Georgia Mathematics

Enhanced Advanced Algebra and AP Precalculus: Concepts and Connections

PC Mathematical Practices

0 Display perseverance and patience in problem-solving. Demonstrate skills and strategies needed to succeed in mathematics, including critical thinking, reasoning, and effective collaboration and expression. Seek help and apply feedback. Set and monitor goals. PC.MP

- 0.1 Make sense of problems and persevere in solving them. PC.MP.1
- 0.2 Reason abstractly and quantitatively. PC.MP.2
- 0.3 Construct viable arguments and critique the reasoning of others. PC.MP.3
- 0.4 Model with mathematics. PC.MP.4
- 0.5 Use appropriate tools strategically. PC.MP.5
- 0.6 Attend to precision. PC.MP.6
- 0.7 Look for and make use of structure. PC.MP.7
- 0.8 Look for and express regularity in repeated reasoning. PC.MP.8

PC Mathematical Modeling

1 Apply mathematics to real-life situations; model real-life phenomena using mathematics. PC.MM.1

- 1.1 Explain contextual, mathematical problems using a mathematical model. PC.MM.1.1
- 1.2 Create mathematical models to explain phenomena that exist in the natural sciences, social sciences, liberal arts, fine and performing arts, and/or humanities contexts. PC.MM.1.2
- 1.3 Using abstract and quantitative reasoning, make decisions about information and data from a contextual situation. PC.MM.1.3
- 1.4 Use various mathematical representations and structures with this information to represent and solve real-life problems. PC.MM.1.4

AA Data & Statistical Reasoning

2 Communicate descriptive and inferential statistics by collecting, critiquing, analyzing, and interpreting real-world data. AA.DSR.2

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2.1 Recognize the purposes of and differences among sample surveys, experiments, and observational studies; explain how randomization relates to each. Distinguish between primary and secondary data and how it affects the types of conclusions that can be drawn. AA.DSR.2.1

2.2 When collecting and considering data, critically evaluate ethics, privacy, potential bias, and confounding variables along with their implications for interpretation in answering a statistical investigative question. Implement strategies for organizing and preparing big data sets. AA.DSR.2.2

2.3 Distinguish between population distributions, sample data distributions, and sampling distributions. Use sample statistics to make inferences about population parameters based on a random sample from that population and to communicate conclusions using appropriate statistical language. AA.DSR.2.3

2.4 Calculate and interpret z-scores as a measure of relative standing and as a method of standardizing units. AA.DSR.2.4

2.5 Given a normally distributed population, estimate percentages using the Empirical Rule, z-scores, and technology. AA.DSR.2.5

2.6 Model sample-to-sample variability in sampling distributions of a statistic using simulations taken from a given population. AA.DSR.2.6

2.7 Given a margin of error, develop and compare confidence intervals of different models to make conclusions about reliability. AA.DSR.2.7

2.8 Summarize and evaluate reports based on data for appropriateness of study design, analysis methods, and statistical measures used. AA.DSR.2.8

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AA Functional & Graphical Reasoning

3 Explore and analyze structures and patterns for exponential and logarithmic functions and use exponential and logarithmic expressions, equations, and functions to model real-life phenomena. AA.FGR.3

- 3.1 Find the inverse of exponential and logarithmic functions using equations, tables, and graphs, limiting the domain of inverses where necessary to maintain functionality, and prove by composition or verify by inspection that one function is the inverse of another. AA.FGR.3.1
- 3.2 Analyze, graph, and compare exponential and logarithmic functions. AA.FGR.3.2
- 3.3 Use the definition of a logarithm, logarithmic properties, and the inverse relationship between exponential and logarithmic functions to solve problems in context. AA.FGR.3.3
- 3.4 Create exponential equations and use logarithms to solve mathematical, applicable problems for which only one variable is unknown. AA.FGR.3.4
- 3.5 Create and interpret logarithmic equations in one variable and use them to solve problems. AA.FGR.3.5
- 3.6 Create, interpret, and solve exponential equations to represent relationships between quantities and analyze the relationships numerically with tables, algebraically, and graphically. AA.FGR.3.6
- 3.7 Create, interpret, and solve logarithmic equations in two or more variables to represent relationships between quantities. AA.FGR.3.7

4 Explore and analyze structures and patterns for radical functions and use radical expressions, equations, and functions to model real-life phenomena. AA.FGR.4

- 4.1 Rewrite radical expressions as expressions with rational exponents. Extend the properties of integer exponents to rational exponents. AA.FGR.4.1
- 4.2 Solve radical equations in one variable, and give examples showing how extraneous solutions may arise. AA.FGR.4.2
- 4.3 Analyze and graph radical functions. AA.FGR.4.3
- 4.4 Create, interpret and solve radical equations with one unknown value and use them to solve problems that model real-world situations. AA.FGR.4.4
- 4.5 Create, interpret, and solve radical equations in two or more variables to represent relationships between quantities. AA.FGR.4.5

