CURRICULUM MANAGEMENT SYSTEM

MONROE TOWNSHIP SCHOOLS

Course Name: Fundamentals of Math Grade 12
Grade 12

For adoption by all regular education programs as specified and for adoption or adaptation by all Special Education Programs in accordance with Board of Education Policy # 2220.

Board Approved: -------, 2011

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ACKNOWLEDGEMENTS

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VISION, MISSION, AND GOALS

Vision Statement

The Monroe Township Board of Education commits itself to all children by preparing them to reach their full potential and to function in a global society through a preeminent education.

Mission Statement

The Monroe Public Schools in collaboration with the members of the community shall ensure that all children receive an exemplary education by well trained committed staff in a safe and orderly environment.

Goals

Raise achievement for all students paying particular attention to disparities between subgroups.

Systematically collect, analyze, and evaluate available data to inform all decisions.

Improve business efficiencies where possible to reduce overall operating costs.

Provide support programs for students across the continuum of academic achievement with an emphasis on those who are in the middle.

Provide early interventions for all students who are at risk of not reaching their full potential.

PHILOSOPHY

Monroe Township Schools are committed to providing all students with a quality education resulting in life-long learners who can succeed in a global society. The mathematics program, grades K-12, is predicted on that belief and is guided by the following six principals as stated by the National Council of Teachers of Mathematics (NCTM) in the *Principles and Standards for School Mathematics, 2000.* First, a mathematics education requires equity. All students will be given worthwhile opportunities and strong support to meet high mathematical expectations. Second, a coherent mathematics curriculum will effectively organize, integrate, and articulate important mathematical ideas across the grades. Third, effective mathematics teaching requires the following: a) knowing and understanding mathematics, students as learners, and pedagogical strategies, b) having a challenging and supportive classroom environment and c) continually reflecting on and refining instructional practice. Fourth, students must learn mathematics with understanding. A student's prior experiences and knowledge will actively build new knowledge. Fifth, assessment should support the learning of important mathematics and provide useful information to both teachers and students. Lastly, technology enhances mathematics learning, supports effective mathematics teaching, and influences what mathematics is taught.

As students begin their mathematics education in Monroe Township, classroom instruction will reflect the best thinking of the day. Children will engage in a wide variety of learning activities designed to develop their ability to reason and solve complex problems. Calculators, computers, manipulatives, technology, and the Internet will be used as tools to enhance learning and assist in problem solving. Group work, projects, literature, and interdisciplinary activities will make mathematics more meaningful and aid understanding. Classroom instruction will be designed to meet the learning needs of all children and will reflect a variety of learning styles.

In this changing world those who have a good understanding of mathematics will have many opportunities and doors open to them throughout their lives. Mathematics is not for the select few but rather is for everyone. Monroe township Schools are committed to providing all students with the opportunity and the support necessary to learn significant mathematics with depth and understanding. This curriculum guide is designed to be a resource for staff members and to provide guidance in the planning, delivery, and assessment of mathematics instruction.

EDUCATIONAL GOALS

This course, Fundamentals of Mathematics Grade 12, is designed for those students who have been unsuccessful in passing the grade 11 HSPA test administered during the junior year of high school. Students will have the opportunity to strengthen skills in area of mathematics. The curriculum for this course will support the HSPA curriculum through pre-teaching and re-teaching strategies. HSPA topics include: **A) Cluster I: Number Sense, Concepts, and Applications. B) Cluster II: Spatial Sense and Geometry. C) Data Analysis, Probability, Statistics, and Discrete Mathematics. D) Cluster IV: Patterns, Functions, and Algebra.** The students are tested on these topics on the HSPA exam and on the alternate high school assessment (AHSA) In addition, this course will prepare students for the AHSA test to be administered during class and the March administration of the HSPA.

NJDOE: CORE CURRICULUM CONTENT STANDARDS

A note about Common Core State Standards for Mathematics

The Common Core State Standards for Mathematics were adopted by the state of New Jersey in 2010. The standards referenced in this curriculum guide refer to these new standards and may be found in the Curriculum folder on the district servers. A complete copy of the new Common Core State Standards for Mathematics and the end of year algebra 1 test content standards may also be found at:

http://www.corestandards.org/the-standards
http://www.achieve.org/AlgebraITestOverview

Quarter I	
Big Idea I: Equivalence	**Big Idea II: Transformation**
1. Real numbers o Rational numbers o Irrational numbers 2. Powers, roots, and exponents 3. Absolute value 4. Scientific notation 5. Properties of equivalence relations (e.g., reflexive, symmetric, transitive) 6. Properties of arithmetic operations (e.g., associative, commutative) 7. Primes, factors, and multiples 8. Ratio 9. Proportion 10. Percent (less than, greater than, or equal to 100%)	1. Geometric terms (e.g. point, ray, line, angle, plane, side, vertices, polygon, face, polyhedron, circle, sphere) 2. Standard notations used in geometry 3. Properties of geometric figures 4. Fundamental relationships between geometric figures (e.g., parallelism, perpendicularity, intersection, congruence, similarity) 5. Inductive and deductive reasoning 6. Spatial relationships (e.g., direction, orientation, and perspective of objects in space) 7. Congruence 8. Similarity 9. Symmetry 10. Transformations a. Rotations b. Reflections c. Translations d. Dilations 11. The rectangular coordinate system 12. Matrices 13. Tessellations 14. Vectors
Quarter I	
Big Idea III: Measurement	
1. Measurable attributes (e.g., perimeter, circumference, area, surface area, volume, angle measure) 2. Standard and non-standard units of measure 3. Dimensions, shapes, and properties of figures and objects 4. Right triangle relationships 5. The Pythagorean Theorem 6. Basic trigonometric ratios	

Quarter II	
Big Idea IV: Risk	**Big Idea V: Patterns**
1. Expected value of a probability-based games 2. Determining whether the game is fair 3. Calculate geometric probabilities 4. Model situations involving probability with simulations and theoretical models 5. Probability Models 6. Determine probabilities in complex situations ▪ Conditional events ▪ Complementary events ▪ Dependent and independent events 7. Theoretical probabilities 8. Predictions based on experimental and theoretical probabilities. 9. "Law of Large numbers"	1. Combinations with replacement 2. Combinations without replacement 3. Multiplication rule of counting in complex situations 1. Replacement 2. Without replacement 3. Ordered counting situations 4. Unordered counting situations 4. Justify solutions to counting problems. 5. Pascal's Triangle 6. Sequences and Series 7. Explicit formulas for n^{th} terms 8. Sums of finite arithmetic series 9. Sums of finite and infinite geometric series 10. Informal notation of limit 11. Inductive reasoning to form generalizations
Quarter II	
Big Idea VI: Data Analysis	
1. Surveys and sampling techniques a. sample selection methods 2. Evaluate the use of data in real-world contexts. a. Accuracy and reasonableness of conclusions b. Bias in conclusions drawn c. Statistical claims based on sampling 3. Statistical experiments 4. Lines of best fit or curves of best fit 5. Analyze data using technology 6. Use statistical terminology to describe conclusions. • Measures of dispersion a) Variance b)Standard deviation c) Outliers • Correlation coefficient • Normal distribution	

Quarter III

AHSA TESTING PROCESS FOR SENIORS CYCLE 1

Big Idea VII: Relationships

1. Relations and Functions
   a. Representations of relations and functions
      - ❖ Equations
      - ❖ Inequalities
      - ❖ Tables
      - ❖ Graphs.
2. Properties and behavior of functions of one variable
   a. Slope of a line or curve
   b. Domain and range
   c. Intercepts
   d. Continuity
   e. Maximum/minimum
   f. Estimating roots of equations
   g. Intersecting points as solutions of systems of equations
   h. Rates of change
3. Transformations
   a. Translations
   b. Reflections
   c. Dilations
   d. Parameters of linear and quadratic graphs
   e. Complex functions using technology
4. Classes of functions
   a. Exponential
   b. Polynomial
   c. Rational
   d. Trigonometric functions
5. Properties
   a. Linear vs. non-linear
   b. Symmetry
   c. Increasing/decreasing on an interval

Big Idea VIII: Modeling

1. Model real-world phenomena
2. Solve equations
   a. Linear
   b. Quadratic
   c. Exponential
   d. Periodic
      - ❖ Sine
      - ❖ Cosine
   e. Step functions
   f. Direct and inverse variation
   g. Absolute value
   h. Expressions, equations and inequalities
   i. Exponential Growth/decay
   j. Applications in mathematics, biology, and economics
      - ❖ Compound interest
3. Independent variable and dependent variables
4. Recursive formulas

Quarter IV	
AHSA TESTING PROCESS FOR SENIORS CYCLE 2	
Big Idea IX: Equivalence	**Big Idea X: Networks**
1. Evaluate and simplify expressions. ▪ Add and subtract polynomials ▪ Multiply a polynomial by a monomial or binomial ▪ Divide a polynomial by a monomial 2. Select and use appropriate methods to solve equations and inequalities. ▪ Linear equations - algebraically ▪ Quadratic equations - factoring (when the coefficient of x^2 is 1) and using the quadratic formula ▪ All types of equations using graphing, computer, and graphing calculator techniques ▪ Judge the meaning, utility, and reasonableness of the results of symbol manipulations, including those carried out by technology	1. Use vertex-edge graphs and algorithmic thinking to represent and solve practical problems. ▪ Circuits that include every edge in a graph ▪ Circuits that include every vertex in a graph ▪ Scheduling problems (e.g., when project meetings should be scheduled to avoid conflicts) using graph coloring ▪ Applications to science (e.g., who-eats-whom graphs, genetic trees, molecular structures) 2. Explore strategies for making fair decisions. ▪ Combining individual preferences into a group decision (e.g., determining winner of an election or selection process) ▪ Determining how many Student Council representatives each class (9th, 10th, 11th, and 12th grade) gets when the classes have unequal sizes (apportionment).

