

Geometry

State Standard Number	State Standard Area/Description	Unit Name	Course Topic Description
1	Number and Operations		
1.1	Understand and apply numbers, ways of representing numbers, and the relationships among numbers and different number systems.		
1.1.PO 1	Solve problems and equations that require the number system to be extended from real to complex numbers.		
1.1.PO 2	Convert between radical and exponential forms of numerical expressions.		
1.2	Understand and apply numerical operations and their relationship to one another.		
1.2.PO 1	Explore different forms of complex numbers; determine if the properties of the real number system extend to complex numbers and matrices.		
1.2.PO 2	Perform computations with complex numbers.		
1.2.PO 3	Describe the relationship between real and complex numbers including plotting complex numbers as points in a plane.		
1.2.PO 4	Define polar coordinates; relate polar coordinates to Cartesian coordinates.		
1.2.PO 5	Convert complex numbers to trigonometric form and then multiply the results.		
1.2.PO 6	Apply DeMoivre's Theorem to calculate products, powers, and roots of complex numbers.		

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1.3	Use estimation strategies reasonably and fluently while integrating content from each of the other strands.		
1.3.PO 1	Recognize the limitations of estimations by assessing the amount of error resulting from estimation and determining whether the error is within acceptable tolerance limits.		
2	Data Analysis, Probability, and Discrete Mathematics		
2.1	Understand and apply data collection, organization, and representation to analyze and sort data.		
2.1.PO 1	Solve problems by estimating and computing with one-variable and two-variable data.		
2.1.PO 2	Compare data sets using graphs and summary statistics, including variance and standard deviation, with or without technology.		
2.1.PO 3	Compute and explain summary statistics for distributions of data including measures of center and spread, including variance and standard deviation.		

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2.1.PO 4	Explain how sampling methods, bias, and the phrasing of questions asked during data collections impact the conclusions that can be drawn.		
2.1.PO 5	Identify misleading uses of data and explain why they are misleading.		
2.1.PO 6	Explain the differences between randomized experiments and observational studies and determine the appropriateness of using each in given situations.		
2.1.PO 7	Determine when arguments based on data mistake correlation for causation.		
2.1.PO 8	Draw a line of best fit for a scatterplot with or without technology, describe how the correlation coefficient relates to fit, and explain when it is appropriate to use the regression equation to make predictions.		
2.1.PO 9	Use matrices to organize and represent data.		
2.2	Understand and apply the basic concepts of probability.		
2.2.PO 1	Apply probability concepts to calculate the probability of events and to make informed decisions in practical situations.		
2.2.PO 2	Use the principal characteristics of the normal distribution to estimate probabilities.		

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2.2.PO 3	Estimate probabilities and predict outcomes using one- and two-variable data.		
2.2.PO 4	Determine the conditional probability of an event given that another event occurs, decide if two events are dependent or independent, and determine the probability of an event given the probability of the complementary event.		
2.3	Understand and demonstrate the systematic listing and counting of possible outcomes.		
2.3.PO 1	Use the binomial theorem and Pascal's Triangle to solve problems.		
2.3.PO 2	Demonstrate the connections between the binomial coefficients, entries of Pascal's triangle, and combinations.		
2.4	Understand and apply vertex-edge graphs.		
2.4.PO 1	Study the following topics related to vertex-edge graphs: Euler circuits, Hamilton circuits, the Travelling Salesperson Problem (TSP), minimum weight spanning trees, shortest paths, vertex coloring, and adjacency matrices.		

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2.4.PO 2	Understand, analyze, and apply vertex-edge graphs to model and solve problems related to paths, circuits, networks, and relationships among a finite number of elements, in real-world and abstract settings.		
2.4.PO 3	Devise, analyze, and apply algorithms for solving vertex-edge graph problems.		
2.4.PO 4	Extend work with adjacency matrices for graphs, such as interpreting row sums and using the n th power of the adjacency matrix to count paths of length n in a graph.		
3	Patterns, Algebra, and Functions		
3.1	Identify patterns and apply pattern recognition to reason mathematically while integrating content from each of the other strands.		
3.1.PO 1	Analyze sequences and series and use them in modeling, including		
3.1.PO 1.a	explicit formulas for n th terms,		

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3.1.PO 1.b	sums of finite arithmetic series, and		
3.1.PO 1.c	sums of finite geometric series.		
3.1.PO 2	Apply recursive formulas for arithmetic and geometric sequences to solve problems.		
3.1.PO 3	Distinguish between explicit and recursive formulas and convert between them, making good choices about when to use which.		
3.1.PO 4	Solve problems involving recursion.		
3.1.PO 5	Use and interpret sigma notation to represent summation.		
3.2	Describe and model functions and their relationships.		
3.2.PO 1	Express and solve problems that can be modeled using linear, quadratic, logarithmic, exponential, cubic, reciprocal, absolute value, and step and other piecewise-defined functions; interpret their solutions in terms of the context.		

