indirect measurement, similarity; surface area and volume of prisms, pyramids, cylinders, cones, and spheres, etc.) and will use geometric concepts, properties and relationships (prove, use and apply theorems/conjectures involving lines, angles, triangles, quadrilaterals, regular, and non-regular polygons, circles, and transformations, etc.) in problem solving situations and communicate the inductive and simple deductive reasoning used in solving these problems.

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**Algebra I: Geometry/Measurement Standards**

- \* GM/A1.1 Understand how ratio and proportion can be used to connect mathematical ideas (use speed and density related to slope and “per unit” amounts—dimensional analysis & conversion factor, recognize ratio of the rise to the run is the same in similar figures, etc.) and that slope is the rate of change between two quantities that may be directly related (positive) or inversely related (negative).
- \* GM/A1.2 Recognize and determine slopes of parallel (same slope) and perpendicular (opposite reciprocals) lines and how they are related in the coordinate plane (find the equation of a line through a point perpendicular or parallel to the given line).
- \* GM/A1.3 Use geometric formulas to solve problems with algebraic expressions and equations (Pythagorean Theorem, distance formula, etc.).

**Skills, Concepts & Relationships**

- \*Find the slope of a line and recognize that slope is a measure of steepness (negative slope, positive slope, rise/run) (5-1)
  - \*Recognize slope is the rate of change of one quantity relative to another and describe slopes of vertical (undefined) and horizontal (zero) lines (5-1)
  - \*Recognize the importance of scale in graphing linear functions and use dimensional analysis (units) (5-2)
  - \*Recognize that conversion factor is the ratio of two equal quantities (5-2)
  - \*Use slopes and y-intercepts to determine whether pairs of lines are parallel, intersecting, or perpendicular (find the equation of a line through a point parallel or perpendicular to another line) (6-1)
  - Develop applying the Pythagorean Theorem and its converse (right triangle, hypotenuse, legs) (7-3)
  - Develop applying the Distance Formula for finding distance in the coordinate plane, to simplify square roots, and use distance to find midpoints of segments on a coordinate grid (7-3)
  - Develop exploring the golden ratio (10-1)
- SFAW-Focus on Algebra in ( )**

**Probability/Statistics Strand**

**HIGH SCHOOL MATHEMATICS EXIT PERFORMANCE STANDARD 3:**

Student will use data collection & analysis, graphing of single-variable and two-variable data (line, bar & circle graphs, histogram, stem and leaf plots, box and whisker plots, scatterplot, linear regression & curve fitting), statistics (mean, median, mode, range, outliers, quartiles), and designing probability experiments & simulations to test theories about real world problems and communicate the reasoning used in solving these problems.

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**Algebra I: Probability/Statistics Standards**

- \* **PS/A1.1** Collect, compile, compare, and display single-variable and two-variable data (line graph, bar graph, circle graph, histogram, stem and leaf plot, box and whisker plot, scatterplot, etc.) to analyze, interpret, draw conclusions, predict outcomes, and discover trends (write a linear equation for a trend line of best fit which models a set of real data) for real life situations.
- \* **PS/A1.2** Understand how range and measures of central tendency (mean, median, mode) influence implications and conclusions.
- \* **PS/A1.3** Design and conduct probability experiments (use sampling techniques & bias issues) then analyze odds and theoretical probabilities (fractions, percents, geometric models, tree diagrams) to make decisions.

**Skills, Concepts & Relationships**

- \*\*Review organizing, describing, interpreting, and analyzing data in various forms (1-1)
- \*\*Review applications of measures of central tendency (mean, median, mode) to summarize data, and understand how they influence implications and conclusions (1-1)
- \*Determine outliers' effects on mean & median (supplement)
- Develop concepts of dispersion and variance: quartile, interquartile, range, clusters, gaps, outliers, etc. (supplement)
- \*Construct, interpret and analyze: histograms, line plots, stem and leaf plots, circle graphs, box and whisker plots, scatterplots, etc. (supplement)
- \*Organize information on a spreadsheet, make appropriate computer generated graphs, & access information from a Database (1-1&supplement)
- \*Use scatterplots to determine whether two quantities are related and to look for patterns and trends in order to make predictions about their values (negative, positive, and no association) (1-2)
- \*Use sampling techniques to draw inferences about large populations (supplement)
- \*\*Review that probability is a ratio that measures the chance or likelihood that an event will occur (1-3)
- \*\*Review differences between experimental probability (actual) and theoretical probability (expected) (1-3)
- \*\*Review the Law of Large Numbers (more experimental trials should get closer to theoretical probability) (supplement)
- \*\*Review finding theoretical probabilities using a formula, tree diagram or geometric model (1-3)
- \*\*Review the Multiplication Fundamental Counting Principle (factorials) (1-3)
- \*\* Review differentiating "odds" and probability (supplement)
- Explore permutations and combinations (supplement)
- \*Use a graphing calculator to collect, represent, and analyze data; enter data into a list; determine statistics: mean, median, mode, quartiles; make a stat plot, box and whisker plot, histogram, and scatterplot (1-1 thru 1-3)
- \*Use scatterplots, trend lines, and linear functions as tools for creating a linear model for interpreting data that do not fall neatly on a line, in practical real world situations (make predictions using a trend line or its equation and interpret the reasonableness of prediction by exploring linear regression on a graphing calculator) (5-2)

**SFAW-Focus on Algebra in ( )**

**Algebraic Ideas Strand**

**HIGH SCHOOL MATHEMATICS EXIT PERFORMANCE STANDARD 4:**

Student will model, analyze, compare and apply linear & nonlinear algebraic functions (quadratic, polynomial, exponential, etc.) using tables, graphs in the coordinate plane, variables, expressions, equations, formulas, and inequalities in practical situations and communicate the reasoning used in solving these problems.