CORE CONTENT STANDARDS:

Core Content Overview	
Big Idea I: Equivalence	**N-RN.1.** Explain how the definition of the meaning of rational exponents follows from extending the properties of integer exponents to those values, allowing for a notation for radicals in terms of rational exponents. *For example, we define $5^{1/3}$ to be the cube root of 5 because we want $(5^{1/3})^3 = 5^{(1/3)3}$ to hold, so $(5^{1/3})^3$ must equal 5.* **N-RN.2.** Rewrite expressions involving radicals and rational exponents using the properties of exponents. **N-Q.1.** Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. **N-Q.2.** Define appropriate quantities for the purpose of descriptive modeling. **N-Q.3.** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. **A-APR.1.** Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials. **A-APR.7.** (+) Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions. ***Modeling*** *is best interpreted not as a collection of isolated topics but rather in relation to other standards. Making mathematical models is a Standard for Mathematical Practice, and specific modeling standards appear throughout the high school standards indicated by a star symbol* (*).
Big Idea II: Transformation	**G-SRT.1.** Verify experimentally the properties of dilations given by a center and a scale factor: a. A dilation takes a line not passing through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged. b. The dilation of a line segment is longer or shorter in the ratio given by the scale factor. **G-SRT.2.** Given two figures, use the definition of similarity in terms of similarity transformations to decide if they are similar; explain using similarity transformations the meaning of similarity for triangles as the equality of all corresponding pairs of angles and the proportionality of all corresponding pairs of sides. **G-SRT.3.** Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar. **G-SRT.4.** Prove theorems about triangles. *Theorems include: a line parallel to one side of a triangle divides the other two proportionally, and conversely; the Pythagorean Theorem proved using triangle similarity.* **G-SRT.5.** Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures. **G-GPE.5.** Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or

CORE CONTENT STANDARDS:

Core Content Overview	
	perpendicular to a given line that passes through a given point). **G-GPE.6.** Find the point on a directed line segment between two given points that partitions the segment in a given ratio. **G-GMD.4.** Identify the shapes of two-dimensional cross-sections of three-dimensional objects, and identify three-dimensional objects generated by rotations of two-dimensional objects. **G-MG.3.** Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).* **N-VM.1.** (+) Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g., $\boldsymbol{v}$, $\lvert\boldsymbol{v}\rvert$, $\lVert\boldsymbol{v}\rVert$, v). **N-VM.2.** (+) Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point. **N-VM.3.** (+) Solve problems involving velocity and other quantities that can be represented by vectors. **N-VM.6.** (+) Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network. **N-VM.7.** (+) Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled. ***Modeling*** *is best interpreted not as a collection of isolated topics but rather in relation to other standards. Making mathematical models is a Standard for Mathematical Practice, and specific modeling standards appear throughout the high school standards indicated by a star symbol* (*).
Big Idea III: Measurement	**G-SRT.6.** Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles. **G-SRT.7.** Explain and use the relationship between the sine and cosine of complementary angles. **G-SRT.8.** Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.* **G-C.2.** Identify and describe relationships among inscribed angles, radii, and chords. *Include the relationship between central, inscribed, and circumscribed angles; inscribed angles on a diameter are right angles; the radius of a circle is perpendicular to the tangent where the radius intersects the circle.* **G-C.5.** Derive using similarity the fact that the length of the arc intercepted by an angle is proportional to the radius, and define the radian measure of the angle as the constant of proportionality; derive the formula for the area of a sector. **G-GPE.4.** Use coordinates to prove simple geometric theorems algebraically. *For example, prove or disprove that a figure defined by four given points in the coordinate plane is a rectangle; prove or disprove that the point (1, √3) lies on the circle centered at the origin and containing the point (0, 2).*

CORE CONTENT STANDARDS:

Core Content Overview	
	G-GPE.7. Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.* **G-GMD.3.** Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.* **G-MG.1.** Use geometric shapes, their measures, and their properties to describe objects (e.g., modeling a tree trunk or a human torso as a cylinder).* **G-MG.2.** Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).* **G-MG.3.** Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).* ***Modeling*** *is best interpreted not as a collection of isolated topics but rather in relation to other standards. Making mathematical models is a Standard for Mathematical Practice, and specific modeling standards appear throughout the high school standards indicated by a star symbol (*).*
Big Idea IV: Risk	**S-CP.1.** Describe events as subsets of a sample space (the set of outcomes) using characteristics (or categories) of the outcomes, or as unions, intersections, or complements of other events ("or," "and," "not"). **S-CP.2.** Understand that two events *A* and *B* are independent if the probability of *A* and *B* occurring together is the product of their probabilities, and use this characterization to determine if they are independent. **S-CP.3.** Understand the conditional probability of *A* given *B* as *P*(*A* and *B*)/*P*(*B*), and interpret independence of *A* and *B* as saying that the conditional probability of *A* given *B* is the same as the probability of *A*, and the conditional probability of *B* given *A* is the same as the probability of *B*. **S-CP.4.** Construct and interpret two-way frequency tables of data when two categories are associated with each object being classified. Use the two-way table as a sample space to decide if events are independent and to approximate conditional probabilities. *For example, collect data from a random sample of students in your school on their favorite subject among math, science, and English. Estimate the probability that a randomly selected student from your school will favor science given that the student is in tenth grade. Do the same for other subjects and compare the results.* **S-CP.5.** Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. *For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.* **S-CP.6.** Find the conditional probability of *A* given *B* as the fraction of *B*'s outcomes that also belong to *A*, and interpret the answer in terms of the model. **S-CP.7.** Apply the Addition Rule, P(A or B) = P(A) + P(B) – P(A and B), and interpret the answer in terms of the model. **S-CP.8.** (+) Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B|A) = P(B)P(A|B), and interpret the answer in terms of the model. **A-APR.5.** (+) Know and apply the Binomial Theorem for the expansion of $(x + y)^n$ in powers of *x* and *y* for a positive integer *n*, where *x* and *y* are any numbers, with coefficients determined for example by Pascal's Triangle.[1]

CORE CONTENT STANDARDS:

Core Content Overview	
Big Idea V: Patterns	**S-CP.5.** Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations. *For example, compare the chance of having lung cancer if you are a smoker with the chance of being a smoker if you have lung cancer.* **S-CP.6.** Find the conditional probability of *A* given *B* as the fraction of *B*'s outcomes that also belong to *A*, and interpret the answer in terms of the model. **S-CP.8.** (+) Apply the general Multiplication Rule in a uniform probability model, P(A and B) = P(A)P(B|A) = P(B)P(A|B), and interpret the answer in terms of the model. **S-CP.9.** (+) Use permutations and combinations to compute probabilities of compound events and solve problems. **F-IF.3.** Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. *For example, the Fibonacci sequence is defined recursively by f(0) = f(1) = 1, f(n+1) = f(n) + f(n-1) for n ≥ 1.* **F-BF.2.** Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.* ***Modeling*** *is best interpreted not as a collection of isolated topics but rather in relation to other standards. Making mathematical models is a Standard for Mathematical Practice, and specific modeling standards appear throughout the high school standards indicated by a star symbol* (*).
Big Idea VI: Data Analysis	**S-ID.1.** Represent data with plots on the real number line (dot plots, histograms, and box plots). **S-ID.2.** Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets. **S-ID.3.** Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers). **S-ID.4.** Use the mean and standard deviation of a data set to fit it to a normal distribution and to estimate population percentages. Recognize that there are data sets for which such a procedure is not appropriate. Use calculators, spreadsheets, and tables to estimate areas under the normal curve. **S-ID.6.** Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. a. Fit a function to the data; use functions fitted to data to solve problems in the context of the data. Use given functions or choose a function suggested by the context. Emphasize linear, quadratic, and exponential models. b. Informally assess the fit of a function by plotting and analyzing residuals. c. Fit a linear function for a scatter plot that suggests a linear association. **S-ID.7.** Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data. **S-ID.8.** Compute (using technology) and interpret the correlation coefficient of a linear fit.

