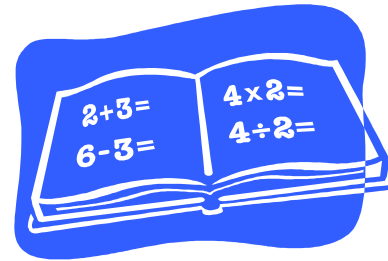


FUNDAMENTAL ALGEBRA I



Niles McKinley High School Mathematics Department
SY2009-2010

September: Grade: 9 Fundamental Algebra

Essential Understanding: Real numbers are classified by their properties and manipulated using a set order

Indicators:

9N1 Identify and justify whether properties (closure, identify, inverse and commutative and associative) hold for a given set and operations (even, integers and multiplication)

9N2 Compare order and determine equivalent forms for rational and irrational numbers.

9N3 Explain the effects of operations such as multiplication or division, and of computing powers and roots on magnitude of qualities.

9N4 Demonstrate fluency in computations using real numbers.

9N5 Estimate the solutions for problem situations involving square and cube roots.

AUTHENTIC ASSESSMENT

Teacher
Use Only

October/November Grade: 9 Fundamental Algebra**Essential Understanding: Equations and inequalities have different forms , representations, and applications****Indicators:**

9P5 Describe and compare characteristics of the following families of functions: linear, quadratic and exponential functions (general shape, number of roots, domain, range and rate of change, maximum or minimum.)

9P6 Write and use equivalent forms of equations and inequalities in problem situations (changing a linear equation to the slope-intercept form.

9P13 Model and solve problems involving direct and inverse variations using proportional reasoning.

9P14 Describe the relationship between slope and graph of a direct variation and inverse variation.

9P15 Describe how a change in the value of a constant in a linear or quadratic equation affects the related graph.

9M1 Covert rates within the same measurement system (miles per hour to feet per second, kilometers per hour to meters per second)

9M2 Use unit analysis to check computations involving measurement.

9M5 Solve problems involving unit conversion for situations involving distances, areas, volumes and rates within the same measurement system.

AUTHENTIC ASSESSMENT

Teacher
Use Only

December/ January Grade: 9 Fundamental Algebra
Essential Understanding: Equalities are represented in various forms (graph symbols)

Indicators:

- 9P11** Define function with ordered pairs in which each domain element is assigned exactly one range element.
- 9P2** Generalize patterns using functions or relationships (linear, quadratic and exponential) and freely translate among tabular, graphical and symbolic representations.
- 9P3** Describe problem situations (linear, quadratic, and exponential (by using tabular, graphical and symbolic representations.)
- 9P4** Demonstrate the relationship among zeros of a function, roots of equations and solutions of graphically and in words.
- 9P8** Find linear equations that represent lines that pass through a given set of ordered pairs and find linear equations that represent lines parallel or perpendicular to a given line through a specific point.
- 9D2** Create a scatter plot for a set of bivariate data, sketch the line of best fit, and interpret the slope of a line of best fit.

AUTHENTIC ASSESSMENT

Teacher
Use Only

February Grade: 9 Fundamental Algebra
Essential Understanding: There are multiple methods for solving systems of equations

Indicators:

9P9 Solve and interpret the meaning of 2 by 2 systems of linear equations graphically, by substitution and by elimination, with and without technology.

AUTHENTIC ASSESSMENT

Teacher
Use Only

March Grade: 9 Fundamental Algebra

Essential Understanding: Data is described and analyzed through probability, combinations, and plots

Indicators:

9D1 Classify data as univariate (single variable) or bivariate (two variables) and as quantitative (measurement) or qualitative (categorical) data.

9D3 Analyze and interpret frequency distributions based on spread, symmetry, skewness, clusters and outliers.

9D4 Describe and compare various types of studies (survey, observation, experiment) and identify possible misuses of statistical data.

9D5 Describe characteristics and limitations of sampling methods and analyze the effects off random versus biased sampling (determine and justify whether the sample is likely to be representative of the population.

9D6 Make inference about relationships in bivariate data, and recognize the difference between evidence of relationship (correlation) and causation.

9D7 Use counting techniques and the fundamental counting principle to determine difference between evidence of relationship (correlation) and causations.