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Algebra I: Algebraic Ideas Standards

- \* AI/A1.1 Recognize and analyze linear algebraic relationships (functions) using tables, graphs in the coordinate plane, variables, expressions, equations and inequalities in problem solving situations.
- \* AI/A1.2 Determine, recognize and apply in problem solving situations (speed, work, mixture, percent, proportions, geometric formulas, etc.) characteristics of graphs and equations of lines including: independent & dependent variables, slope, intercepts, slope-intercept form ( $y=mx+b$ ), equation of line with a point and slope, two-point equation of a line, standard form ( $Ax+By=C$ ), and transformations (vertical and horizontal shifts).
- \* AI/A1.3 Determine and apply relationships between pairs of lines and inequalities to solve real life (expenses versus income to determine profit point) problems including parallel lines, perpendicular lines, and solving a system of two linear equations or inequalities with two variables by graphing on paper and with a graphing calculator or computer program.
- \* AI/A1.4 Determine and recognize differences in linear and non-linear equations, graph functions of the form  $f(x)=ax^2$  and  $f(x)=ax^2+c$  that model relationships between real world quantities, and approximate solutions for simple quadratic functions by graphing on paper, with tables, or with a graphing calculator or computer program.

**Skills, Concepts & Relationships**

- \*Graph real data using all four quadrants of the Cartesian coordinate system to find associations to connect quantities and categories of data that occur in the real world (1-2)
- \*Understand the difference between constant and variable quantities (2-1)
- \*Describe how the change in one quantity relates to changes in a related quantity (directly, inversely) using tables, graphs, and written words (2-1)
- \*Represent functional situations with tables, graphs, and equations; recognize the interrelationship of these and show how each representation is useful in different situations (domain of independent variables & range of dependent variables of a function) (3-1)
- \*Recognize the characteristics of linear ( $y=mx+b$ , constant change), nonlinear (not constant change) and proportional ( $y=ax$ , direct variation) functions, and identify their equations (3-2)
- \*Determine the slope and position of a line from its equation and graph a line given the slope and the y-intercept (slope-intercept form, y-intercept, point-slope formula) (5-2)
- \*Recognize that two points determine a unique line and determine the equation of a line through the two given points in real world situations (fixed costs vs. variable costs) (5-2)
- \*Use a graphing calculator to graph a line (table of values, coordinates grid; enter function in "y=" form, set and evaluate table, use window, trace and zoom) (5-2)
- \*Solve and apply a system of two linear equations graphically (graph paper and graphing calculator) and interpret the solution for real life situations (6-1)
- \*Recognize standard form of a linear equation  $Ax+By=C$  (6-1)
- \*Solve systems of linear equations using substitution & linear combination (elimination) and interpret the solution for practical situations (same line dependent infinite solutions, parallel lines inconsistent no solutions) (6-2)
- Introduce solving a system of linear equations with matrices (6-2)
- \*Sketch the region of a linear inequality (6-2)
- Introduce sketching the region that represents the solution to a system of linear inequalities in problem solving situations (design or geography) (6-3)
- Introduce comparing graphs of absolute value functions, and explain how changing the parameters affects the graphs of these functions (7-1)
- \*Graph quadratic functions of the form  $y=ax^2$  to model real relationships and recognize the curve is a parabola (axis of symmetry, vertex) (9-1)
- Introduce using the graphs of quadratic functions of the form  $y=ax^2$ ,  $y=ax^2+c$ , and  $y=ax^2+bx+c$  to determine maximum and minimum values (9-1)
- Introduce finding x-intercepts of a quadratic function (9-2)
- Introduce examining simple exponential functions of the form  $y=ab^x$  and using them to model exponential growth and decay (10-2)
- Introduce elementary logarithmic functions as the inverses of exponential functions (10-2)
- Introduce using exponential functions to analyze population growth in order to predict future trends (10-2)

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**Geometry: Number/Computation Standards**

- \* NC/G.1 Apply inductive reasoning to find patterns in geometric figures, polygons (growing shapes), and fractals to generalize first and second degree sequences by giving the rule for the  $n$ th term and defending the generalization.
- \* NC/G.2 Apply appropriate strategies to solve equations and use formulas to find measures (missing lengths; formulas for circumference, area, volume, etc.) of two-dimensional and three-dimensional geometric figures or diagrams.

**Skills, Concepts & Relationships**

- \*Apply inductive reasoning to recognize, create, continue, and generalize patterns in arithmetic (linear) and geometric (quadratic) sequences by giving the rule for the  $n$ th term and defending the generalization (ch1)
- Introduce patterns in fractals and recursion in number patterns (ch1.2&1.3)
- \*Use geometric models to model physical situations and generalize patterns in problem solving (determine figurate numbers that correspond to geometric figures, determine the number connecting  $n$  random points, the number of intersections of  $n$  random lines, and the number of diagonals in an  $n$ -gon) (ch1.4-1.6)
- Introduce finding the coordinates of points of concurrency by estimating the coordinates from its graph and solving the equations of two appropriate lines simultaneously. (ch4.6)
- \*\*Review finding and approximating square roots using a calculator (recognize perfect squares to 169) (ch10.4)
- \*\*Review defining and using ratio, proportions and percents to solve problems (ch12.1)
- \*\*Review recognizing that measures of similar figures have equal ratios (ch12.1)