CORE CONTENT STANDARDS:

Core Content Overview	
	Modeling *is best interpreted not as a collection of isolated topics but rather in relation to other standards. Making mathematical models is a Standard for Mathematical Practice, and specific modeling standards appear throughout the high school standards indicated by a star symbol* (*).
Big Idea VII: Relationships	**A-APR.3.** Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial. **A-REI.1.** Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method. **A-REI.3.** Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. **A-REI.5.** Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions. **A-REI.6.** Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. **A-REI.7.** Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line $y = -3x$ and the circle $x^2 + y^2 = 3$. **A-REI.10.** Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line). **A-REI.11.** Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.* **A-REI.12.** Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes. **F-IF.1.** Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$. **F-IF.2.** Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context. **F-IF.4.** For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.**

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Core Content Overview	
	F-IF.5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.** **F-IF.6.** Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.* **F-IF.7.** Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.* a. Graph linear and quadratic functions and show intercepts, maxima, and minima. b. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior. c. (+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior. **F-IF.8.** Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context. **F-IF.9.** Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.* **F-BF.1.** Write a function that describes a relationship between two quantities.* b. Determine an explicit expression, a recursive process, or steps for calculation from a context. c. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.* d. (+) Compose functions. *For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.* **F-BF.3.** Identify the effect on the graph of replacing $f(x)$ by $f(x) + k$, $k\,f(x)$, $f(kx)$, and $f(x + k)$ for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them. ***Modeling*** *is best interpreted not as a collection of isolated topics but rather in relation to other standards. Making mathematical models is a Standard for Mathematical Practice, and specific modeling standards appear throughout the high school standards indicated by a star symbol* (*).
Big Idea VIII: Modeling	**A-CED.1.** Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear and quadratic functions, and simple rational and exponential functions.* **A-CED.2.** Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales. **A-CED.3.** Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable

Core Content Overview

options in a modeling context. *For example, represent inequalities describing nutritional and cost constraints on combinations of different foods.*

A-CED.4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.*

A-REI.1. Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

A-REI.2. Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise.

A-REI.3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.

A-REI.4. Solve quadratic equations in one variable.

a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form.
b. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b.

A-REI.5. Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions.

A-REI.6. Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

A-REI.7. Solve a simple system consisting of a linear equation and a quadratic equation in two variables algebraically and graphically. For example, find the points of intersection between the line $y = -3x$ and the circle $x^2 + y^2 = 3$.

A-REI.8. (+) Represent a system of linear equations as a single matrix equation in a vector variable.

A-REI.10. Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

A-REI.11. Explain why the x-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.*

A-REI.12. Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

CORE CONTENT STANDARDS:

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F-IF.1. Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If *f* is a function and *x* is an element of its domain, then *f*(*x*) denotes the output of *f* corresponding to the input *x*. The graph of *f* is the graph of the equation *y* = *f*(*x*).

F-IF.2. Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

F-IF.3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. *For example, the Fibonacci sequence is defined recursively by f(0) = f(1) = 1, f(n+1) = f(n) + f(n-1) for n ≥ 1.*

F-IF.4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.**

F-IF.5. Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.**

F-IF.6. Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.*

F-IF.7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*

a. Graph linear and quadratic functions and show intercepts, maxima, and minima.
b. Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.
c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.
d. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

F-IF.8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
b. Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as y = (1.02)t, y = (0.97)t, y = (1.01)12t, y = (1.2)t/10, and classify them as representing exponential growth or decay.

F-IF.9. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*

F-BF.1. Write a function that describes a relationship between two quantities.*

a. Determine an explicit expression, a recursive process, or steps for calculation from a context.
b. Combine standard function types using arithmetic operations. *For example, build a function that models the temperature of a cooling body by adding a constant function to a decaying exponential, and relate these functions to the model.*

CORE CONTENT STANDARDS:

Core Content Overview	
	c. (+) Compose functions. *For example, if T(y) is the temperature in the atmosphere as a function of height, and h(t) is the height of a weather balloon as a function of time, then T(h(t)) is the temperature at the location of the weather balloon as a function of time.* **F-BF.2.** Write arithmetic and geometric sequences both recursively and with an explicit formula, use them to model situations, and translate between the two forms.* **F-LE.1.** Distinguish between situations that can be modeled with linear functions and with exponential functions. a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals. b. Recognize situations in which one quantity changes at a constant rate per unit interval relative to another. c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another. **F-LE.2.** Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table). **F-LE.3.** Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function. **F-LE.5.** Interpret the parameters in a linear or exponential function in terms of a context. ***Modeling*** *is best interpreted not as a collection of isolated topics but rather in relation to other standards. Making mathematical models is a Standard for Mathematical Practice, and specific modeling standards appear throughout the high school standards indicated by a star symbol (*).*
Big Idea IX: Equivalence	**A-CED.4.** Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.* **A-REI.2.** Solve simple rational and radical equations in one variable, and give examples showing how extraneous solutions may arise. **A-REI.3.** Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters. **A-REI.4.** Solve quadratic equations in one variable. a. Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x - p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form. b. Solve quadratic equations by inspection (e.g., for $x^2 = 49$), taking square roots, completing the square, the quadratic formula and factoring, as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as $a \pm bi$ for real numbers a and b. **F-IF.8.** Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function. a. Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.

CORE CONTENT STANDARDS:

Core Content Overview	
	b. Use the properties of exponents to interpret expressions for exponential functions. For example, identify percent rate of change in functions such as y = (1.02)t, y = (0.97)t, y = (1.01)12t, y = (1.2)t/10, and classify them as representing exponential growth or decay. **A-APR.1.** Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials. **A-APR.7.** (+) Understand that rational expressions form a system analogous to the rational numbers, closed under addition, subtraction, multiplication, and division by a nonzero rational expression; add, subtract, multiply, and divide rational expressions. ***Modeling*** *is best interpreted not as a collection of isolated topics but rather in relation to other standards. Making mathematical models is a Standard for Mathematical Practice, and specific modeling standards appear throughout the high school standards indicated by a star symbol* (*).
Big Idea X: Networks	**N-VM.6.** (+) Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network. ***Modeling*** *is best interpreted not as a collection of isolated topics but rather in relation to other standards. Making mathematical models is a Standard for Mathematical Practice, and specific modeling standards appear throughout the high school standards indicated by a star symbol (*).*

BIG IDEA I: EQUIVALENCE

Curriculum Management System

COURSE NAME: FUNDAMENTALS OF MATH GRADE 12

OVERARCHING GOALS

1. ***Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.***
2. ***Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.***
3. ***Investigate, research, and synthesize various pieces of information from a variety of media sources.***

ESSENTIAL QUESTIONS

- How do Mathematical ideas **interconnect** and build on one another resulting in a **coherent whole**?
- How are numbers applied in **real-world** situations?
- Does this **make sense**?

SUGGESTED BLOCKS FOR INSTRUCTION: 7-8

<table>
<tr><th>KNOW</th><th>UNDERSTAND</th><th>DO</th></tr>
<tr><td>Students will know that:</td><td>Students will understand that:</td><td>Students will be able to:</td></tr>
<tr><td>

- **Real numbers** are all values that are found on a number line
- **Rational numbers** can be written in the form a/b where a and b are both integers and $b \neq 0$
- **Irrational numbers** cannot be written in the form a/b.
- A **terminating decimal** has finite number of digits
- A **repeating decimal** has a digit or sequence of digits that repeats indefinitely
- **Integers** are the set of positive and negative whole numbers
- **Square root** is one of the two equal factors of a number

</td><td rowspan="2">

- Mathematical ideas **interconnect** and build on one another resulting in a **coherent whole**.
- Understand types of numbers, our numeration system, and the different ways they are applied and used in real-life situations

SAMPLE CONCEPTUAL UNDERSTANDINGS

SAMPLE MULTIPLE CHOICE RESPONSE ITEM

What set of numbers does π belong to?

A. Rational numbers
B. Irrational numbers
C. Repeating decimal
D. Terminating decimal number

SAMPLE SHORT CONSTRUCTED RESPONSE (NJDOE TEST SPECIFICATIONS LINK)

Tonya's little brother has accidentally spilled chocolate sauce on one of Tonya's homework problems:
$(5.382 \times 10^5) \times (2.\blacksquare\blacksquare\blacksquare \times 10^2)$
If three digits are unreadable, give the range of possible values for the product.
Answer: $(10.764 \times 10^7 \leq p \leq 16.141 \times 10^7)$

SAMPLE MULTIPLE CHOICE RESPONSE ITEM

Compare the following numbers and decide which one is the greatest?

A. 5.5×10^{-3}
B. 5.5×10^{3}
C. -5.5×10^{-3}
D. -5.5×10^{3}

</td><td>

- Extend understanding of the number system
- Compare and order rational and irrational numbers
- Extend understanding and use of operations to include real numbers and algebraic procedures
- Develop, apply and explain various methods for solving problems involving exponents including rational and negative exponents
- Distinguish between terminating and repeating decimal forms of rational numbers
- Recognize that mathematics is used in a variety of contexts

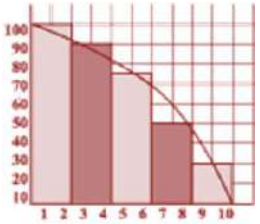
</td></tr>
<tr><td>

- To multiply powers having the same base, the exponents are added.
- To find the power of a power, multiply the exponents. To find a power of product, find the power of each factor and multiply.
- A non-zero number to the zero power is 1.
- $a^{-n} = \frac{1}{a^n}; a \neq 0$
- **Exponentia**l function is of the form: $y = a \cdot b^x$
- Quotient of powers property states to divide powers having the same base, subtract

</td><td>

- Determine whether or not properties of equivalence relations and arithmetic operations apply to different relations and operations
- Evaluate and write expressions containing exponents
- Recognize that mathematical facts, procedures, and claims have to be justified
- Use verbal and algebraic models to represent real-life situations.
- Solve simple quadratic equations
- Determine exponential growth and decay factors
- Use technology to gather, analyze,

