

Mathematics: Precalculus

<p><b>Content Standard #4</b> Students will have demonstrated proficiency in mathematics by solving problems requiring number sense, accurate computation, accurate measurement, collection of data and statistics, algebraic methods and geometry.</p>
<p><b>#4A</b> Students demonstrated proficiency in number sense, properties, and operations.</p>
<p><b>#4B</b> Students demonstrated understanding of patterns, functions, and algebraic structures.</p>
<p><b>#4C</b> Students demonstrated understanding of data analysis, statistics, and probability.</p>
<p><b>#4D</b> Students demonstrated understanding of shape, dimension, and geometric relationships.</p>

**Description**

This course is designed to prepare the student for advanced study in calculus. The student is expected to gain an understanding of the role of logic in deductive systems and recognize that manipulative techniques in mathematical systems are a reflection of the structure of that system. The study of trigonometry is emphasized. Other topics include data analysis, coordinate geometry, polynomials, inequalities, functions, exponents and logarithms, polar coordinates and complex numbers. Graphing calculators will be used on a daily basis.

**Time Allocation**  
Ninety minutes daily for one smear

**Texts/References**  
Precalculus: Graphing and Data Analysis, Prentice Hall, 2001  
Math Mates, Educational Advantage Pty Ltd.

**Assessments**  
 Quizzes  
 Tests  
 Activities  
 Midterm and final exams

**Grades and Achievement Levels**  
 Grades are based on completion of assignments and quality of work. Each student also receives a rating that shows the student's achievement performance level on the mathematics standard. The rating is based upon the student's attainment of course expectations.

## Essential Learning: Mathematics Precalculus

<b>Standard #4A</b> <b>Number sense, properties, and operations</b>	<b>Standard #4B</b> <b>Patterns, functions, and algebraic structures</b>	<b>Standard #4C</b> <b>Data analysis, statistics, and probability</b>	<b>Standard #4D</b> <b>Shape, dimension, and geometric relationships</b>
<ul style="list-style-type: none"> <li>• The complex number system includes real numbers and imaginary numbers</li> <li>• Formulate, represent, and use algorithms with real numbers flexibly, accurately, and efficiently</li> <li>• Systematic counting techniques are used to describe and solve problems</li> </ul>	<ul style="list-style-type: none"> <li>• Functions model situations where on quantity determines another and can be represented algebraically, graphically, and using tables</li> <li>• Graphs and tables are used to describe the qualitative behavior of common types of functions</li> <li>• Parameters influence the shape of the graphs of functions</li> <li>• Expressions, equations, and inequalities can be expressed in multiple, equivalent forms</li> <li>• Solutions to equations, inequalities and systems of equations are found using a variety of tools</li> <li>• Quantitative relationships in the real world can be modeled and solved using functions</li> </ul>	<ul style="list-style-type: none"> <li>• Statistical methods take variability into account, supporting informed decision-making through quantitative studies designed to answer specific questions</li> <li>• The design of an experiment or sample survey is of critical importance to analyzing the data and drawing conclusions</li> <li>• Visual displays and summary statistics condense the information in data sets into usable knowledge</li> <li>• Randomness is the foundation for using statistics to draw conclusions when testing a claim or estimating plausible values for a population characteristics</li> <li>• Probability models outcomes for situations in which there is inherent randomness, quantifying the degree of certainty in terms of relative frequency of occurrence</li> </ul>	<ul style="list-style-type: none"> <li>• Attributes of two- and three-dimensional objects are measurable and can be quantified</li> <li>• Objects in the plane and their parts, attributes, and measurements can be analyzed deductively</li> <li>• Objects in the plane can be transformed, and those transformations can be described and analyzed mathematically</li> <li>• Right triangles are central to geometry and its applications</li> </ul>

## Expectations: Precalculus

<b>Standard #4A</b> <b>Number sense, properties, and operations</b>	<b>Standard #4B</b> <b>Patterns, functions, and algebraic structures</b>	<b>Standard #4C</b> <b>Data analysis, statistics, and probability</b>	<b>Standard #4D</b> <b>Shape, dimension, and geometric relationships</b>
<ol style="list-style-type: none"> <li>1. Recognized and used equivalent representations of real numbers in a variety of forms including scientific notation, radicals, and other irrational numbers such as pi</li> <li>2. Developed and tested conjectures about the properties of the real number system and common subsets of the real number system</li> <li>3. Verified and applied exponential properties</li> <li>4. Converted from one set of units to another</li> <li>5. Determined when estimation is an appropriate method to solve a problem and described the error that may result from estimation</li> <li>6. Applied appropriate computational methods to solve multi-step problems involving all types of numbers from the real number system</li> </ol>	<ol style="list-style-type: none"> <li>1. Demonstrated the relationship between all representations of linear functions using point-slope, slope-intercept, and standard form of a line</li> <li>2. Represented linear, quadratic, absolute value, power, exponential, logarithmic, rational, trigonometric, and step functions in a table, graph, and equation and converted from one representation to another</li> <li>3. Evaluated a function at a given point in its domain given an equation, a table, and a graph</li> <li>4. Identified the domain and range of a function given an equation, a table, and a graph</li> <li>5. Identified intercepts, zeros, maxima, minima, and intervals of increase and decrease of a function given an equation, a table, and a graph</li> <li>6. Made qualitative statements about the rate of change of a function, based on its graph or table</li> <li>7. Applied transformations to a parent function and interpreted the results verbally, graphically, and symbolically</li> </ol>	<ol style="list-style-type: none"> <li>1. Formulated appropriate research questions that can be answered with statistical analysis</li> <li>2. Determined appropriate data collection methods to answer a research question</li> <li>3. Explained how data might be analyzed to provide answers to a research question</li> <li>4. Identified the characteristics of a well-designed and well-conducted survey</li> <li>5. Identified the characteristics of a well-designed and well-conducted experiment</li> <li>6. Differentiated between the inferences that can be drawn in experiments versus observational studies</li> <li>7. Identified and chose appropriate ways to summarize numerical or categorical data using tables, graphical displays, and numerical summary statistics and accounting for outliers when appropriate</li> <li>8. Described the relationship between two categorical variables using percents</li> </ol>	<ol style="list-style-type: none"> <li>1. Used the Pythagorean Theorem and its converse to solve real-world problems</li> <li>2. Used right triangle trigonometry to solve real-world problems</li> <li>3. Solved SAS and SSS triangles</li> <li>4. Found the area of SAS and SSS triangles</li> <li>5. Found the value of trigonometric functions of acute angles</li> <li>6. Determined the equation of various conic sections</li> <li>7. Created a graphical representation of conic sections, including various attributes such as conjugate axis, minor/major axes, foci points, and asymptotes</li> <li>8. Created a graphical representation of polar coordinates and equations</li> <li>9. Identified the periodicity and even-odd properties of the trigonometric functions</li> <li>10. Converted between radians and degrees</li> <li>11. Established identities.</li> <li>12. Applied properties of vectors to solve real-world applications</li> </ol>