**Geometry Mathematics Standards**  
**Fayette County Public Schools**  
**Geometry/Measurement Strand**

**HIGH SCHOOL MATHEMATICS EXIT PERFORMANCE STANDARD 2:**

**Student will apply properties of measurement (ratio measures including slope, rate, indirect measurement, similarity; surface area and volume of prisms, pyramids, cylinders, cones, and spheres, etc.) and will use geometric concepts, properties and relationships (prove, use and apply theorems/conjectures involving lines, angles, triangles, quadrilaterals, regular, and non-regular polygons, circles, and transformations, etc.) in problem solving situations and communicate the inductive and deductive reasoning used in solving these problems.**

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**Geometry: Geometry/Measurement Standards**

- \* **GM/G.1** Classify, analyze, and draw visual representations of two-dimensional and three-dimensional figures with accurate standard measures (convert within a measurement system) using construction tools and instruments (compass, MIRA, patty paper, paper folding, protractor, angle ruler, isometric dot paper, Geometer's Sketchpad, Peanut Geometry, etc.) to solve problems and support basic theorems/conjectures with inductive reasoning.
- \* **GM/G.2** Understand, prove, and apply theorems/conjectures involving space (points, lines, planes, betweenness, etc.), lines (slopes, parallel, perpendicular, transversal, equations of lines, etc.) & angles (interior, exterior, vertical, complementary, supplementary, etc.) to solve problems.
- \* **GM/G.3** Classify triangles (acute, right, obtuse, equilateral, scalene, isosceles), recognize and prove relationships in triangles: triangle sum theorem, triangle inequalities, triangles are congruent or similar, altitude, median, and use concept of corresponding parts of congruent triangles when appropriate.
- \* **GM/G.4** Classify quadrilaterals (square, rectangle, parallelogram, kite, special trapezoids) and polygons (regular and non-regular, convex and concave) based on number of angles, sides, and properties; determine and apply theorems/conjectures involving these properties and formulas.
- \* **GM/G.5** Prove and solve problems regarding relationships among chords, secants, tangents, inscribed angles, concentric circles, and inscribed & circumscribed polygons of circles.
- \* **GM/G.6** Describe, draw and determine changes in properties of figures and their images involving symmetry and transformations (rotations, translations, reflections, and dilations) in tessellations and the coordinate plane.
- \* **GM/G.7** Determine and apply the formulas for volume and surface area of prisms, pyramids, cylinders, cones and spheres in real world problems.
- \* **GM/G.8** Determine and apply relationships of angles and sides in right triangles including: proving the Pythagorean Theorem (and its Converse) in more than one way, basic trigonometric ratios (sine, cosine, tangent), special right triangles (30-60-90, 45-45-90), proportional relationships to make scale drawings, angles of elevation & depression, and using similar triangle methods for finding indirect measurement (shadow method, mirror method, clinometer).

**Skills, Concepts & Relationships**

- \*\*Review defining and using basic geometric terms: point, line, plane, space, segment, ray, angle, collinear, and coplanar points (ch2.1)
- \*\*Review using a protractor or angle ruler to measure and draw angles (ch2.2)
- \*Use and express appropriate symbols for marking figures to show measurements and congruence relationships (ch2.2)
- \*Recognize and apply incoming and outgoing angles in practical situations (billiards, miniature golf, light striking and reflecting from a mirror, etc.) (ch2.2)
- \*Identify, write and interpret conditional statements including: converse, if-then, biconditional, and counterexample (ch2.3)
- \*\*Review recognizing and applying special line (parallel, skew, perpendicular, midpoint of a segment, etc.) and angle relationships (right, acute, obtuse, complementary, supplementary, vertical, linear pair, angle bisector, etc.) in problem solving situations (ch2.4)
- \*\*Review defining, classifying, and applying polygons (triangle, quadrilateral, pentagon, hexagon, heptagon, octagon, nonagon, decagon, undecagon, dodecagon, n-gon) and related terms (angle, side, vertex, convex, concave, congruent, perimeter, diagonal, equilateral, equiangular, regular) in problem solving situations (ch2.5)
- \*\*Review defining, classifying, and applying triangles (acute, obtuse, scalene, isosceles, etc.) and their related parts (median, altitude, height) in problem solving situations (ch2.6)
- \*\*Review defining, classifying, and applying quadrilaterals (trapezoid, kite, parallelogram, rhombus, rectangle, square) in problem solving situations (ch2.7)
- \*Describe the classifications of triangles and quadrilaterals (ch2.7)
- \*\*Review visualizing, drawing and recognizing relationships in two and three dimensions (cross sections and solids: prism, pyramid, cylinder, cone, sphere, hemisphere) (ch2.8)
- \*\*Review translating descriptions and word problems into drawings and diagrams (ch2.9)
- \*Use construction tools and methods (straightedge & compass, patty papers, and computer software-Geometer's Sketchpad, Peanut Geometry, etc.) to duplicate segments, angles and polygons; to construct perpendicular bisectors & midpoints, and make conjectures; to construct a perpendicular from a point not on a line, using the shortest path from a point to a line; to construct an angle bisector and determine that a point on the bisector of an angle is equally distant from the sides of the angles (ch3)
- \*Determine the measure of each angle of an equilateral triangle is 60 degrees (ch3.4)
- \*Use construction tools and methods to construct parallel lines (equidistant method, rhombus method) (ch3.5)
- \*Determine through construction whether or not a triangle can be determined given certain parts (ch3.6)
- \*Determine, identify and apply relationships between points of concurrency and: angle bisectors, perpendicular bisectors, altitudes of triangles, medians, and inscribed & circumscribed circles (ch3.4&3.8)