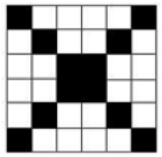
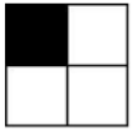
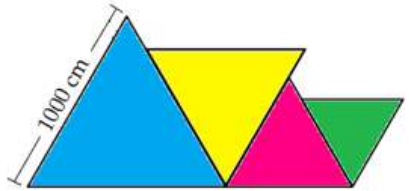
</td></tr>
</table>

KNOW		UNDERSTAND	DO
Students will know that:		*Students will understand that:*	*Students will be able to:*
	exponents. • Power of a quotient property states to find the power of the quotient, find the power of the numerator and the power of the denominator and divide. • All positive real numbers have two square roots: a positive and negative square root. The positive square root is called the principle square root. • The number or expression inside a radical symbol $(\sqrt{\ })$ is the radicand. • The square root of a negative number is undefined. • Numbers whose square roots are integers or quotients of integers are called perfect squares.	**SAMPLE OPEN ENDED RESPONSE** (NJDOE TEST SPECIFICATIONS LINK) Every Tuesday, at the Dog Deli, the manager gives away free hot dogs and soda. Every sixth customer gets a free soda, and every eighth customer gets a free hot dog. The Dog Deli served 73 customers last Tuesday. • How many free sodas did the Dog Deli give away last Tuesday? How many hot dogs were given away? • Did any customers receive both a free hot dog and a free soda? If so, how many customers? • If a soda sells for 99¢ and a hot dog sells for $1.99, how much did the Dog Deli lose in income by giving away these items?	and communicate mathematical information
	• **Absolute value** of a number is the distance of a value from zero on the number line.		• Use absolute values, exponents, and approximations for roots of numbers in real-life situations
	• **Scientific notation** is of the form $c \times 10^n$ where $1 \leq c < 10$ and n is an integer.		• Distinguish between rational and irrational numbers from their decimal representations
	• The **reflexive** property of equality states that any quantity is equal to itself • The **symmetric** property of equality states that if first quantity equals the second, then the second quantity also equals the first	**SAMPLE OPEN ENDED RESPONSE** (NJDOE TEST SPECIFICATIONS LINK)  • Find the length, width, and area of each of the 5 shaded rectangles. • What is the total area represented by the 5 rectangles? • How do you think the area of the 5 rectangles compares to the area of the region under the curve? Explain your reasoning. ***Justify your answers.***	• Apply approximation techniques to situations involving initial portions of infinite decimal

KNOW		UNDERSTAND	DO
Students will know that:		*Students will understand that:*	*Students will be able to:*
	• The **transitive** property of equality states that when one quantity equals the second quantity and the second quantity equals a third quantity, then the first and the third quantity are equal • The **substitution** property of equality states that a quantity may be substituted for its equal in a given expression	**SAMPLE SHORT CONSTRUCTED RESPONSE** (NJDOE TEST SPECIFICATIONS LINK) In the compound interest formula $A = P(1 + r/n)^{nt}$, A represents the value of the investment in the future, P is the amount of the original investment, r is the annual interest rate, t is the number of years of the investment, and n is the number of times the interest is compounded each year. Find the total amount after $2500 is invested for 18 years at a rate of 6%, compounded quarterly. (*Answer:* $7302.89)	
	• **Commutative property** of addition and multiplication states that the order in which numbers are added/multiplied does not change the sum/product • **Associative property** of addition/multiplication states that the way numbers/factors are grouped does not change the sum/product • **Distributive property** states that the product of a factor and a sum or difference is the same as the sum or difference of two products	**SAMPLE SHORT CONSTRUCTED RESPONSE** In a class 48% students liked math over language. If 252 students liked math, how many students were there in total? Sample Open Ended response Store A and Store B both sell a product for $38.50. During a clearance sale, Store A the price by 35% and then takes off another 20% off the discounted price at the register. Store B offers a onetime discount of 55%. Which store should you buy the product from and why? **SAMPLE SHORT CONSTRUCTED RESPONSE** Kiran and her brother drove to their grandparent's house. Kiran drove for an hour at 40 MPH and her brother drove for 3 hours at 55 MPH. Find the average speed for the entire trip?	• Apply associative, commutative, and distributive properties to simplify algebraic expressions
	• **A factor** is a whole number that can divide another number evenly • **A Multiple** is the product of a given whole number and another number • A **prime number** is a whole	**SAMPLE SHORT CONSTRUCTED RESPONSE** Simran paid $95.20 in sales tax on a TV purchase. If the sales tax rate was 7%, what was the original price of the TV?	• Use primes, factors and multiples in real-world situations • Understand how mathematical ideas interconnect and build on one another to complete a whole

KNOW	UNDERSTAND	DO
Students will know that:	***Students will understand that:***	***Students will be able to:***
number greater than 1 that has exactly two factors, 1 and itself • **A composite number** is a whole number greater than 1 that has more than two factors • **Prime factorization** is an expression that shows the given number as a product of factors that are all prime numbers	**SAMPLE MULTIPLE CHOICE RESPONSE ITEM** If you have a coupon for 25% off on a skirt. The store has already reduced the price of the skirt by 30%. The original price of the skirt was $85, what would be the final sale price before tax? A. 30.00 B. 38.25 C. 44.63 D. 46.75	
• **Ratio** is a comparison of two numbers		• Apply mathematics in practical situations
• **A proportion** is an equation stating that the two ratios are equal • **Cross products** is a way of solving a proportion by multiplying the numerator of each ratio by the denominator of the other ratio • **Apportionment** is the division of something proportionally according to numbers or population	**SAMPLE SHORT CONSTRUCTED RESPONSE** John runs at 12 feet per second and Pam rides her bicycle at 8.5 miles per hour. Who is traveling at a faster rate? Explain and show all your work. **SAMPLE SHORT CONSTRUCTED RESPONSE** (NJDOE TEST SPECIFICATIONS LINK) Find the average rate of speed for the entire trip if a car travels for one hour at 30 mph and two hours at 36 mph. (*Answer:* 34 mph) **SAMPLE OPEN ENDED RESPONSE** (NJDOE TEST SPECIFICATIONS LINK) The original ticket price of a shirt is $25.99. During a clearance sale, this shirt is reduced by 40% of the ticket price; then 25% of the reduced price is taken off at the cash register. • Rounded to the nearest penny, what is the price paid by the customer? (*Answer to first bullet:* $11.69 *or* $11.70) • What price would the customer have paid if this shirt were sold at a one-time reduction of 65% from the	• Use reasoning to support mathematical conclusions and problem solutions • Select and apply a variety of appropriate problem-solving strategies • Solve proportions • Change from a fraction or decimal to a percent and from a percent to a fraction or decimal • Illustrate and model ratios, proportions, and percents in real-life situations • Compare effects of percent decrease and percent increase in price of objects with and without sale tax • Solve a variety of problems using proportions and percents

KNOW	UNDERSTAND	DO
Students will know that:	***Students will understand that:***	***Students will be able to:***
	original price? • Why didn't the store simply sell this shirt at 65% off the original sticker price? **SAMPLE MULTIPLE CHOICE RESPONSE** (NJDOE TEST SPECIFICATIONS LINK) A car was sold at a discount of $700, which represented 5% of the original price. What was the original price? a. $350 b. $1,400 c. $3,500 d. 14,000 * **SAMPLE OPEN ENDED RESPONSE** (NJDOE TEST SPECIFICATIONS LINK) **Monthly Salary Options** Plan A: $1000 + 5% of monthly sales Plan B: 10% of monthly sales ***Sales for the prior salesperson were:*** **January:** $40,000 **February:** $30,000 **March:** $50,000 **April:** 60,000 Based on this information, a. Which salary option would Bob select if he decides to accept the job? b. Explain your answer.	

KNOW	UNDERSTAND	DO
Students will know that:	*Students will understand that:*	*Students will be able to:*
	SAMPLE MULTIPLE CHOICE RESPONSE ITEM (WWW.STATE.NJ.US) Which of the following figures has the same fractional part of the area shaded as the sample below?  A.  B.  C.  D. 	
	SAMPLE SHORT CONSTRUCTED RESPONSE ITEM (ADAPTED FROM: FCAT Released Test Item) Gurpal is painting a mural using equilateral triangles. The first triangles sides measure 1000 cm each. The sides of each subsequent triangle will measure 20% smaller than the previous triangle. What will be the length of the fourth triangle's sides? Show all your work! 	