9D8 Describe, create and analyze a sample space and use it to calculate probability.

9D9 Identify situations involving independent and dependent events and explain differences between and common misconceptions about probabilities associated with those events.

9D10 Use theoretical and experimental probability, including simulations or random numbers, to estimate probabilities and to solve problems dealing with uncertainty (compound events, simple dependent events)

9P7 Use formulas to solve problems involving exponential growth & decay.

AUTHENTIC ASSESSMENT

Teacher
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April/May Grade: 9 Fundamental Algebra

Essential Understanding: Unknown measurements are found by using trig ratios. Polynomials can be simplified

Indicators:

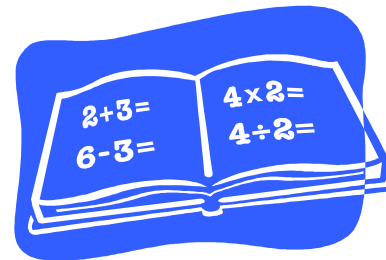
- 9G1** Define the basic trigonometric ratios in right triangles: sine, cosine and tangent.
- 9G2** Apply proportions and right triangle trigonometric ratios to solve problems involving missing lengths and angle measures in similar figures.
- 9G3** Analyze two-dimensional figures in a coordinate plane (use slope and distance formulas to show that a quadrilateral is a parallelogram.
- 9M3** Use the ratio of lengths in similar two-dimensional figures or three-dimensional objects to calculate the ration of their areas or volumes respectively.
- 9M4** Use scale drawings and right triangle trigonometry to solve problems that include unknown distances and angle measures.
- 9P10** Solve quadratic equations with real roots by factoring, graphing, using the quadratic formula and with technology.
- 9P11** Add, subtract, multiply, and divide monomials and polynomials.
- 9P12** Simplify rational expressions by eliminating common factors and applying properties of integer exponents.

AUTHENTIC ASSESSMENT

Teacher
Use Only



ALGEBRA I



Niles McKinley High School Mathematics Department
SY2009-2010

September: Grade: 9 – Algebra I Math**Essential Understanding: Real numbers are classified by their properties and manipulated using a set order****Indicators:**

9N1 Identify and justify whether properties (closure, identity, inverse, commutative and associative) hold for a given set of operations (even integer and multiplication)

9N2 Compare order and determine equivalent forms for rational and irrational numbers.

9N3 Explain the effects of operations such as multiplication or division, and of computing powers and roots on the magnitude of quantities.

9N4 Demonstrate fluency in computations using real numbers.

9N5 Estimate the solutions for problem situations involving square and cube roots.

9P1 Define function with ordered pairs in which each domain element is assigned exactly one range element.

9P5 describe and compare characteristics of the following families of functions: linear, quadratic, and exponential functions – general shape, number of roots, domain, range, rate of change, maximum or minimum.

9M1 Convert rates within the same measurement system (miles per hour to feet per second, kilometers per hour to meters per second.)

9M2 Use unit analysis to check computations involving measurement.

9M5 Solve problems involving unit conversion for situations involving distances, areas, volumes, rates within the same measurement system.

AUTHENTIC ASSESSMENT

Teacher
Use Only

October: Grade: 9 – Algebra I Math

Essential Understanding: Linear equations can be solved using different methods.

Indicators:

9M3 Use ratio of lengths in similar two-dimensional figures or three-dimensional objects to calculate the ratio of their areas or volumes respectively.

9G2 Apply proportions and right triangles trigonometric ratios to solve problems involving missing lengths and angle measures in similar figures.

9D1 Classify data as univariate (single variable) or bivariate (two variables) and as quantitative (measurement) or qualitative (categorical) data.

AUTHENTIC ASSESSMENT

Teacher
Use Only

November : Grade: 9 – Algebra I Math

Essential Understanding: Equations and inequalities have different forms and representations

Indicators:

9P6 Write and use equivalent forms or equations and inequalities in problem situations (changing a linear equation to the slope-intercept form.)

9P13 Model and solve problems involving direct and inverse variations using proportional reasoning.

9P14 Describe the relationship between slope and the graph of a direct variation and inverse variation.

9P15 Describe how a change in the value of a constant in a linear or quadratic equation affects the related graph.