**Geometry Mathematics Standards**  
**Fayette County Public Schools**

- \*Determine, recognize, and apply relationships between special pairs of angles (complementary, supplementary, linear pair, vertical) in problem solving situations (ch4.1)
- \*Determine, recognize and apply relationships of the angles of parallel lines cut by a transversal (corresponding, alternate interior, alternate exterior, consecutive interior, etc.) in problem solving situations (ch4.2)
- \*\*Review that the sum of the angles of a triangle is 180 degrees (ch5.1)
- \*Use geometric tools and inductive reasoning to recognize, determine, and apply relationships among the sides & angles of a triangle (ch5)
- \*Use geometric tools and problem solving to recognize, determine, and apply valid shortcut methods for deciding whether triangles are congruent (SSS, SAS, ASA, & SAA are good shortcuts; SSA & AAA not necessarily congruent) (ch5.4 & 5.5)
- \*Use the definition of congruent triangles to show that corresponding parts of congruent triangles are congruent (CPCTC) (ch5.6)
- \*Use logical and visual thinking skills to create flow chart proofs to prove geometric relationships (introduce deductive reasoning) (ch5.6)
- \*\*Review that the sum of the measures of the four angles of any quadrilateral is 360 degrees (ch6.1)
- \*Use geometric tools and inductive reasoning to recognize, determine, and apply the properties of polygons (ch6)
- Introduce using parallelograms in vector diagrams and to find resultant vector, or vector sums (ch6.5)
- \*Define, recognize, and apply properties of circles and their parts (radius, diameter, chord, secant, tangent, arc, minor arc, major arc, inscribed angle, central angle, etc.), and figures related to circles (congruent circles, concentric circles, etc.) (ch7)
- \*\*Review recognizing, determining, and applying the relationship between the circumference of a circle and the length of its diameter as  $\pi$  ( $C=\pi d$  because  $D=2r$  and  $C=2\pi r$ ) (ch7.5&7.6)
- \*Use geometric tools and inductive reasoning to recognize, determine and apply a formula for finding the length of an arc of a circle (arc length=degree of the measure of the arc divided by 360 degrees and multiplied by the circumference of the circle) (ch7.7)
- \*Describe, draw, and determine changes in properties of figures and their images involving transformations: translations (slide), rotations (turn), and reflections (flip) in the coordinate plane (ch8.1)
- \*Recognize, determine and apply concepts of reflectional, rotational, translational, and glide-reflectional symmetry to polygons, nature, etc. (ch8.3)
- \*Recognize, create, classify and apply monohedral, regular, semiregular, and demiregular tessellations (ch8.4)
- \*Recognize, create and apply Escher-type tessellations using translations, rotations, and glide reflections (ch8.6-8.8)
- \*\*Review determining and applying formulas for areas of rectangles, parallelograms, triangles, trapezoids, and circles (ch9.1-9.3&9.5&9.8)
- \*Determine and apply formulas for areas of kites and regular polygons (ch9.2&9.4)
- \*Determine and apply formulas and methods for calculating areas of annuli, sectors, and segments of circles (ch9.6)
- \*Determine and apply formulas for surface area of solids (prism, pyramid, cylinder, cone, etc.) (ch9.7-9.8)
- \*Determine and apply the Pythagorean Theorem and its converse (ch10)
- \*Determine, recognize and apply the relationship among the sides of special right triangles (45-45-90 & 30-60-90) (ch10.4)
- \*Determine, recognize and apply a relationship in the multiples of Pythagorean triples (multiply the lengths of all three sides of any right triangle by the same number and the resulting triangle will also be a right triangle) (ch10.5)
- \*Determine and apply the Pythagorean relationship to problems involving circles (ch10.8)
- \*Identify and use appropriate vocabulary for polyhedra (regular polyhedron, prism, right prism, oblique prism, pyramid, base, lateral faces, lateral edges, vertex, altitude, height, tetrahedron, etc.) circular solids (sphere, radius, center, hemisphere, great circle, cylinder, right cylinder, oblique cylinder, cone, right cone, oblique cone, bases, axis) (11.1&11.2)
- \*Determine and apply formulas for finding the volumes of prisms, cylinders, pyramids and cones ( $V=BH$  where B is the area of the base and H is the height of the solid;  $V=(1/3)BH$  where B is the area of the base and H is the height of the solid) (ch11.3-11.5)
- \*Recognize the 5 Platonic Solids (ch11)
- \*Determine how changes in dimensions affect perimeter, area, and volume of common geometric figures and solids (maximum volume of a box -- graphing calculator, can problem, etc.) (ch11)
- \*Determine and apply the formulas for finding the volumes and surface areas of spheres and hemispheres (Volume of a sphere where  $V=(4/3)\pi r^3$  and a hemisphere is half the volume of a sphere) (ch11.7-11.9)
- \*Determine, recognize and apply the concept of similar polygons and dilations (expand & contract) to solve problems (if one polygon is the image of another polygon under a dilation, then the polygons are similar) (ch12.2)
- \*Use geometric & measurement tools, proportions, and problem solving to recognize, determine, and apply valid shortcut methods for deciding whether triangles are similar (SSS, AA, & SAS are valid shortcuts) (ch12.3)
- \*Calculate indirect measurement (height of flagpole, mirror method, shadow knows method project, use the clinometer from project in ch4, etc.) with similar triangles (ch12.4)
- \*Determine, recognize, and apply the relationship between corresponding parts of similar triangles (ch12.5)
- \*Use geometric tools and problem solving to determine, recognize, and apply that angle bisector in a triangle divides the opposite side into two segments whose lengths are in the same ratio as the lengths of the two sides forming the angle (ch12.5)
- \*Derive and recognize the relationship between areas of similar figures (for similar polygons m and n the ratio of the areas is  $m^2/n^2$ ), and volumes of similar solids (for similar solids m and n the ratio of the volumes is  $m^3/n^3$ ) (ch12.6)
- \*Recognize and apply similarity conjectures to problems involving area and volume (ch12.6)