## Expectations: Precalculus continued

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<ol style="list-style-type: none"> <li>7. Showed that between any two rational numbers there are an infinite number of rational numbers, and that between any two irrational numbers there are also an infinite number of irrational numbers</li> <li>8. Used appropriate computation methods that encompass estimation and calculation</li> <li>9. Used technology to perform operations on numbers written in scientific notation</li> <li>10. Described factors affecting take home pay and calculated the impact (PFL)</li> <li>11. Designed and used a budget, including income and expenses to demonstrate how living within your means is essential for a secure financial future(PFL)</li> <li>12. Use combinatorics (Fundamental Counting Principle, permutations and combinations) to solve problems in real-world contexts.</li> <li>13. Used number sense to estimate and justify the reasonableness of solutions to problems involving rational and irrational numbers</li> </ol>	<ol style="list-style-type: none"> <li>8. Categorized sequences as arithmetic, geometric, or neither and developed formulas for the general terms related to arithmetic and geometric sequences.</li> <li>9. Determined the inverse of a function from a graph or table.</li> <li>10. Performed and justified steps in generating equivalent expressions by identifying properties using the commutative, associative, inverse, and identity properties</li> <li>11. Used appropriate measurements to solve problems indirectly (for example, find the height of a flagpole using similar triangles)</li> <li>12. Solved equations for one variable in terms of the others</li> <li>13. Found solutions to quadratic and cubic equations and inequalities by using appropriate algebraic methods such as factoring, completing the square, graphing or using the quadratic formula</li> <li>14. Solved systems of linear equations and inequalities with two variables</li> </ol>	<ol style="list-style-type: none"> <li>9. Drew and interpreted scatter plots</li> <li>10. Found the equation for various regression models, involving cubic, quadratic, exponential, and linear functions</li> <li>11. Used Person's correlation coefficient as a measure of strength and interpreted the slope and y-intercept in the context of the problem</li> <li>12. Explained the role of p-values in determining statistical significance</li> <li>13. Determined the margin of error associated with an estimate of a population characteristic</li> <li>14. Defined and explained the meaning of significance</li> <li>15. Analyzed the cost of insurance as a method to offset the risk of a situation (PFL)</li> <li>16. Developed simulations that demonstrated probability as a long-run relative frequency</li> <li>17. Applied and solved problems using the concepts of independence and conditional probability</li> </ol>	<ol style="list-style-type: none"> <li>13. Solved for unknown quantities in relationships involving perimeter, area, surface area, and volume</li> <li>14. Applied the Pythagorean Theorem and its converse to solve real-world problems</li> <li>15. Used appropriate measurements to solve problems indirectly (for example, find the height of a flagpole using similar triangles)</li> <li>16. Selected and used appropriate tools and techniques to measure quantities in order to achieve specified degrees of precision, accuracy, and error (or tolerance) or measurements</li> <li>17. Found and analyzed relationships among geometric figures using transformation (for example, reflections, translations, rotations, dilations) in coordinate systems</li> </ol>

Expectations: Precalculus continued

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	<ul style="list-style-type: none"> <li>15. Generated the graphs of trigonometric functions and explored various transformations upon these graphs</li> <li>16. Represented, solved, and interpreted problems in various contexts using linear, quadratic, rational, and exponential, and trigonometric functions</li> <li>17. Analyzed the impact of interest rates on a personal financial plan</li> <li>18. Analyzed various lending sources, services, and financial institutions</li> <li>19. Applied the properties of positive and negative rational exponents to generate equivalent algebraic expressions including those involving <math>n</math>th roots</li> <li>20. Found solutions to equations involving power, exponential, trigonometric, rational, logarithmic, and radical functions</li> <li>21. Recognized even and odd functions using its graph and equation</li> <li>22. Graphed polar equations</li> </ul>	<ul style="list-style-type: none"> <li>18. Applied and solved problems using the concept of mutually exclusive properties when combining probabilities</li> <li>19. Evaluated and interpreted probabilities using normal distribution</li> <li>20. Found and interpreted the expected value and standard deviation of a discrete random variable <math>x</math></li> </ul>	