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3.2.PO 2	Use function notation flexibly and evaluate a function at a value represented by an algebraic expression.		
3.2.PO 3	Graph absolute value, and step and other piecewise-defined functions identifying their key characteristics.		
3.2.PO 4	Graph exponential functions identifying their key characteristics.		
3.2.PO 5	Sketch the graphs and determine the key characteristics of power functions in the form $f(x) = ax^n$, a is not equal to 0, for positive integral values of n .		
3.2.PO 6	Graph polynomial functions identifying their key characteristics.		
3.2.PO 7	Find domain, range, intercepts, zeros, asymptotes, and points of discontinuity of functions.		
3.2.PO 8	Find the major and minor axes, intercepts and asymptotes of conic sections.		
3.2.PO 9	Find domain, range, intercepts, period, amplitude, and asymptotes of trigonometric functions.	Unit 8: Right Triangles and Trigonometry	Section C, p. 6: Writing Assignment: Graphing the Cosine Function
3.2.PO 10	Given a function		

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3.2.PO 10.a	find the inverse of the function,		
3.2.PO 10.b	determine whether the inverse is a function,		
3.2.PO 10.c	explain why the graph of a function and its inverse are reflections of each other over the line $y = x$.		
3.2.PO 11	Find approximate solutions for polynomial equations with or without graphing technology.		
3.2.PO 12	Use theorems of polynomial behavior (including but not limited to the Fundamental Theorem of Algebra, Remainder Theorem, the Rational Root Theorem, Descartes Rule of Signs, the Conjugate Root Theorem) to find the zeros of a polynomial function.		
3.2.PO 13	Relate logarithms and exponential functions as inverses, prove basic properties of a logarithm using properties of its inverse, and apply those properties to solve problems.		
3.2.PO 14	Combine functions by composition, as well as by addition, subtraction, multiplication, and division including any necessary restrictions on the domain.		
3.2.PO 15	Determine if functions are even, odd, or neither both algebraically and graphically.		

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3.2.PO 16	Identify the degree of a given polynomial function and write a polynomial function of a given degree.		
3.2.PO 17	Develop an informal notion of limits.		
3.3	Represent and analyze mathematical situations and structures using algebraic representations.		
3.3.PO 1	Rewrite and describe the need for equivalent forms of algebraic expressions.		
3.3.PO 2	Apply the laws of exponents including rational and negative exponents to rewrite expressions in alternative forms.		
3.3.PO 3	Solve systems of three linear equations in three variables with or without technology.		
3.3.PO 4	Use matrices to represent everyday problems that involve systems of linear equations.		
3.3.PO 5	Simplify radical expressions by performing operations on them.		

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3.3.PO 6	Divide a polynomial by a lower degree polynomial.		
3.3.PO 7	Find complex solutions for quadratic equations.		
3.3.PO 8	Describe the relationships among the solutions of an equation, the zeros of a function, the x-intercepts of a graph, and the factors of a polynomial expression with and without technology.		
3.3.PO 9	Use matrix operations and the inverse of a matrix to solve problems.		
3.3.PO 10	Represent vectors as matrices.		
3.3.PO 11	Add, subtract, and compute the dot product of two-dimensional vectors; multiply a two-dimensional vector by a scalar.		
3.4	Analyze how changing the values of one quantity corresponds to change in the values of another quantity.		
3.4.PO 1	Analyze and describe how a change in an independent variable leads to a change in a dependent variable.		

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3.4.PO 2	Identify patterns in a function's rate of change, including intervals of increase, decrease, and constancy; if possible, relate them to the function's verbal description or its graph.		
3.4.PO 3	Analyze change in various contexts by modeling and solving word problems using functions and equations.		
3.4.PO 4	Compare relative magnitudes of functions and their rates of change.		
3.4.PO 5	Solve problems involving compound interest.		
3.4.PO 6	Demonstrate the relationship between		
3.4.PO 6.a	simple interest and linear growth		
3.4.PO 6.b	compound interest and exponential growth.		
3.4.PO 7	Determine the total cost of purchasing consumer durables over time given different down payments, financing options, and fees.		

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3.4.PO 8	Apply a variety of strategies to use tax tables and determine, calculate, and complete yearly federal income tax.		
3.4.PO 9	Develop a personal budget including debit, checking, and savings accounts by interpreting multiple personal budget examples.		
3.4.PO 10	Determine an effective retirement savings plan to meet personal financial goals including IRAs, ROTH accounts, and annuities.		
3.4.PO 11	Compare and contrast the role of insurance as a device to mitigate risk and calculate expenses of various options.		
4	Geometry and Measurement		
4.1	Analyze the attributes and properties of 2- and 3- dimensional figures and develop mathematical arguments about their relationships.		
4.1.PO 1	Perform basic geometric constructions using a variety of methods, including		
4.1.PO 1.a	perpendicular bisector of a line segment,	Unit 1: Introduction to Geometry	Section A, p. 13: Writing Assignment: Construct a Segment Bisector