**Geometry Mathematics Standards**  
**Fayette County Public Schools**

\*Use similarity to develop, evaluate, and use the trigonometric ratios (sine, cosine, and tangent) (ch13.1)

\*Apply right triangle trigonometry to practical situations including finding indirect measurement (determine angles of elevation & depression, use clinometer from project in ch4) (ch13.2)

**Probability/Statistics Strand**

**HIGH SCHOOL MATHEMATICS EXIT PERFORMANCE STANDARD 3:**

Student will use data collection & analysis, graphing of single-variable and two-variable data (line, bar & circle graphs, histogram, stem and leaf plots, box and whisker plots, scatterplot, linear regression & curve fitting), statistics (mean, median, mode, range, outliers, quartiles), and designing probability experiments & simulations to test theories about real world problems and communicate the reasoning used in solving these problems.

*Based on Kentucky's Core Content for Mathematics Assessment, the Kentucky Program of Studies, and Academic Expectations: 1.5-1.9 Mathematical Communication & Reasoning, 1.16 Technology, 2.7 Number, 2.8 Procedures, 2.11 Change, 2.12 Structure, 2.13 Probability & Statistics; Goal 5 Think & Solve Problems; & Goal 6 Integrate Knowledge*

**Geometry: Probability/Statistics Standards**

\* PS/G.1 Use geometric principles and properties to construct geometric models (linear, area, volume) to analyze theoretical probabilities.

**Skills, Concepts & Relationships**

\*Draw, visualize, and use geometric models to solve probability problems (ch4.7)

**Algebraic Ideas Strand**

**HIGH SCHOOL MATHEMATICS EXIT PERFORMANCE STANDARD 4:**

Student will model, analyze, compare and apply linear & nonlinear algebraic functions (quadratic, polynomial, exponential, etc.) using tables, graphs in the coordinate plane, variables, expressions, equations, formulas and inequalities in practical situations and communicate the reasoning used in solving these problems.

*Based on Kentucky's Core Content for Mathematics Assessment, the Kentucky Program of Studies, and Academic Expectations: 1.5-1.9 Mathematical Communication & Reasoning, 1.16 Technology, 2.7 Number, 2.8 Procedures, 2.9 Space and Dimensionality, 2.11 Change, 2.12 Structure; Goal 5 Think & Solve Problems; & Goal 6 Connect & Integrate Knowledge*

**Geometry: Algebraic Ideas Standards**

\* AI/G.1 Understand and prove how geometric concepts are related to algebraic procedures by comparing, contrasting and translating among synthetic, coordinate, and transformational geometry (prove the Pythagorean Theorem; in the coordinate plane determine: distance, slope, midpoint, transformations, etc.).

**Skills, Concepts & Relationships**

\*Determine and recognize the graph of a sequence with a constant difference (first degree) is a set of points that lie on a straight line (linear) (ch1.4)

\*Determine and recognize that a sequence with two linear factors (no constant difference at the first level) is a quadratic function (second degree) (ch1.5)

\*\*Review determining, recognizing, and applying the slope of a line in the coordinate plane (ch4.3)

\*Determine, recognize and apply a formula for finding the midpoint of a segment in the coordinate plane (ch4.3)

\*\*Review relationships between the slopes of parallel lines (equal slopes) and between the slopes of perpendicular lines (negative reciprocal slopes) (ch4.4)

\*\*Review recognizing, determining, and applying slope-intercept form ( $y=mx+b$ ) of the equation of a line (find y-intercept) and applying linear relationships to solve real world problems (ch4.5)

\*Use the slope of a line that best fits a set of points to predict values in linear relationships (ch4)

\*\*Review solving a system of linear equations graphically by finding the intersections of lines to model practical situations (ch4.6)

-Introduce determining and applying the Pythagorean relationship on the coordinate plane (distance formula) and deriving the equation of a circle from the distance formula (ch10.7)

**Algebra II Mathematics Standards**  
**Fayette County Public Schools**  
**Number/Computation Strand**

**HIGH SCHOOL MATHEMATICS EXIT PERFORMANCE STANDARD 1:**

**Student will apply number sense and order relations in problem solving situations to perform estimations and/or calculations with equations, matrices, and sequences involving complex numbers (counting numbers, whole numbers, integers, rational numbers, irrational numbers, real numbers, etc.) with and without calculators and will communicate the reasoning used in solving these problems.**

*Based on Kentucky's Core Content for Mathematics Assessment, the Kentucky Program of Studies, and Academic Expectations: 1.5-1.9 Mathematical Communication & Reasoning, 1.16 Technology, 2.7 Number, 2.8 Procedures, 2.11 Change, 2.12 Structure; Goal 5 Think & Solve Problems; & Goal 6 Connect & Integrate Knowledge*