Assessment Models

- **NOTE: The assessment models provided in this document are suggestions for the teacher. If the teacher chooses to develop his/her own model, *it must be of equal or better quality and at the same or higher cognitive levels (as noted in parentheses*).**
- **Depending upon the needs of the class, the assessment questions may be answered in the form of essays, quizzes, mobiles, PowerPoint, oral reports, booklets, or other formats of measurement used by the teacher.**

Pre-Assessment/Diagnostic Assessment:

- Cluster I assessment
- HSPA sample tests

Open-Ended (Formative) Assessment:

- Group and individual work is assigned daily, from various sources *(Synthesis, Analysis, and Evaluation).*
- Introductory and Closing Activities will be done every day to pre-assess student knowledge and assess understanding of topics *(Synthesis, Analysis, and Evaluation).*

Summative Assessment:

- Assessment questions should be open-ended and should follow the general format illustrated in the Essential Questions/Sample Conceptual Understanding section. *(Synthesis, Analysis, Evaluation)*
- Students will be given quizzes that provide a brief review of the concepts and skills in the previous lessons.
- Students will take the HSPA again
- Students will participate in the AHSA process

Additional Resources

- http://www.state.nj.us/education/njpep/assessment/hspa/hspa_math/main_menu.htm
- ***Primiani, A. Rose and William Caroscio, Prentice Hall Brief Review for New Jersey: HSPA Mathematics, Pearson: 2008***
- ***Sico, John J., HSPA Success Work-A-Text in Mathematics – Expanded Edition, Instructivision: 2003***

21st Century Skills		
Creativity and Innovation	***Critical Thinking and Problem Solving***	***Communication and Collaboration***
Information Literacy	***Media Literacy***	***ICT Literacy***
Life and Career Skills	***Technology Based Activities***	
http://www.p21.org/index.php?option=com_content&task=view&id=254&Itemid=119 http://www.iste.org/standards/nets-for-students.aspx		

Differentiated Learning Activities

- Discuss multiple strategies to solve a given problem
- Have students use the state rubric to grade the responses for open-ended questions
- ***Concept applications: Attendance***
- ***Concept applications: Taxes and deductions***
- ***Concept applications: Commission***

Performance Assessment Task Sample	**Teacher Resources:** ❖ ***Concept applications: Car Maintenance*** ❖ ***Released PAT: Keeping Records at the Gas Station*** ❖ ***Released PAT: Pizza Party*** ❖ ***Released PAT: Credit Card Calculations***

BIG IDEA II: TRANSFORMATION

Curriculum Management System

COURSE NAME: FUNDAMENTALS OF MATH GRADE 12

OVERARCHING GOALS

1. ***Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.***
2. ***Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.***
3. ***Investigate, research, and synthesize various pieces of information from a variety of media sources.***

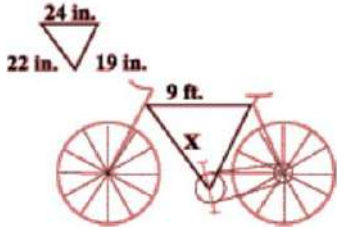
ESSENTIAL QUESTIONS

- How can properties of three-dimensional objects be understood using two-dimensional representations?
- How can geometric models be used to solve real-life problems?
- How can you explain the impact of change in an object's dimensions on its surface area, volume, and perimeter?
- Does this **make sense**?

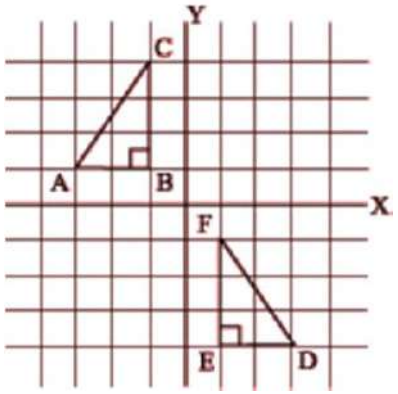
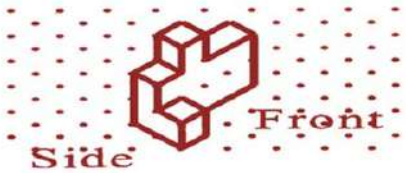
SUGGESTED BLOCKS FOR INSTRUCTION: 7-8

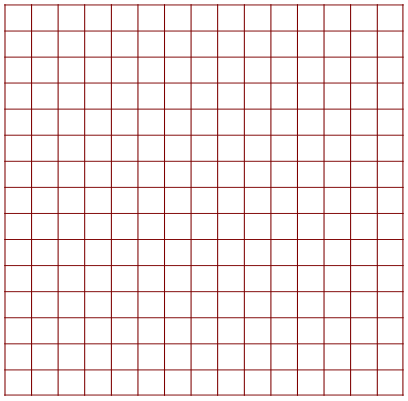
<table>
<tr><th>KNOW</th><th>UNDERSTAND</th><th>DO</th></tr>
<tr><td>Students will know that:</td><td>Students will understand that:</td><td>Students will be able to:</td></tr>
<tr>
<td>• Two points are needed to make a line and it extends in either direction indefinitely
• A ray has a starting point and direction in which it extends indefinitely
• An angle has a vertex and two sides
• A polygon is a closed figure with 3 or more sides that are segments
• Vertex is appoint where the sides of a polygon or the edges of a solid meet
• A plane is a flat surface with no thickness that extends indefinitely in all directions
• A circle is a set of points in a plane that are equidistant from a center point</td>
<td rowspan="3">• Mathematical ideas interconnect and build on one another resulting in a coherent whole.
• The effect of change in the dimensions of an object on its surface area, volume, and perimeter can be expressed mathematically

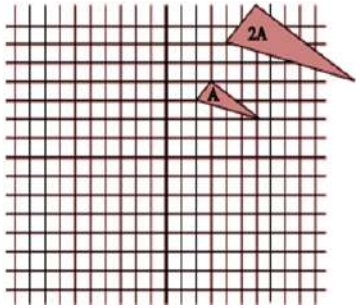
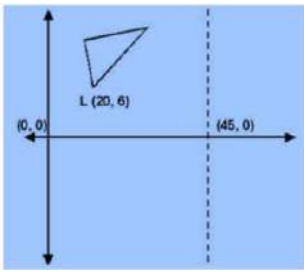
SAMPLE CONCEPTUAL UNDERSTANDINGS

SAMPLE SHORT CONSTRUCTED RESPONSE (NJDOE TEST SPECIFICATIONS LINK)
A billboard designer must enlarge this picture of a bicycle to fit on a large outdoor sign.
 
The actual dimensions of the seat-pedal-handle bar triangle are shown below. The bar connecting the seat with the handle bars, for example, is 24 inches long. The corresponding part on the billboard would be 9 feet long.
 

Find the missing billboard length, X, as shown.</td>
<td>• Use properties, definitions, and relationships to identify, classify, and describe two-dimensional and three-dimensional geometric figures
• Draw two-dimensional representations of three-dimensional objects by sketching shadows, projections, perspectives, and map views
• Recognize, identify, and describe geometric relationships and properties as they exist in nature, art, and other real-world settings
• Apply concepts of symmetry, similarity, and congruence to problem solving</td>
</tr>
<tr>
<td>• The symbol for ray AB is $\overrightarrow{AB}$
• The symbol for line AB is $\overleftrightarrow{AB}$
• The symbol for angle ABC is $\angle ABC$ or $\angle ABC$ or $\angle ABC$
• Symbol for perpendicular lines is given by $\perp$</td>
<td>• Recognize and use symbols appropriately
• Use properties of perpendicular lines to solve problems</td>
</tr>
<tr>
<td>• Squares have four right angles and congruent sides
• The sum of all angles of a
• quadrilateral equals 360 degrees
• Three angles of a triangle add up to 180 degrees
• All sides and angles are congruent</td>
<td>• Use inductive and deductive reasoning to solve real-life problems and justify solutions
• Use properties, definitions, and relationships to identify, classify, and describe two-dimensional and three-dimensional geometric figures</td>
</tr>
</table>

KNOW	UNDERSTAND	DO
Students will know that:	***Students will understand that:***	***Students will be able to:***
in an equilateral triangle • Two consecutive angles in a parallelogram are supplementary • A trapezoid has exactly two sides parallel • Right triangle has a 90 degree angle • Isosceles triangle has two congruent legs and angles • 2 is a parallelogram with congruent sides	(*Answer:* x = 8.25 ft. or 8 ft. 3 in. or 99 in.) **SAMPLE SHORT CONSTRUCTED RESPONSE** What transformation will map $\triangle ABC$ onto $\triangle DEF$?  	• Recognize, identify, and describe geometric relationships and properties that exist in real-world settings
• Two parallel lines cut by a transversal form corresponding angles • Two intersecting lines form two pairs of vertical angles		• Recognize and apply properties of parallel lines and intersecting lines to solve real-life problems
• **Congruent figures** have same shape(same corresponding angles) and size	**SAMPLE SHORT CONSTRUCTED RESPONSE** Given the following isometric drawing:	• Analyze properties of three-dimensional geometric figures by using models and by drawing and interpreting two-dimensional representations of them
• **Similar figures** have same shape and all corresponding sides in the same ratio.	 	• Apply concepts of symmetry, similarity, and congruence to problem solving
• **Dilation** is a transformation in which a figure is proportionally made smaller or larger • The new image after performing a transformation is called an image where as the original is called the preimage • The **line of reflection** is a line in which a figure is flipped in a	Sketch the top, side, and front view of the solid figure. **SAMPLE OPEN ENDED RESPONSE** A boat starts at point A and travels 8 miles east, and then turns south and travels 6 miles to a point B located on the shore of	• Solve real-world and mathematical problems using geometric models • Given the pre-image and transformation, find the image and vice versa • Given the pre-image & image, determine the transformation • Determine the sequence of