AUTHENTIC ASSESSMENT

Teacher
Use Only

December/January Grade: 9 – Algebra I Math

Essential Understanding: Equalities are represented in various forms (graph symbols)

Indicators:

9P2 Generalize patterns using functions or relationships (linear, quadratic and exponential) and freely translate among tabular, graphical and symbolic representations.

9P3 Describe problem situations (linear, quadratic and exponential) by using tabular, graphical and symbolic representations.

9P4 Demonstrate the relationship among zeros of a function, roots of equations, and solutions of equations graphically in words.

9P8 Find linear equations that represent lines that pass through a given set of ordered pairs, and find linear equations that represent lines parallel or perpendicular to a given line through a specific point.

9D2 Create a scatter plot for a set of bivariate data, sketch the line of best fit and interpret the slope of the line of best fit.

AUTHENTIC ASSESSMENT

Teacher
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February : Grade: 9 – Algebra I Math

Essential Understanding: There are multiple methods for solving systems of equations

Indicators:

9P9 Solve and interpret the meaning of 2 by 2 systems of linear equations graphically, by substitution and by elimination, with and without technology.

AUTHENTIC ASSESSMENT

Teacher
Use Only

March: Grade: 9 – Algebra I Math

Essential Understanding: Data is described and analyzed through probability, combinations, and plots equations

Indicators:

- 9D3** Analyze and interpret frequency distributions based on spread, symmetry, skewness, clusters and outliers.
- 9D4** Describe and compare various types of studies (survey, observation, experiment) and identify possible misuses of statistical data.
- 9D5** Describe characteristics and limitations of sampling methods and analyze the effect of random versus biased sampling (determine and justify whether the sample is likely to be representative of the population).
- 9D6** Make inferences about relationships in bivariate data and recognize the difference between evidence of relationship (correlation) and causation.
- 9D7** Use counting techniques and the Fundamental Counting principle to determine between evidence of relationship (correlation) and causation.
- 9D8** Describe, create and analyze a sample space and use it to calculate probability.
- 9D9** Identify situations involving independent and dependent events and explain differences between and common misconceptions about probabilities associated with those events
- 9D10** Use theoretical and experimental probability, including simulations or random numbers to estimate probabilities and to solve problems dealing with uncertainty (compound events, independent events, simple dependent events).
- 9P7** Use formulas to solve problems involving exponential growth and decay.

AUTHENTIC ASSESSMENT

Teacher
Use Only

April: Grade: 9 – Algebra I Math

Essential Understanding: Evaluate quadratic equations by algebraic manipulation and graphing

Indicators:

9G3 Analyze two-dimensional figures in coordinate plane (use slope and distance formulas to show that a quadrilateral is a parallelogram.

9P10 Solve quadratic equations with real roots by factoring, graphing, using the quadratic formula with and without technology.

AUTHENTIC ASSESSMENT

Teacher
Use Only

May: Grade: 9 – Algebra I Math

Essential Understanding:

- 1. Unknown measurements are found by using trig ratios**
- 2. Polynomials can be simplified**

Indicators:

9M4 Use scale drawing and right triangle trigonometry to solve problems that include unknown distances and angle measures.

9G1 Define the basic trigonometric ratios in right triangles: sine, cosine and tangent.

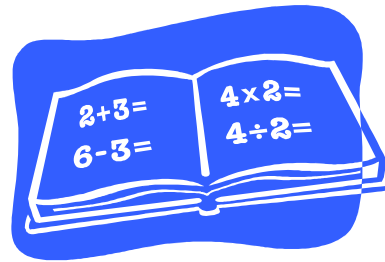
9P11 Add, subtract, multiply, and divide monomials and polynomials.

9P12 Simplify rational expressions by eliminating common factors and applying properties of integer exponents.

AUTHENTIC ASSESSMENT

Teacher
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GEOMETRY



Niles McKinley High School Mathematics Department
SY2009-2010

September: Grade: 10 – Geometry Math

**Essential Understanding: Irrational numbers are represented on a number line and in equations.
The basic geometric concepts are demonstrated through definition and construction.**

Indicators:

10N1 Connect physical, verbal and symbolic representations of irrational numbers (construct square root of 2 as a hypotenuse or on a number line)

10N2 Explain the meaning of the Nth root.