**Algebra II: Number/Computation Standards**

- \* **NC/A2.1** Show number sense by interpreting, modeling and using appropriate mathematical notation and operations ( $\%$ ,  $!$ ,  $\pi$ , square roots-taking a root, scientific notation, absolute value, exponents-raising to a fixed power, matrix, opposite, reciprocal, factorial, permutation, combination, logarithm) for complex numbers and by comparing and contrasting various subsets of the complex number system (counting, whole, integers, rational, irrational, real, and imaginary).
- \* **NC/A2.2** Select and apply appropriate concrete, pictorial, and abstract models and strategies to simplify and solve quadratic, cubic, rational, and exponential equations that contain complex numbers, radicals and absolute values including applications involving direct, inverse, combined and joint variation; and solve systems of linear equations and inequalities with two or three variables simultaneously using linear combinations (elimination), substitution, graphing, and matrices for practical situations.
- \* **NC/A2.3** Select and apply appropriate concrete, pictorial, and abstract models and strategies to apply the laws of exponents, perform operations on expressions with integral exponents including complex algebraic fractions with negative exponents in the numerator and denominator, and expand powers of binomials using Pascal's Triangle for coefficients or by using the Binomial Theorem.
- \* **NC/A2.4** Recognize, generate, find and defend the general term, find the sums and derive the summation formulas for arithmetic & geometric series, and communicate the concept of limit (fractals).

**Skills, Concepts & Relationships**

- \*Translate real world data into matrices (2x2) and demonstrate matrix addition, matrix subtraction, scalar multiplication, and matrix multiplication using multiplicative inverse and identity properties of matrices (1-3) [Appendix A]
- \*\*Review using graphs and/or properties of equalities to solve linear equations (2-1) [2-1]
- \*\*Review recognizing absolute value as a measure of distance, finding the absolute value of a given number, and solving one-variable equations and inequalities involving absolute values symbolically and graphically (boundary point, compound inequality) (2-3) [1-6]
- \*Graph & solve linear and absolute value inequalities with two variables that describe restrictions in real relationships (test points to locate graphs, use boundary lines) (2-3) [4-10]
- \*Solve systems of two or more linear equations simultaneously using substitution, linear combinations (elimination), and matrices (inverse matrices), and interpret the solution for real life situations (3-1) [4-5, 4-9]
- \*Solve a 3x3 system of linear equations with a graphing calculator (3-1) [4-8]
- \*Recognize and generate arithmetic sequences (to model patterns-nature) and find partial sums of arithmetic series (common difference) (4-1) [11-2, 11-3]
- \*Represent arithmetic sequences and series using sigma notation and explicit or nth term formula (4-1) [11-4]
- \*Recognize and generate geometric sequences (to model patterns-real data) and find partial sums of finite geometric series (common ratio) (4-1) [11-2]
- \*Represent geometric sequences and series using sigma notation and explicit or nth term formula (4-1) [11-4]
- Introduce the convergence of infinite geometric series and finding the sum of an infinite geometric series (communicate the concept of limit) (4-1) [11-4, 11-5]
- \*Recognizes arithmetic and geometric sequences as forms of linear and exponential functions, respectively (4-1) [11-1, 11-7]
- \*Identify, compare and contrast various subsets of the complex number system (counting numbers, whole numbers, integers, rational numbers, irrational numbers, real numbers, and imaginary numbers) (4-3) [1-1, 5-4, 10-2, 10-3]
- \*Simplify radical expressions (4-3) [1-2]
- \*Define and use imaginary and complex numbers to find square roots of negative numbers and simplify complex expressions (complex conjugate) (4-3) [10-2, 10-3]
- \*Solve quadratic equations by using a table of values and by factoring to solve for exact roots (Principle of Zero Products) (5-2) [5-2]
- \*\*Review using Pascal's Triangle to determine theoretical probability of binomial situations (6-2) [12-7]
- \*Relate counting Combinations, the Binomial Theorem and Pascal's Triangle (6-2) [11-9, 11-10]
- \*Apply the properties of exponents to simplify expressions and use scientific notation (Product of Powers, Power of Powers, Quotient of Powers, and Power of Quotients) (7-1) [6-3 to 6-6]
- \*Use the properties of real and complex numbers to simplify radical expressions and solve related equations (simplify and evaluate expressions with rational exponents, solve simple radical equations with extraneous roots, and solve equations containing two or more radical expressions) (7-2) [8-4]
- \*Combine functions through addition, subtraction, multiplication and composition, and use a composite function to classify real world situations (find and evaluate functions of functions) (7-3) [4-4]
- \*Identify, and find inverse functions algebraically and graphically (use an inverse of a relation or function) (7-3) [6-12]
- \*\*Recognize and use terms and definitions associated with polynomial expressions and functions (Expressions: monomial-1term, binomial-2terms, trinomial-3terms; Functions: linear-degree1, quadratic-degree2, cubic-degree3) (8-1) [1-4]
- \*Find the x-intercepts, maximums, minimums and zeros of polynomial functions of degree 3 or more graphically (continuous, real root, zero) and apply the functions to real world contexts (8-1) [10-4 to 10-6, 7-6]
- \*\*Review adding, subtracting, multiplying and dividing polynomials using concrete (algebra tiles) and abstract models in the context of practical applications (8-2) [1-3, 1-4, 7-5]
- \*Find all solutions of polynomial equations by and recognize the nature of the solutions, and analyze and interpret the results (8-2) [10-4]
- \*Use factoring and division to solve for roots of polynomial equations (8-2 & supplement synthetic division) [10-3, 10-4]
- \*Use Rational Roots Theorem to identify possible rational solutions and use the Fundamental Theorem of Algebra to identify number of roots (8-2) [7-6]
- \*Use the properties of real numbers to simplify rational expressions and solve related equations (write, evaluate, multiply, divide & simplify rational expressions and simplify sums and differences of rational expressions - LCD) (8-3) [7-7 to 7-10]
- \*Understand properties of logarithms to simplify logarithmic numeric expressions and identify their approximate values (9-2) [6-3]