KNOW	UNDERSTAND	DO
Students will know that:	***Students will understand that:***	***Students will be able to:***
reflection • The **point of rotation** is the point around which a figure is turned • **Transformation** is a way of changing the position or size of a geometric figure without altering the shape • **Translation** is a form of transformation in which a figure is slid horizontally, vertically, or both	the lake. • Using the grid paper, make a scale drawing using vectors to show the boat's movement, starting from point A. • Draw a vector that would show the direct path from point A to point B. • What would be the approximate number of miles the boat could have traveled along this path? • Approximately how many degrees from North would this path be? Explain how you arrived at your answer. 	transformations needed to map one figure onto another • Determine the sequence of transformations needed to map one figure onto another • Solve problems in geometry using transformations, coordinates, and vectors • Relate the concepts of symmetry, similarity, and congruence to transformations • Predict and represent resulting figures when combining, subdividing, and changing figure
• **Tessellation** results from the use of congruent geometric figures to cover a plane without overlapping and without gaps • A regular tessellation is made up of one type of polygon • A semi-regular tessellation uses more than one type of regular polygon • In a tessellation, the angles of polygons at a vertex add up to 360°	**SAMPLE OPEN-ENDED RESPONSE** (NJDOE TEST SPECIFICATIONS LINK) Figure A below is the original. Figure 2A is an expansion of A with magnitude 2. • Draw a figure with a magnitude of 1/2A. • Draw figure -A by multiplying the coordinates of points on A by a negative 1 (the multiplication by negatives reverses directions). • Give the coordinates of the vertices of triangle -A.	• Recognize regular and semi-regular tessellations • Create an original tessellation • Draw a figure & tessellate it • Solve problems in geometry using transformations, coordinates, and vectors
• **Matrix** is a rectangular array of numbers • The dimensions of matrix are given by $n \times m$ the number of rows (n) by the number of columns (m) • An individual entry in a matrix is		• Perform scalar multiplication on matrices

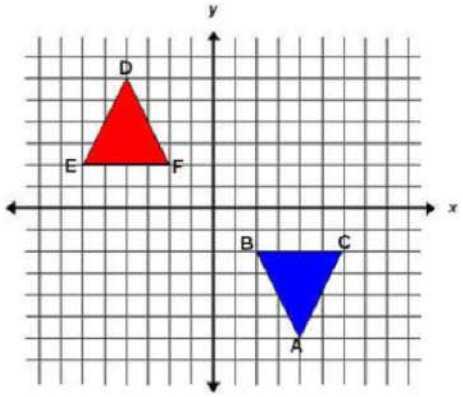
KNOW	UNDERSTAND	DO
Students will know that:	***Students will understand that:***	***Students will be able to:***
called an elements		
• Vectors are used to represent motion • A **vector** is a directed line segment that is shown with an arrow • A vector has both length and direction • The length of a vector can be found using the distance formula • Equivalent vectors have same direction and same magnitude • Two vectors are opposite if they have the same length but opposite direction	**SAMPLE SHORT CONSTRUCTED RESPONSE** (WWW.STATE.NJ.US) A graphic artist designing a company's logo wants to reflect triangle LMN across the dotted line to form triangle PQR. What will the vertex of point P be?  **SAMPLE MULTIPLE CHOICE** (NJDOE TEST SPECIFICATIONS LINK) If a tessellation is made from regular polygons, what is the sum of the measures of the angles that meet at a vertex if the polygons do not overlap? a. 60° b. 90°	• Solve problems in geometry using transformations, coordinates, and vectors

KNOW	UNDERSTAND	DO
Students will know that:	*Students will understand that:*	*Students will be able to:*

c. 180°
d. 360°

SAMPLE MULTIPLE CHOICE (WWW.STATE.NJ.US)

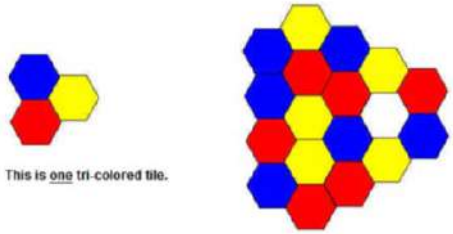
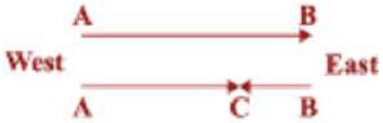
What must happen to triangle ABC to create triangle DEF?

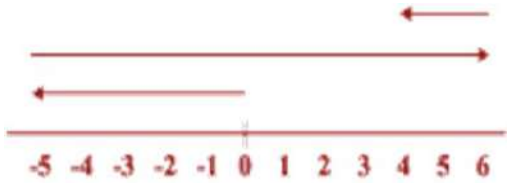
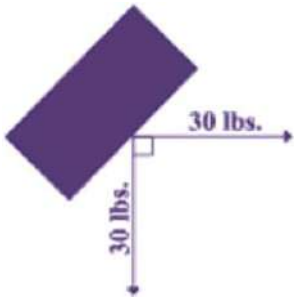


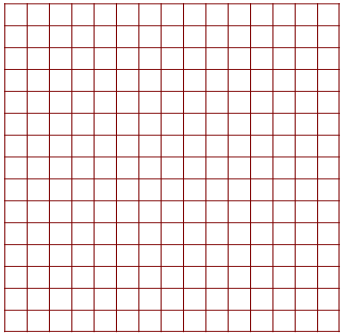
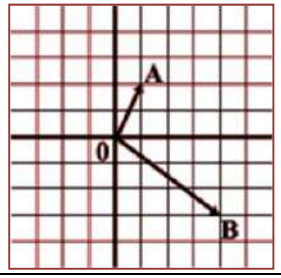
A. Triangle ABC is reflected over X-axis and translated 8 spaces to the left and 4 spaces up
B. Triangle ABC is reflected over Y-axis and translated 4 spaces up.
C. Triangle ABC is reflected over Y-axis and translated 8 spaces to the left
D. Triangle ABC is reflected over X-axis and translated 8 spaces to the left

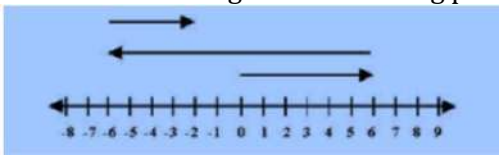
SAMPLE MULTIPLE CHOICE (WWW.STATE.NJ.US)

A stone mason is repaving a school's courtyard with the following 3-color tiles. Given that he is only using these tiles, what color will the white stone in the large area be?

KNOW	UNDERSTAND	DO
Students will know that:	*Students will understand that:*	*Students will be able to:*
	 A. The white space may be any of the three colors B. The white space should be blue C. The white space should be red D. The white space should be yellow **SAMPLE MULTIPLE CHOICE (NJDOE TEST SPECIFICATIONS LINK)** The given vector diagram represents an airplane flying with an air speed of 200 mph directly into a headwind of 30 mph.  What resulting speed and direction of the plane does the vector AC represent? a. 230 mph East b. 170 mph East c. 230 mph West d. 170 mph West **SAMPLE MULTIPLE CHOICE (NJDOE TEST SPECIFICATIONS LINK)**	

KNOW	UNDERSTAND	DO
Students will know that:	***Students will understand that:***	***Students will be able to:***
	The vector diagram below models which addition problem? (Assume the origin is the starting point.)  a. $(-5)+11+(-2)$ * b. $(-5)+6+4$ c. $5+(-11)+2$ d. $5+(-6)+(-4)$ **SAMPLE OPEN-ENDED RESPONSE** (NJDOE TEST SPECIFICATIONS LINK) You may use the grid, a ruler, and protractor to solve this problem  Juan and Carlos need to move a heavy crate which is on a loading platform. The ropes which they attach to it form a right angle. Each boy pulls on his rope with a force of 30 lb.	

KNOW		UNDERSTAND	DO
Students will know that:		*Students will understand that:*	*Students will be able to:*
		Make a vector drawing to present the forces pulling on the crate and the resulting path along which the crate would move. Juan and Carlos know that a single force could have the same result in moving the crate? Approximately how many pounds would this force be, and in what direction? Explain how you arrived at your answer.  **SAMPLE MULTIPLE CHOICE (NJDOE TEST SPECIFICATIONS LINK)** Let vector OA be represented by the ordered pair (1, 2). If vector OB is represented by (4, -3), what ordered pair represents vector AB? 	