10N4 Approximate the Nth root of a given number greater than zero between consecutive integers when n is an integer (the 4th root of 40 is between 2 and 3)

10P5 Solve simple linear and nonlinear equations and inequalities having square roots as coefficients and solutions.

10P6 Solve equations and inequalities having rational expressions as coefficients and solution.

10G1 Formally define and explain key aspects of geometric figures including:

G1a interior and exterior angles of polygons;

10G2 Recognize and explain the necessity for certain terms to remain undefined, such as point, line and plane.

10G3a Prove the Pythagorean Theorem.

10G5 Solve simple linear and nonlinear equations and inequalities having square roots as coefficients and solutions.

AUTHENTIC ASSESSMENT

Teacher
Use Only

October: Grade: 10 – Geometry Math

Essential Understanding: Geometric theorems are proven using reasoning skills and algebraic properties.

Indicators:

10G3 Make, test and establish the validity of conjectures about geometric properties and relationships using counter example, inductive and deductive reasoning and paragraph or two-column proof including:

10G3c prove theorems involving properties of lines, angles, triangles and quadrilaterals.

10G3d test a conjecture using basic constructions made with a compass and straightedge or technology.

10P4 Use algebraic representations and functions to describe and generalize geometric properties and relationships.

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Teacher
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November: Grade: 10 – Geometry Math**Essential Understanding: Linear equations and inequalities can be solved using different methods.****Indicators:****10P7** Solve systems of linear inequalities.**10P9** Recognize and explain that the slopes of parallel lines are equal and the slopes of perpendicular lines are negative reciprocals.**10P11** Solve real-world problems that can be modeled using systems of linear equations and inequalities,**AUTHENTIC ASSESSMENT**

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December: Grade: 10 – Geometry Math

Essential Understanding: Probability can be calculated using models and computations.

Indicators:

10N3 Use factorial notation and computation to represent and solve problem situation involving arrangements.

10D7 Model problems dealing with uncertainty with area models (geometric probability)

10D8 Differentiate and explain relationship between the probability of an event and the odds of the event and compute one given the other.

10G3b prove theorems involving triangles similarities and congruence.

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Teacher
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January: Grade: 10 – Geometry Math

Essential Understanding: Transformations can be represented on a coordinate plane or algebraically.

Indicators:

10G6 Identify the reflection and rotation symmetries of two and three dimensional figures.

10G7 Perform reflection and rotations using compass and straightedge construction and dynamic geometric software.

10G8 Derive coordinate rules for translation, reflections and rotations of geometric figure in the coordinate plane.

10G9 Show and describe the results of combinations of translations, reflections and rotations (compositions) perform compositions and specify the results of a composition as the outcome of as single motion when applicable.

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February: Grade: 10 – Geometry Math

Essential Understanding: Analyzing and solving families of functions. Construction right triangles can be used to describe linear graphs.

Indicators:

10G4 Construct right triangles, equilateral triangles, parallelograms, trapezoids, rectangles rhombuses, square and kites, using compass and straightedge or dynamic geometric software.

10P1 Define function formally and with $f(x)$ notation.

10P2 Describe and compare characteristics of the following families of functions: square root, cubic, absolute value and basic trigonometric function (general shape, possible number of roots, domain and range.

10P3 Solve equations and formulas for a specified variable (express the base of a triangle in terms of the area and height.)

10P8 Graph the quadratic relationship that defines circles.

10P10 Solve real-world problems that can be modeled using linear, quadratic, and exponential or square root functions.

10P12 Describe the relationship between slope of line through the origin and the tangent functions of the angle created by the line and the positive x-axis.