**03-SFAW-Focus on Advanced Algebra in ( ) / Advanced -Forester Algebra and Trig in [ ]**

**Geometry/Measurement Strand**

**HIGH SCHOOL MATHEMATICS EXIT PERFORMANCE STANDARD 2:**

Student will apply properties of measurement (ratio measures including slope, rate, indirect measurement, similarity; surface area and volume of prisms, pyramids, cylinders, cones, and spheres, etc.) and will use geometric concepts, properties and relationships (prove, use and apply theorems/conjectures involving lines, angles, triangles, quadrilaterals, regular, and non-regular polygons, circles, and transformations, etc.) in problem solving situations and communicate the inductive and simple deductive reasoning used in solving these problems.

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**Algebra II: Geometry/Measurement Standards**

\* GM/A2.1 Visualize objects, paths and regions in space, including intersections and cross sections of three dimensional figures and describe these using geometric language [Demonstrate and explain how the graph of a conic section (asymptotes, foci) depends on the coefficients of the quadratic equation representing it (analytic geometry)].

\* GM/A2.2 Represent graphs of functions in standard coordinate systems.

**Skills, Concepts & Relationships**

-Explore generating fractal images (4-2) [11-7]

\*Use circle and parabola curves to model real world phenomena and recognize & explain why they are known as conic sections (5-3) [9-6]

\*Given a quadratic equation identify as a parabola or circle (5-3) [9-2,9-5]

-Introduce ellipse and hyperbola curves as conic sections (5-3) [\*master ellipse, hyperbola 9-3,9-4]

**03-SFAW-Focus on Advanced Algebra in ( ) / Advanced -Forester Algebra and Trig in [ ]**

**Probability/Statistics Strand**

**HIGH SCHOOL MATHEMATICS EXIT PERFORMANCE STANDARD 3:**

Student will use data collection & analysis, graphing of single-variable and two-variable data (line, bar & circle graphs, histogram, stem and leaf plots, box and whisker plots, scatterplot, linear regression & curve fitting), statistics (mean, median, mode, range, outliers, quartiles), and designing probability experiments & simulations to test theories about real world problems and communicate the reasoning used in solving these problems.

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**Algebra II: Probability/Statistics Standards**

- \* **PS/A2.1** Analyze sets of data using dispersion (range, outliers, quartiles, standard deviation, variance), arithmetic & geometric means, and use curve fitting (linear, exponential, & power regression equations on the graphing calculator) to model real data and make predictions about trends.
- \* **PS/A2.2** Analyze sets of data using normal curve distributions.
- \* **PS/A2.3** Formulate and test theories using a variety of quantified information, sampling techniques, probability simulations and discrete probability distributions (fundamental addition and multiplication counting principles, combinations, permutations, conditional probabilities).

**Skills, Concepts & Relationships**

- \*\*Review using scatterplots to determine whether two quantities are related and to look for patterns and trends in order to make predictions about their values (negative, positive, or no association) (1-1) [supplement]
- \*\*Review measuring the probability of an event with theoretical probability (formula, tree diagram, geometric probability model) or with experimental probability (simulation, random number charts, etc.) and differentiating probability and “odds” (1-2, supplement odds) [12-2, 12-3]
- \*\*Review using scatterplots, trend lines and linear functions as tools for creating a linear model for interpreting data that do not fall neatly on a line in practical real world situations (make predictions using trend line, its equation, and interpret reasonableness of predictions) (2-2) [3-5]
- \*Find a trend line of best fit graphically using a graphing calculator (2-2) [supplement]
- \*Count the number of ways a series of events can occur using tree diagrams or counting principles (Addition Counting Principle for mutually exclusive events, Multiplication Fundamental Counting Principle) (6-1) [12-3]
- \*Use permutations to count the number of ways that items in a set can be arranged when all of the items are different, when all of the items are the same, and to find probabilities in complex situations (6-1) [12-4,11-8]
- \*Use combinations to count the number of ways items in a set can be arranged without regard to order to find probabilities (6-1) [12-5]
- \*Use real number exponents to model data with a power regression curve and determine the practical use of rational exponents and radicals in the real world (7-2) [6-14]
- \*Use exponential regression to find the equation of a curve to model data that shows exponential growth or decay in practical contexts (9-1) [6-14]
- \*Calculate and distinguish among probabilities of complementary, compound, dependent (conditional with and without replacement), and independent events to solve real world problems (11-1) [12-6]
- \*\*Review differences between experimental probability (actual), theoretical probability (expected), and odds (supplement) [supplement]
- \*\*Review constructing, interpreting, and analyzing: histograms, line plots, stem and leaf plots, circle graphs, box and whisker plots, scatterplots, etc. (supplement) [supplement]
- \*Recognize methods of random sampling (11-2) [12-2]
- \*Formulate a hypothesis to investigate a problem about a statistical theory, and design an experiment (supplement) [supplement]
- \*Recognize normally distributed data and estimate the probabilities that normally distributed data lies within one or two standard deviations of the mean (11-2) [12-9]
- \*Determine concepts of variance and dispersion and compute for a distribution of data: standard deviation and variance (quartile, interquartile, range, outliers) (supplement) [12.9 and supplement]

**03-SFAW-Focus on Advanced Algebra in ( ) / Advanced -Forester Algebra and Trig in [ ]**

**Algebraic Ideas Strand**

**HIGH SCHOOL MATHEMATICS EXIT PERFORMANCE STANDARD 4:**

Student will model, analyze, compare and apply linear & nonlinear algebraic functions (quadratic, polynomial, exponential, etc.) using tables, graphs in the coordinate plane, variables, expressions, equations, formulas and inequalities in practical situations and communicate the reasoning used in solving these problems.