KNOW		UNDERSTAND	DO
Students will know that:		*Students will understand that:*	*Students will be able to:*
		Four answer choices given. a. (-3.5) b. $(5,-3)$ c. $(-5,3)$ d. $(3,-5)$ * **SAMPLE MULTIPLE CHOICE (WWW.STATE.NJ.US)** Which addition problem is represented by the following vector diagram? (Assume that the origin is the starting point.  a. $6+(-12)+4$ b. $6+(-6)+(-2)$ c. $6+(-12)+(-2)$ d. $6+(-6)+4$	

Assessment Models

- **NOTE: The assessment models provided in this document are suggestions for the teacher. If the teacher chooses to develop his/her own model, *it must be of equal or better quality and at the same or higher cognitive levels (as noted in parentheses*).**
- **Depending upon the needs of the class, the assessment questions may be answered in the form of essays, quizzes, mobiles, PowerPoint, oral reports, booklets, or other formats of measurement used by the teacher.**

Pre-Assessment/Diagnostic Assessment:

- Cluster 2 problems
- HSPA Practice tests

Open-Ended (Formative) Assessment:

- Group and individual work is assigned daily, from various sources *(Synthesis, Analysis, and Evaluation).*
- Introductory and Closing Activities will be done every day to pre-assess student knowledge and assess understanding of topics *(Synthesis, Analysis, and Evaluation).*

Summative Assessment:

- Assessment questions should be open-ended and should follow the general format illustrated in the Essential Questions/Sample Conceptual Understanding section. *(Synthesis, Analysis, Evaluation)*
- Students will be given quizzes that provide a brief review of the concepts and skills in the previous lessons.
- Students will take the HSPA again
- Students will participate in the AHSA process

Additional Resources

- http://www.state.nj.us/education/njpep/assessment/hspa/hspa_math/main_menu.htm
- ***Primiani, A. Rose and William Caroscio, Prentice Hall Brief Review for New Jersey: HSPA Mathematics, Pearson: 2008***
- ***Sico, John J., HSPA Success Work-A-Text in Mathematics – Expanded Edition, Instructivision: 2003***

21st Century Skills		
Creativity and Innovation	***Critical Thinking and Problem Solving***	***Communication and Collaboration***
Information Literacy	***Media Literacy***	***ICT Literacy***
Life and Career Skills	***Technology Based Activities***	
http://www.p21.org/index.php?option=com_content&task=view&id=254&Itemid=119 http://www.iste.org/standards/nets-for-students.aspx		

Differentiated Learning Activities

- Discuss multiple strategies to solve a given problem
- Have students use the state rubric to grade the responses for open-ended questions
- ***Concept Application: Vectors***
- ***Concept Application: Location***

Performance Assessment Task Sample	**Teacher Resources:** ❖ ***Concept applications: Congruent Triangles*** ❖ ***Concept applications: Nets***

BIG IDEA III: MEASUREMENT

Curriculum Management System

COURSE NAME: FUNDAMENTALS OF MATH GRADE 12

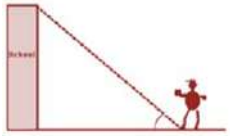
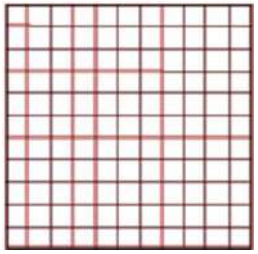
OVERARCHING GOALS

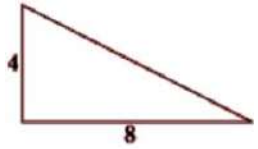
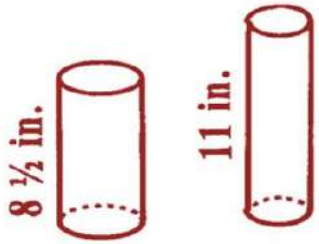
1. ***Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.***
2. ***Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.***
3. ***Investigate, research, and synthesize various pieces of information from a variety of media sources.***

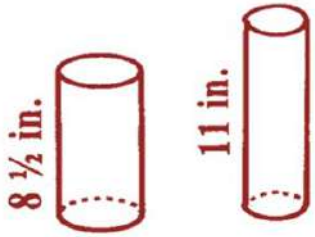
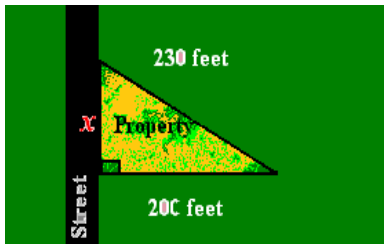
ESSENTIAL QUESTIONS

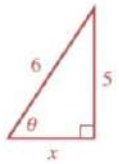
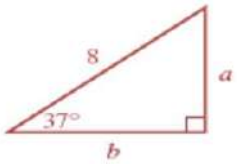
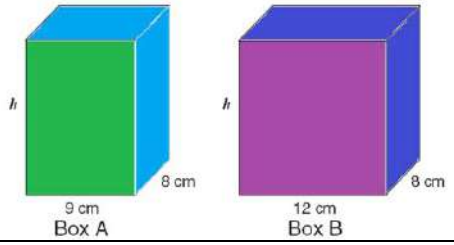
- How can properties of three-dimensional objects be understood using two-dimensional representations?
- How can geometric models be used to solve real-life problems?
- How can you explain the impact of change in an object's dimensions on its surface area, volume, and perimeter?
- Does this **make sense**?

SUGGESTED BLOCKS FOR INSTRUCTION: 7-8

KNOW	UNDERSTAND	DO
Students will know that:	***Students will understand that:***	***Students will be able to:***
• **Area** is the measure, in square units, of the inside of a two-dimensional surface or shape of a three-dimensional object • **Area of a parallelogram** is given by the formula: $A = bh$ • **Area of a triangle** is given by the formula: $A = \frac{1}{2}bh$ • **Area of a trapezoid** is given by the formula: $A = \frac{1}{2}h(b_1 + b_2)$ • **Area of a circle** is given by the formula: $A = \pi r^2$ • **Volume** represents the amount of space enclosed by a three-dimensional shape • **Volume of a cone** is given by the formula: $V = \frac{1}{3}Bh$ where B is the area of the base and *h* is the height of the solid • **Volume of a pyramid** is given by the formula: $V = \frac{1}{3}Bh$ where B is the area of the base and *h* is the height of the solid • **Volume of a cylinder** is given by the formula: $V = Bh$ *or* $\pi r^2 h$ where B is the area of the base and *h* is the height of the solid	• Mathematical ideas **interconnect** and build on one another resulting in a **coherent whole**. • A significant digit in a number is any non-zero digit or any zero that is used other than to locate a decimal **SAMPLE CONCEPTUAL UNDERSTANDINGS** **SAMPLE OPEN-ENDED RESPONSE ITEM** (NJDOE TEST SPECIFICATIONS LINK) Describe in detail how you could use a calculator with trigonometric functions to help find the height of your school building if you knew the distance you were standing from the building and the angle from the ground at your feet to the top of the building.  **SAMPLE SHORT CONSTRUCTED RESPONSE ITEM** (NJDOE TEST SPECIFICATIONS LINK) On the unit-grid in your answer folder, draw a right triangle with an area of 16 square units.  *One possible answer:*	• Utilize appropriate formulas and label answers with appropriate units of measure • Measure geometric objects and determine the degree of accuracy needed when measuring them • Choose the appropriate techniques, tools, and units to measure quantities to achieve the desired level of accuracy

KNOW		UNDERSTAND	DO
Students will know that:		*Students will understand that:*	*Students will be able to:*
	• **Volume of a prism** is given by the formula: $V = Bh$ where B is the area of the base and h is the height of the solid • **Volume of a sphere** is given by the formula: $V = \frac{4}{3}\pi r^3$ where r is the radius	 **SAMPLE OPEN_ENDED RESPONSE ITEM** (NJDOE TEST SPECIFICATIONS LINK) A standard 8 1/2" x 11" sheet of paper is rolled along its short side to form a cylinder as shown.	
	• All non-zero digits are always significant • Zeros between two significant digits are significant (e.g. 5.03 has three significant digits) • Zeros to the right of the decimal point and a significant digit are significant (e.g. 0.0030 has two significant digits) • Placeholders are not significant (e.g. 66,000 has two significant digits)	A second sheet of standard 8 1/2" x 11" paper is rolled along its longer side to form a second cylinder. There is no overlap.  • Will the taller cylinder have the name volume, greater volume, or less volume than that of the short cylinder? • Explain your answer	• Develop and apply a variety of strategies for determining perimeter, circumference, area, surface area, volume, and angle measure • Solve problems using the Pythagorean Theorem • Develop informal ways of approximating the measures of familiar objects • Express mathematically and explain the impact of change in an object's dimensions on its surface area, volume, and/or perimeter • Measure geometric objects and determine the degree of accuracy needed when measuring them
	• **Triangle Inequality Theorem** states that the sum of the lengths of two sides of any triangle is greater than the length of the third side • **Midsegment** of a triangle connects the midpoints of two	**SAMPLE MULTIPLE CHOICE RESPONSE** (NJDOE TEST SPECIFICATIONS LINK) A standard 8 1/2" x 11" sheet of paper is rolled along its short side to form a cylinder as shown. A second sheet of standard 8 1/2" x 11'' paper is rolled along its	• Utilize appropriate formulas and label answers with appropriate units of measure

KNOW		UNDERSTAND	DO
Students will know that:		***Students will understand that:***	***Students will be able to:***
	sides of a triangle and is parallel to the third side	longer side to form a second cylinder. There is no overlap.	
	• **Hypotenuse** is the side of a right triangle that is opposite the right angle • **Leg** is the side of the right triangle adjacent to the hypotenuse • The legs of a right triangle are always perpendicular to each other • **Pythagorean Theorem** states that the sum of the squares of the lengths of two legs is equal to the square of the hypotenuse	 How will the volumes of the two cylinders be related? a. The shorter cylinder will have the greater volume. b. The taller cylinder will have the greater volume. c. The two cylinders will have the same volume, but the shorter cylinder will have the greater surface area. d. The two cylinders will have the same volume, but the taller cylinder will have the greater surface area.	• Correctly identify all parts of a right triangle • Solve problems using Pythagorean Theorem
	• **Trigonometric ratios** are the ratios made up of the lengths of the sides of the right triangle • **Sine Ratio** is the ratio of the length of the side opposite an acute angle to the length of the hypotenuse in a given right triangle • **Cosine Ratio** is the ratio of the length of the side adjacent to an acute angle to the length of the hypotenuse in a given right triangle • **Tangent Ratio** is the ratio of the length of the side opposite an acute angle to the length of the	**SAMPLE SHORT CONSTRUCTED RESPONSE ITEM** You are surveying a triangular-shaped piece of land. You have measured and recorded two lengths on a plot plan. What is the length of the property along the street? 	• Use basic trigonometric ratios to solve problems involving indirect measurement • Develop and apply a variety of strategies for determining perimeter, circumference, area, surface area, and angle measure