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Teacher
Use Only

March: Grade: 10 – Geometry Math

Essential Understanding: Data, including bivariate data, can be interpreted using different graphical displays or algebraic computations. Error in measurement or calculation is taken into consideration when comparing the validity of results

Indicators:

- 10D1** Describe measures of center and the range verbally, graphically and algebraically.
- 10D2** Represent and analyze bivariate data using appropriate graphical displays (scatterplots, parallel box-and-whisker plots, histograms with more than one set of data, tables, charts, spreadsheets) with and without technology.
- 10D3** Display bivariate data where at least one variable is categorical.
- 10D4** Identify outliers on a data display; e.g., use interquartile range to identify outliers on a box-and-whisker plot.
- 10D6** Interpret the relationship between two variables using multiple graphical displays and statistical measures; e.g., scatterplots, parallel box-and-whisker plots, and measures of center and spread.
- 10M** Explain how a small error in measurement may lead to a large error in calculated results.
- 10M3** Explain the difference between absolute error and relative error in measurement.
- 10M4** Give examples of how the same absolute error can be problematic in one situation but not in another; e.g., compare “accurate to the nearest foot” when measuring the height of a person versus when measuring the height of a mountain.
- 10M2** Calculate relative error.
- 10D5** Provide examples and explain how a statistic may or may not be an attribute of the entire population; e.g., intentional or unintentional bias may be present.

AUTHENTIC ASSESSMENT

Teacher
Use Only

April: Grade: 10 – Geometry Math

Essential Understanding: Points of concurrency of triangles are found by drawing special segments.

Indicators:

10G1b Segments related to triangles (median, altitude, mid-segment)

10G1c Points of concurrency related to triangles (centroid, incenter, orthocenter, circumcenter)

AUTHENTIC ASSESSMENT

Teacher
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May: Grade: 10 – Geometry

Math

Essential Understanding: Points of concurrency of triangles are found by drawing special segments.

Indicators:

10M5 Determine the measure of center and inscribed angles and their associated major and minor arcs.

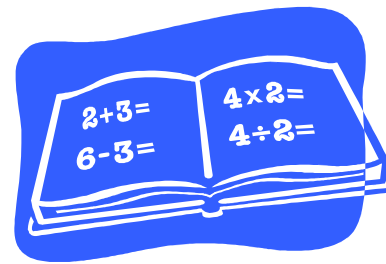
10G10 Solve problems involving chords, radii and arcs within the same circle

10G1d circles (radius, diameter, chord, circumference, major arc, minor arc, sector, segment, inscribed angle.)

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Teacher
Use Only

ALEGBRA II



Niles McKinley High School Mathematics Department
SY2009-2010

September: Grade: 11 – Algebra II Math

Essential Understanding: Transforming graphs of functions affects properties of the functions.

Indicators:

11D8 Analyze and interpret univariate and bivariate data to identify patterns, note trends, draw conclusions and make predictions.

11D3 Describe how all linear transformation of univariate data affects range, mean, mode & median.

11P5 Identify families of functions with graphs that have rotation symmetry and reflection symmetry about the y-axis or $y=x$

AUTHENTIC ASSESSMENT

Teacher
Use Only

October: Grade: 11 – Algebra II Math

Essential Understanding: Data is used to predict future events.

Indicators:

11M4 Calculate distances, areas, surface areas and volume of composite three-dimensional objects to a specified number of significant digits.

11D5 Use technology to find the Least Square Regression Line, the Regression Coefficient, and the Correlation Coefficient for bivariate data with a linear trend and interpret each of these statistics in the context of the problem situation.

11D4 Create a scatterplot of bivariate data, identify trends and find a function to model the data.

11D1 Design a statistical experiment, survey a study for a problem, collect data for the problem and interpret the data with appropriate graphical displays, descriptive statistics, concepts of variability causation, correlation and standard deviation.

11N3 Represent complex numbers on the complex plane.

AUTHENTIC ASSESSMENT

Teacher
Use Only

November: Grade: 11 – Algebra II Math

Essential Understanding: Matrices solve real-life problems.

Indicators:

11N1 Determine what properties hold for matrix addition and matrix multiplication (use examples to show addition is commutative and multiplication is not commutative).

11N6 Compute sums, differences and products of matrices using paper and pencil calculations for simple cases and technology for more complicated cases.

11P7 Model and solve problems with matrices and vectors.

11P9 Solve 3 by 3 systems of linear equations by elimination and using technology and interpret graphically what the solution means (point, line, plane or no solution)

AUTHENTIC ASSESSMENT

Teacher
Use Only

December/January: Grade: 11 – Algebra II Math

Essential Understanding: Demonstrate computing functions of 3-D objects & find surface area and volume

Indicators:

11P8 Solve equations involving radical expressions and complex roots.