5 Extend exploration of quadratic solutions to include real and non-real numbers and explore how these numbers behave under familiar operations and within real-world situations; create polynomial expressions, solve polynomial equations, graph polynomial functions, and model real-world phenomena. AA.FGR.5

- 5.1 Graph and analyze quadratic functions in contextual situations and include analysis of data sets with regressions. AA.FGR.5.1
- 5.2 Define complex numbers i such that i^2 = –1 and show that every complex number has the form a + bi where a and b are real numbers and that the complex conjugate is a – bi. AA.FGR.5.2

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5.3 Use the relation i^2 = –1 and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers. AA.FGR.5.3

5.4 Use the structure of an expression to factor quadratics. AA.FGR.5.4

5.5 Write and solve quadratic equations and inequalities with real coefficients and use the solution to explain a mathematical, applicable situation. AA.FGR.5.5

5.6 Solve systems of quadratic and linear functions to determine points of intersection. AA.FGR.5.6

5.7 Create and analyze quadratic equations to represent relationships between quantities as a model for contextual situations. AA.FGR.5.7

5.8 Identify the number of zeros that exist for any polynomial based upon the greatest degree of the polynomial and the end behavior of the polynomial by observing the sign of the leading coefficient. AA.FGR.5.8

5.9 Identify zeros of polynomial functions using technology or pre-factored polynomials and use the zeros to construct a graph of the function defined by the polynomial function. Analyze identify key features of these polynomial functions. AA.FGR.5.9

5.10 Use the structure of an expression to factor polynomials, including the sum of cubes, the difference of cubes, and higher-order polynomials that may be expressed as a quadratic within a quadratic. AA.FGR.5.10

5.11 Using all the zeros of a polynomial function, list all the factors and multiply to write a multiple of the polynomial function in standard form. AA.FGR.5.11

8 **Analyze the behaviors of rational functions to model applicable, mathematical problems.** AA.FGR.8

8.1 Rewrite simple rational expressions in equivalent forms. AA.FGR.8.1

8.2 Add, subtract, multiply and divide rational expressions, including problems in context and express rational expressions in irreducible form. AA.FGR.8.2

8.3 Graph rational functions, identifying key characteristics. AA.FGR.8.3

8.4 Solve simple rational equations in one variable, and give examples showing how extraneous solutions may arise. AA.FGR.8.4

AA Patterning & Algebraic Reasoning

6 **Represent data with matrices, perform mathematical operations, and solve systems of linear equations leading to real-world linear programming applications.** AA.PAR.6

6.1 Use matrices to represent data, and perform mathematical operations with matrices and scalars, demonstrating that some properties of real numbers hold for matrices, but that others do not. AA.PAR.6.1

6.2 Rewrite a system of linear equations using a matrix representation. AA.PAR.6.2

6.3 Use the inverse of an invertible matrix to solve systems of linear equations. AA.PAR.6.3

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6.4 Utilize linear programming to represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret data points as solutions or non-solutions under the established constraints in real-world problems. AA.PAR.6.4

PC Patterning & Algebraic Reasoning

7 Demonstrate how sequences and series apply to mathematical models in real-life situations. PC.PAR.7

7.1 Demonstrate that sequences are functions whose domain is the set of natural numbers. PC.PAR.7.1

7.2 Represent sequences graphically, numerically, and symbolically. PC.PAR.7.2

7.3 Determine the limit of a sequence if it exists. PC.PAR.7.3

7.4 Demonstrate that a series is the sum of the sequence and represent series graphically, numerically, and symbolically. PC.PAR.7.4

7.5 Describe the behavior of a series in terms of the limit of its partial sums. PC.PAR.7.5

7.6 Derive and use the sum formula of a finite geometric series to solve contextual problems to model real-life situations. PC.PAR.7.6

7.7 Derive and use the sum formula of an infinite geometric series to solve contextual problems to model real-life situations. PC.PAR.7.7

PC Functional & Graphical Reasoning

2 Analyze the behaviors of rational and piecewise functions to model contextual mathematical problems. PC.FGR.2

2.1 Graph piecewise-defined functions, including step functions and absolute value functions. PC.FGR.2.1

2.2 Describe characteristics by interpreting the algebraic form and graph of a piecewise-defined function. PC.FGR.2.2

2.3 Represent the limit of a function using both the informal definition and the graphical interpretation in the context of piecewise-defined functions; interpret limits expressed in analytic notation. PC.FGR.2.3