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4.1.PO 1.b	bisector of an angle	Unit 1: Introduction to Geometry	Section C, p. 21 – Writing Assignment: Construct an Angle Bisector
4.1.PO 1.c	perpendicular or parallel lines.	Unit 3: Lines and the Coordinate Plane	Section A, p. 11: Writing Assignment: Construct a Parallel Line Section C, p. 22: Writing Assignment: Construct a Perpendicular Line
4.1.PO 2	Explore geometries other than Euclidean geometry in which the parallel postulate is not true.		
4.1.PO 3	Apply the law of cosines and the law of sines to find missing sides and angles of triangles.	Unit 8: Right Triangles and Trigonometry	Section B, p. 14: Finding Angles Using Trigonometric Ratios Section B, p. 19 – Flashcards: Trigonometric Ratios in Real-life Problems
4.1.PO 4	Use basic trigonometric identities including Pythagorean, reciprocal, half-angle and double-angle, and sum and difference formulas to solve equations and problems.		
4.2	Apply spatial reasoning to create transformations and use symmetry to analyze mathematical situations.		
4.2.PO 1	Describe how changing the parameters of a quadratic function affects the shape and position of its graph ($f(x) = a(x-h)^2+k$).		
4.2.PO 2	Describe how changing the parameters of an exponential function affects the shape and position of its graph ($f(x) = ab$ to the x power).		

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4.2.PO 3	Describe how changing the parameters of a trigonometric function affects the shape and position of its graph ($f(x) = A \sin B(x-C)+D$ or the other trigonometric functions).	Unit 8: Right Triangles and Trigonometry	Section C, p. 9 – More Advanced Graphs of Sine, Cosine, and Tangent Functions
4.3	Specify and describe spatial relationships using rectangular and other coordinate systems while integrating content from each of the other strands.		
4.3.PO 1	Graph the solution set of a system of two or three linear inequalities and given an ordered pair determine whether it is a solution to the system.		
4.3.PO 2	Determine an equation of a circle given its center and radius; given an equation of a circle, find its center and radius.	Unit 7: Circles	Section C, p. 4: Equations of a Circle Centered at the Origin
4.3.PO 3	Graph equations of conic sections explaining the relationship between their algebraic form and key characteristics of the graph.		
4.3.PO 4	Graph all six trigonometric functions identifying their key characteristics.	Unit 8: Right Triangles and Trigonometry	Section C
4.3.PO 5	Evaluate all six trigonometric functions at angles between (0 degrees and 360 degrees, 0 and 2π radians) using the unit circle in the coordinate plane.		
4.3.PO 6	Convert between rectangular and polar coordinates.		

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4.3.PO 7	Graph equations given in polar coordinates.		
4.4	Understand and apply appropriate units of measure, measurement techniques, and formulas to determine measurements.		
4.4.PO 1	Explain, use, and convert between degree and radian measures for angles.		
5	Structure and Logic		
5.1	Use reasoning to solve mathematical problems.		
5.1.PO 1	Use a variety of approaches (inductive and deductive reasoning, estimations, generalizations, formal and informal methods of proof) to analyze algorithms.		
5.2	Evaluate situations, select problem-solving strategies, draw logical conclusions, develop and describe solutions, and recognize their applications.		
5.2.PO 1	Analyze a problem situation, determine the question(s) to be answered, organize given information, determine how to represent the problem, and identify implicit and explicit assumptions that have been made.		

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5.2.PO 2	Solve problems by using theorems, formulating one or more strategies, applying the strategies, verifying the solution(s), and communicating the reasoning used to obtain the solution(s).		
5.2.PO 3	Evaluate a solution for reasonableness and interpret the meaning of the solution in the context of the original problem.		
5.2.PO 4	Generalize a solution strategy for a single problem to a class of related problems and explain the role of generalizations in inductive and deductive reasoning.		
5.2.PO 5	Summarize and communicate mathematical ideas using formal and informal reasoning.	Unit 2: Introduction to Proofs	Section B, p. 11: Two Column Proofs in Geometry
5.2.PO 6	Synthesize mathematical information from multiple sources to draw a conclusion, make inferences based on mathematical information, evaluate the conclusions of others, analyze a mathematical argument, and recognize flaws or gaps in reasoning.		
5.2.PO 7	Analyze and explain the general properties and behavior of functions or relations using algebraic and graphing techniques.		
5.2.PO 8	Use inductive and deductive reasoning to make, analyze, and validate or refute conjectures and/or proofs.	Unit 2: Introduction to Proofs	Section A, p. 4: Inductive Reasoning p. 10: Deductive Reasoning
5.2.PO 9	Use mathematical models to represent and analyze personal and professional situations.		



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5.2.PO 10	Differentiate, interpret, apply, and develop concepts in the context of personal and professional situations.		
5.2.PO 11	Determine under what conditions a given statement (algebraic, geometric) is true.		