11P10 Describe the characteristics of graphs of conic sections

11P11 Describe how a change in the values of a constant in an exponential, logarithmic or radical equation affects the graph of the equation.

11M3 Derive a formula for the surface area of a cone as a function of its slant height and the circumference of its base.

11N7 Compute sums, differences, products and quotients of complex numbers.

11G5 Identify, sketch and classify the cross-section of three-dimensional objects

AUTHENTIC ASSESSMENT

Teacher
Use Only

February: Grade: 11 – Algebra II Math**Essential Understanding: Radicals and exponents are interchangeable.****Indicators:**

11P1 Identify and describe problem situations involving an iterative process that can be represented as a recursive function (compound interest).

11P2 Translate a recursive function into a closed form expression or formula for the Nth term to solve a problem situation involving an iterative process (find the value of an annuity after 7 years).

11P6 Represent the inverse function symbolically and graphically as a reflection about $y=x$.

11N8 Use fractional and negative exponents as optional ways of representing and finding solutions for problem situations ($27^{2/3} = (27^{1/3})^2 = 9$)

11M5 Solve real-world problems involving area, surface area, volume and density to a specific degree of precision.

AUTHENTIC ASSESSMENT

Teacher
Use Only

March: Grade: 11 – Algebra II Math

Essential Understanding: Real life objects have mathematical representations.

Indicators:

11P3 Describe and compare the characteristics of the following families of functions: quadratics with complex roots, polynomials of any degree, logarithms and rational functions (general shape, number of roots, domain and range, asymptotic behavior).

AUTHENTIC ASSESSMENT

Teacher
Use Only

April: Grade: 11 – Algebra I1 Math

Essential Understanding: Variables can change the properties of a normal curve.

Indicators:

11P3 Describe and compare the characteristics of the following families of functions: quadratics with complex roots, polynomials of any degree, logarithms and rational functions (general shape, number of roots, domain and range, asymptotic behavior).

11D6 Use technology to compute the standard deviation for a set of data and interpret standard deviation in relation to the content of problem situations.

11D7 Describe the standard normal curve and its general properties and answer questions dealing with data assumed to be normal.

11D10 Understand and use the concept of random variable and compute and interpret the expected value for a random variable in simple cases.

11D11 Examine statement and decisions involving risk (insurance rates and medical decisions.)

AUTHENTIC ASSESSMENT

Teacher
Use Only

May: Grade: 11 – Algebra II Math

Essential Understanding: Vectors and trigonometry are related through right triangles.

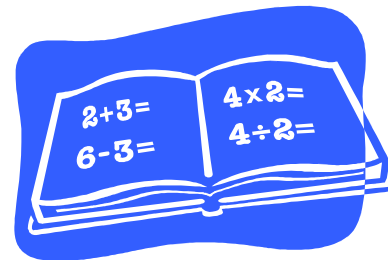
Indicators:

- 11G1** Use polar coordinates to specify locations on a plane.
- 11G2** Represent translations using vectors.
- 11G3** Describe multiplication of a vector and a scalar graphically and algebraically and apply to problem situations.
- 11G4** Use trigonometric relationships to determine lengths and angle measures to solve problems and perform conversion as needed.
- 11M2** Use radian degree angle measures to solve problems and perform conversions as needed.
- 11P4** Identify the maximum and minimum points of polynomials, rational and trigonometric functions graphically and with technology.
- 11N2** Determine what properties hold for vector addition and scalar multiplication.
- 11N5** Model using the coordinate plane, vector addition and scalar multiplication.
- 11N9** Use vector and scalar multiplication to solve problems.

AUTHENTIC ASSESSMENT

Teacher
Use Only

PRE-CALCULUS



Niles McKinley High School Mathematics Department
SY2009-2010

September/October Grade: 12 Pre-Calculus Math

Essential Understanding: Using trigonometric equations to model and solve real-life problems.

Indicators:

12M1 Solve problems involving derived measurements; e.g., acceleration and pressure.

12M2 Use radian measures in the solution of problems involving angular velocity and acceleration.

12G2 Derive and apply the basic trigonometric identities; i.e., angle addition, angle subtraction and double angle.