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Algebra II: Algebraic Ideas Standards

- \* AI/A2.1 Describe real world phenomena as functions by translating among graphic, algebraic, numeric and verbal mathematical models.
- \* AI/A2.2 Model relationships between real world quantities and find solutions for quadratic functions by graphing, factoring, completing the square, and using the quadratic formula (including equations whose roots are complex numbers); interpret the maximum and minimum values and intercepts in the context of the problem; and recognize the function as a circle or parabola.
- \* AI/A2.3 Model relationships between real world quantities and find solutions for polynomial functions by graphing and factoring; find zeros, intercepts, and approximate turning points; and recognize the degree of the function.
- \* AI/A2.4 Model relationships between real world quantities (exponential growth and decay) and find solutions for exponential functions by graphing, substituting, and applying inverse relationships; and recognize exponential and logarithmic functions as inverses.

**Skills, Concepts & Relationships**

- \*\*Review representing functional situations with tables, graphs, and equations, recognizing the interrelationship of these and showing how each representation is useful in different situations (domain of independent variables and range of dependent variables of a function; difference between constant and variable quantities) (1-1) [2-3]
- \*\*Review that slope is the rate of change of one quantity relative to another quantity and describe slopes of vertical (undefined) and horizontal (zero) lines and oblique (2-1) [3-2]
- \*\*Review recognizing characteristics of linear ( $y=mx+b$ , constant change), nonlinear (not constant change) and proportional ( $y=ax$ , direct variation) functions and identify their equations (2-1) [3-1 to 3-3]
- \*\*Review using slopes and y-intercepts with linear graphs and forms of linear equalities to determine whether pairs of lines are parallel, intersecting, or perpendicular (find equation of a line through a point parallel or perpendicular to another line) (2-1) [3-4]
- \*\*Review solving and applying a system of two linear equations graphically (graph paper and graphing calculator) and interpreting the solution for real life situations (same line dependent infinite solutions, parallel lines inconsistent no solution) (3-1) [4-2,4-11]
- \*Sketch the region that represents the solution of a system of linear inequalities in problem solving situations (3-2) [4-10]
- \*Show how real world constraints of a linear programming problem can be modeled by systems of inequalities (feasible region) (3-2)
- Introduce solving linear programming problems as a tool for decision making (objective function, optimal solution, Vertex Theorem) (3-2 and supplement) [4-11]
- \*\*Review graphing quadratic functions of the form  $y=ax^2$  to model real relationships and recognize the curve is a parabola (axis of symmetry, vertex) (5-1) [5-2]
- \*Use translations to determine and explain how the graph of a parabola changes as  $a$ ,  $h$ , &  $k$  vary in the equation  $y=a(x-h)^2+k$  (5-1) [9-5]
- \*Describe and analyze quadratic functions of the form  $y=ax^2$ ,  $y=ax^2+c$ , and  $y=ax^2+bx+c$  to help make decisions in practical situations (determine maximum, minimum, and zero values of the function by graphing) (5-1) [5-7]
- \*Use the method of completing the square to put an equation of the form  $ax^2+by^2+cx+dy+e=0$  into standard form and recognize whether its graph is a parabola (vertex, axis of symmetry) or a circle (5-1) [ellipse, hyperbola 9-5, 9-6]
- \*Use graphs of quadratic functions to solve quadratic equations ( $y=ax^2+bx+c$  standard form when  $y=0$  which describes the x-axis, x-intercepts: zero, one, or two solutions) (5-2) [5-5]
- \*Derive, recognize and use the quadratic formula to solve quadratic equations in problems similar to those encountered by physicists, engineers, and business people (5-2) [5-3, 5-7]
- \*Use the discriminant of the quadratic formula to determine the nature of the roots of a quadratic equation (positive-two real roots, negative-two complex roots, zero-one real root -- double root) (5-2) [5-3]
- \*Recognize, graph, determine the standard form of the equation of a circle (center, radius) (5-3) [9-2]
- Introduce graphing, determining & recognizing the standard form of the equation of an ellipse and hyperbola (center, foci, major axis, minor axis, vertices) (5-3) [\*master 9-3, 9-4]
- \*Classify relationships between variables by type of variation (direct: one increases while other increases-graph is line that contains origin; inverse: one increases while other decreases-graph is rectangular hyperbola; combined: relationship shows both inverse and direct variation; and joint: one variable varies directly with two or more variables but does not vary inversely with any other variable) and apply direct variation and scientific notation (7-1) [7-11]
- \*Use exponential functions of the form  $y=ab^x$  to model quantities increase or decrease over time at a given percentage, and to model exponential growth and decay (9-1) [6.14]
- \*Recognize the inverse relationship between exponential and logarithmic functions (9-2) [6.8]
- \*Use the definition of logarithms and the product formula for logs to translate between logs in any bases (9-2) [6.9]
- \*Use logarithmic functions to model real world problems (9-2) [6.14]

**03-SFAW-Focus on Advanced Algebra in ( ) / Advanced -Forester Algebra and Trig in [ ]**

**Algebra II Mathematics Standards**  
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