2.4 Divide polynomials using various methods. PC.FGR.2.4

2.5 Graph rational functions and identify key characteristics. PC.FGR.2.5

2.6 Represent the behavior of a rational function using limit notation for vertical and horizontal asymptotes and end behavior. PC.FGR.2.6

2.7 Represent the limit of a function using both the informal definition and the graphical interpretation in the context of rational functions; interpret limits expressed in analytic notation. PC.FGR.2.7

2.8 Solve simple rational equations in one variable, and give examples showing how extraneous solutions may arise. PC.FGR.2.8

2.9 Perform partial fraction decomposition of rational functions using non-repeated linear factors. PC.FGR.2.9

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3 Utilize trigonometric expressions to solve problems and model periodic phenomena with trigonometric functions. PC.FGR.3

- 3.1 Use the concept of a radian as the ratio of the arc length to the radius of a circle to establish the existence of 2π radians in one revolution. PC.FGR.3.1
- 3.2 Utilize right triangles on the unit circle to determine the values of the six trigonometric ratios for π/6, π/4, and π/3. Use reflections of the triangles as reference angles to establish known values in all four quadrants of the coordinate plane. PC.FGR.3.2
- 3.3 Define the six trigonometric ratios in terms of x, y, and r using the unit circle centered at the origin of the coordinate plane. Interpret radian measures of angles as a rotation both counterclockwise and clockwise around the unit circle. PC.FGR.3.3
- 3.4 Derive the fundamental trigonometric identities. PC.FGR.3.4
- 3.5 Determine the value(s) of trigonometric functions for a set of given conditions. PC.FGR.3.5
- 3.6 Graph and write equations of trigonometric functions using period, phase shift, and amplitude in modeling contexts. PC.FGR.3.6
- 3.7 Classify the six trigonometric functions as even or odd and describe the symmetry. PC.FGR.3.7
- 3.8 Restrict the domain of a trigonometric function to create an invertible function and graph the inverse function. Evaluate inverse trigonometric expressions. PC.FGR.3.8

AA Geometric & Spatial Reasoning

7 Develop an introductory understanding of the unit circle; solve trigonometric equations using the unit circle. AA.GSR.7

- 7.1 Define the three basic trigonometric ratios in terms of x, y, and r using the unit circle centered at the origin of the coordinate plane. AA.GSR.7.1
- 7.2 Apply understanding of the angle measures and coordinates of the unit circle to solve practical, real-life problems involving trigonometric equations. AA.GSR.7.2

PC Geometric & Spatial Reasoning

5 Analyze the behaviors of conic sections and polar equations to model contextual mathematical problems. PC.GSR.5

- 5.1 Identify and graph different conic sections given the equations in standard form. PC.GSR.5.1
- 5.2 Identify different conic sections in general form and complete the square to convert the equation of a conic section into standard form. PC.GSR.5.2
- 5.3 Define polar coordinates and relate polar coordinates to Cartesian coordinates. PC.GSR.5.3
- 5.4 Classify special polar equations and apply to contextual situations. PC.GSR.5.4
- .5 Graph equations in the polar coordinate plane with and without the use of technology. PC.GSR.5.5

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PC Algebraic & Geometric Reasoning

4 Manipulate, prove, and apply trigonometric identities and equations to solve contextual mathematical problems. PC.AGR.4

- 4.1 Apply the fundamental trigonometric identities to simplify expressions and verify other identities. PC.AGR.4.1
- 4.2 Use sum, difference, double-angle, and half-angle formulas for sine, cosine, and tangent to establish other identities and apply them to solve problems. PC.AGR.4.2
- 4.3 Solve trigonometric equations arising in modeling contexts. PC.AGR.4.3
- 4.4 Prove and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles. PC.AGR.4.4
- 4.5 Determine the area of an oblique triangle. PC.AGR.4.5

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6 Represent and model vector quantities to solve problems in contextual situations. PC.AGR.6

- 6.1 Represent vector quantities as directed line segments; represent magnitude and direction of vectors in component form using appropriate mathematical notation. PC.AGR.6.1
- 6.2 Add and subtract vectors and multiply vectors by a scalar to find the resultant vector. PC.AGR.6.2
- 6.3 Add and subtract vectors on a coordinate plane using different methods. PC.AGR.6.3
- 6.4 Solve contextual vector problems, such as those involving velocity, force, and other quantities. PC.AGR.6.4
- 6.5 Sketch the graph of a curve represented parametrically, indicating the direction of motion. PC.AGR.6.5
- 6.6 Apply parametric equations to contextual problems. PC.AGR.6.6