12P9 Translate freely between polar and Cartesian coordinate systems.

AUTHENTIC ASSESSMENT

Teacher
Use Only

November/December Grade: 12 Pre-Calculus Math

Essential Understanding: Graphs of equations can take multiple forms and be used in different applications.

Indicators:

12G4 Recognize and compare specific shapes and properties in multiple geometries; e.g., plane, spherical and hyperbolic

12P5 Set up and solve systems of equations using matrices and graphs, with and without technology.

12P6 Make arguments about mathematical properties using mathematical induction.

AUTHENTIC ASSESSMENT

Teacher
Use Only

January/February Grade: 12 Pre-Calculus Math

Essential Understanding: Transformations of equations affect graphs, roots, and behavior.

Indicators:

12G3 Relate graphical and algebraic representations of lines, simple curves and conic sections.

12P3 Describe and compare the characteristics of transcendental and periodic functions; e.g., general shape, number of roots, domain and range, asymptotic behavior, extremes, local and global behavior.

12P4 Represent the inverse of a transcendental function symbolically.

12N1 Determine what properties (closure, identity, inverse, commutative and associative) hold for operations with complex numbers.

AUTHENTIC ASSESSMENT

Teacher
Use Only

March **Grade: 12** **Pre-Calculus Math**

Essential Understanding: Data models take various forms.

Indicators:

12D1 Identify and use various sampling methods (voluntary response, convenience sample, random sample, stratified **random sample, census) in a study.**

12D2 Transform bivariate data so it can be modeled by a function; e.g., use logarithms to allow nonlinear relationship to be modeled by linear function.

12D3 Describe the shape and find all summary statistics for a set of univariate data, and describe how a linear transformation affects shape, center and spread.

12D4 Recognize and compare specific shapes and properties in multiple geometries; e.g., plane, spherical and hyperbolic.

AUTHENTIC ASSESSMENT

Teacher
Use Only

April Grade: 12 Pre-Calculus Math

Essential Understanding: Probability is used to understand and explain the occurrences of different events.

Indicators:

12N2 Apply combinations as a method to create coefficients for the Binomial Theorem, and make connections to everyday and workplace problem situations.

12G1 Use matrices to represent translations, reflections, rotations, dilations and their compositions.

12D5 Use sampling distributions as the basis for informal inference

12D6 Use theoretical or experimental probability, including simulations, to determine probabilities in real-world problem situations involving uncertainty, such as mutually exclusive events, complementary events, and conditional probability

AUTHENTIC ASSESSMENT

Teacher
Use Only

May Grade: 12 Pre-Calculus Math**Essential Understanding: Limits can be used to find maximum or minimum values of functions or to write a function.****Indicators:**

12M3 Apply informal concepts of successive approximation, upper and lower bounds, and limits in measurement situations; e.g., measurement of some quantities, such as volume of a cone, can be determined by sequences of increasingly accurate approximations.

12P1 Analyze the behavior of arithmetic and geometric sequences and series as the number of terms increases

12P2 Translate between the numeric and symbolic form of a sequence or series

12P7 Make mathematical arguments using the concepts of limit

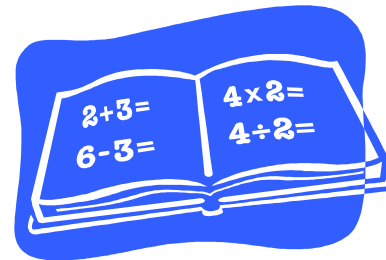
12P8 Compare estimates of the area under a curve over a bounded interval by partitioning the region with rectangles; e.g., make successive estimates using progressively smaller rectangles.

12P10 Use the concept of limit to find instantaneous rate of change for a point on a graph as the slope of a tangent at a point.

AUTHENTIC ASSESSMENT

Teacher
Use Only

CALCULUS



Niles McKinley High School Mathematics Department
SY2009-2010

September/October: AP Calculus**Essential Understanding:** Limits are used to analyze functions**Limits of functions (including one-sided limits)**

- An intuitive understanding of the limiting process
- Calculating limits using algebra
- Estimating limits from graphs or tables of data

Asymptotic and unbounded behavior

- Understanding asymptotes in terms of graphical behavior
- Describing asymptotic behavior in terms of limits involving infinity
- Comparing relative magnitudes of functions and their rates of change (for example, contrasting exponential growth, polynomial growth, and logarithmic growth)

Continuity as a property of functions

- An intuitive understanding of continuity. (The function values can be made as close as desired by taking sufficiently close values of the domain.)
- Understanding continuity in terms of limits
- Geometric understanding of graphs of continuous functions (Intermediate Value Theorem and Extreme Value Theorem)

AUTHENTIC ASSESSMENTS

Teacher
Use Only

November/December: AP Calculus**Essential Understanding:** Derivatives are used to find the rate of change of a function**Concept of the derivative**

- Derivative presented graphically, numerically, and analytically
- Derivative interpreted as an instantaneous rate of change
- Derivative defined as the limit of the difference quotient
- Relationship between differentiability and continuity

Derivative at a point

- Slope of a curve at a point. Examples are emphasized, including points at which there are vertical tangents and points at which there are no tangents.
- Tangent line to a curve at a point and local linear approximation
- Instantaneous rate of change as the limit of average rate of change
- Approximate rate of change from graphs and tables of values

Derivative as a function

- Corresponding characteristics of graphs of f and f'
- Relationship between the increasing and decreasing behavior of f and the sign of f'
- The Mean Value Theorem and its geometric interpretation
- Equations involving derivatives. Verbal descriptions are translated into equations involving derivatives and vice versa.

Second derivatives

- Corresponding characteristics of the graphs of f , f' , and f''
- Relationship between the concavity of f and the sign of f''
- Points of inflection as places where concavity changes

AUTHENTIC ASSESSMENTS

Teacher
Use Only

January/February: AP Calculus**Essential Understanding:** Derivatives are used to analyze graphs of functions**Indicators:****Applications of derivatives**

- Analysis of curves, including the notions of monotonicity and concavity
- Optimization, both absolute (global) and relative (local) extreme
- Modeling rates of change, including related rates problems
- Use of implicit differentiation to find the derivative of an inverse function
- Interpretation of the derivative as a rate of change in varied applied contexts, including velocity, speed, and acceleration
- Geometric interpretation of differential equations via slope fields and the relationship between slope fields and solution curves for differential equations

Computation of derivatives

- Knowledge of derivatives of basic functions, including power, exponential, logarithmic, trigonometric, and inverse trigonometric functions
- Derivative rules for sums, products, and quotients of functions
- Chain rule and implicit differentiation

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March/April: AP Calculus**Essential Understanding:** Definite integrals are used in a variety of applications and situations**Indicators:****Interpretations and properties of definite integrals**

- Definite integral as a limit of Riemann sums
- Definite integral of the rate of change of a quantity over an interval interpreted as the change of the quantity over the interval.
- Basic properties of definite integrals (examples include additivity and linearity)

Applications of integrals Appropriate integrals are used in a variety of applications to model physical, biological, or economic situations. Although only a sampling of applications can be included in any specific course, students should be able to adapt their knowledge and techniques to solve other similar application problems. Whatever applications are chosen, the emphasis is on using the method of setting up an approximating Riemann sum and representing its limit as a definite integral. To provide a common foundation, specific applications should include finding the area of a region, the volume of a solid with known cross sections, the average value of a function, the distance traveled by a particle along a line, and accumulated change from a rate of change.

Fundamental Theorem of Calculus

- Use of the Fundamental Theorem to evaluate definite integrals
- Use of the Fundamental Theorem to represent a particular antiderivative, and the analytical and graphical analysis of functions so defined

Numerical approximations to definite integrals Use of Riemann sums (using left, right, and midpoint evaluation points) and trapezoidal sums to approximate definite integrals of functions represented algebraically, graphically, and by tables of values

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May

Essential Understanding: Antiderivatives are found using a variety of methods

Indicators:**Techniques of antidifferentiation**

- Antiderivatives following directly from derivatives of basic functions
- Antiderivatives by substitution of variables (including change of limits for definite integrals)

Applications of antidifferentiation

- Finding specific antiderivatives using initial conditions, including applications to motion along a line
- Solving separable differential equations and using them in modeling (including the study of the equation $y' = ky$ and exponential growth)

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