KNOW	UNDERSTAND	DO
Students will know that:	***Students will understand that:***	***Students will be able to:***
adjacent side in a given right triangle	**SAMPLE SHORT CONSTRUCTED RESPONSE ITEM**  • Find the length of the missing side • What is the measure of the acute angle? • Find all six trigonometric ratios **SAMPLE SHORT CONSTRUCTED RESPONSE ITEM** Find the lengths of the two missing sides and show all your work.  **SAMPLE SHORT CONSTRUCTED RESPONSE ITEM** **(ADAPTED FROM: FCAT Released Test Item)** Two rectangular boxes have same height and length, but different width as shown in the figure below. The difference in the volume of box B and box A is 360 cubic cms. What is the height of both boxes in cms?  	

Assessment Models

- **NOTE: The assessment models provided in this document are suggestions for the teacher. If the teacher chooses to develop his/her own model, *it must be of equal or better quality and at the same or higher cognitive levels (as noted in parentheses*).**
- **Depending upon the needs of the class, the assessment questions may be answered in the form of essays, quizzes, mobiles, PowerPoint, oral reports, booklets, or other formats of measurement used by the teacher.**

Pre-Assessment/Diagnostic Assessment:

- Cluster 2 problems
- HSPA Practice tests

Open-Ended (Formative) Assessment:

- Group and individual work is assigned daily, from various sources *(Synthesis, Analysis, and Evaluation).*
- Introductory and Closing Activities will be done every day to pre-assess student knowledge and assess understanding of topics *(Synthesis, Analysis, and Evaluation).*

Summative Assessment:

- Assessment questions should be open-ended and should follow the general format illustrated in the Essential Questions/Sample Conceptual Understanding section. *(Synthesis, Analysis, Evaluation)*
- Students will be given quizzes that provide a brief review of the concepts and skills in the previous lessons.
- Students will take the HSPA again
- Students will participate in the AHSA process

Additional Resources

- http://www.state.nj.us/education/njpep/assessment/hspa/hspa_math/main_menu.htm
- ***Primiani, A. Rose and William Caroscio, Prentice Hall Brief Review for New Jersey: HSPA Mathematics, Pearson: 2008***
- ***Sico, John J., HSPA Success Work-A-Text in Mathematics – Expanded Edition, Instructivision: 2003***

21st Century Skills		
Creativity and Innovation	***Critical Thinking and Problem Solving***	***Communication and Collaboration***
Information Literacy	***Media Literacy***	***ICT Literacy***
Life and Career Skills	***Technology Based Activities***	
http://www.p21.org/index.php?option=com_content&task=view&id=254&Itemid=119 http://www.iste.org/standards/nets-for-students.aspx		

Differentiated Learning Activities

- Discuss multiple strategies to solve a given problem
- Have students use the state rubric to grade the responses for open-ended questions
- ***Concept applications: Gardening choices***
- ***Concept applications: Draining the pool***
- ***Concept applications: Container***

Performance Assessment Task Sample	**Teacher Resources:** ❖ ***Concept applications: House Pets*** ❖ ***Concept applications: Storage*** ❖ ***Concept applications: Boxes and More Boxes*** ❖ ***Released PAT: Sand and Salt Storage*** ❖ ***Released PAT: Fencing the field*** ❖ ***Released PAT: Cake Cutting***

BIG IDEA IV: RISK

Curriculum Management System

COURSE NAME: FUNDAMENTALS OF MATH GRADE 12

OVERARCHING GOALS

1. ***Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.***
2. ***Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.***
3. ***Investigate, research, and synthesize various pieces of information from a variety of media sources.***

ESSENTIAL QUESTIONS

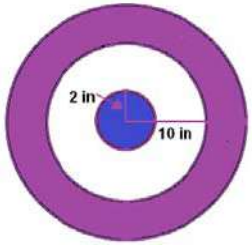
- How are theoretical and empirical probability related?
- How can you use probability and expected value to help determine whether a game is fair?
- Does this **make sense**?

SUGGESTED BLOCKS FOR INSTRUCTION: 5-6

<table>
<tr><th colspan="2">KNOW</th><th>UNDERSTAND</th><th>DO</th></tr>
<tr><th colspan="2">Students will know that:</th><th>Students will understand that:</th><th>Students will be able to:</th></tr>
<tr><td></td><td>• Expected Value is the average of a probability distribution. It is the sum of the products of the outcomes of an event and their associated probabilities.
$E(X) = \sum X \cdot P(X)$</td><td rowspan="6">• Probability is a way of predicting outcomes, but does not assure outcomes
• Risk and fairness are interrelated
• Profit is determined by the delicate balance of human perception of odds and underlying probability.
• Mathematical ideas interconnect and build on one another resulting in a coherent whole.

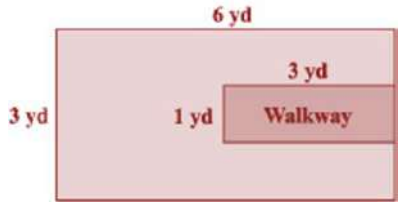
SAMPLE CONCEPTUAL UNDERSTANDINGS

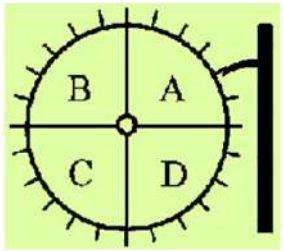
SAMPLE SHORT CONSTRUCTED RESPONSE ITEM
What is the probability of hitting the bull's eye on the target below?

SAMPLE MC RESPONSE ITEM (NJDOE TEST SPECIFICATIONS LINK)
Weatherpersons predict tomorrow's weather based on what has happened in the past on the days following days just like today. During the past 50 years, there have been 380 days that have been just like today, and of those, 200 have been followed by a clear day. Which of the following is the approximate probability of a clear day tomorrow that would be given by a weatherperson using the prediction rule described in this problem?</td><td>• Calculate the expected value of a probability-based game, given the probabilities and payoffs of the various outcomes, and determine whether the game is fair</td></tr>
<tr><td></td><td>• Geometric probability uses the concept of space and area to calculate probability of an event.</td><td>• Use concepts and formulas of area to calculate geometric probabilities.</td></tr>
<tr><td></td><td>• Mutually exclusive events are two events that cannot occur at the same time.</td><td>• Model situations involving probability with simulations (using spinners, dice, calculators and computers) and theoretical models, and solve problems using these models.</td></tr>
<tr><td></td><td>• Independent events are two events where one event does not affect the outcome of the second event.</td><td>• Determine probabilities in complex situations such as conditional, complementary, and independent/dependent events.</td></tr>
<tr><td></td><td>• Dependent events are two events where one event affects the outcome of the second event.</td><td>• Estimate probabilities and make predictions based on experimental and theoretical probabilities.</td></tr>
<tr><td></td><td>• The "Law of Large Numbers" states that empirical probability will approach the theoretical probability of an event after an infinite number of trials.</td><td>• Understand and use the "law of large numbers".</td></tr>
</table>

KNOW	UNDERSTAND	DO
Students will know that:	*Students will understand that:*	*Students will be able to:*
	a. 13% b. 34% c. 53% * d. 66% **SAMPLE OPEN-ENDED RESPONSE ITEM** (NJDOE TEST SPECIFICATIONS LINK) Two number cubes, numbered 1-6, are rolled. • What sum is more likely to occur than any other? • Explain your answer. **SAMPLE OPEN-ENDED RESPONSE ITEM** (NJDOE TEST SPECIFICATIONS LINK) A computer simulated tossing 3 coins 400 times. The results are shown in this table. **HHH 41 TTH 50** **HHT 54 THT 53** **HTH 48 HTT 45** **THH 57 TTT 52** • Calculate the experimental probability as shown by this simulation. • Determine the theoretical probability of tossing 2 heads and 1 tail. • Compare the two probabilities and explain any differences. **SAMPLE MC RESPONSE ITEM** (NJDOE TEST SPECIFICATIONS LINK) The rectangular garden shown contains a rectangular, brick walkway.	

KNOW	UNDERSTAND	DO
Students will know that:	*Students will understand that:*	*Students will be able to:*
	 What is the probability that a seed tossed randomly into the garden will land on the walkway? a. 1/6 * b. 1/5 c. 1/4 d. 1/3 **SAMPLE SHORT CONSTRUCTED RESPONSE ITEM** Jack and Jill are playing a game. One option is to flip a coin 10 times and the other is to flip a coin 100 times and count the number of tails that pop up. The object of the game is to have the greater empirical probability of flipping "tails". Which option would you choose and why? **SAMPLE SHORT CONSTRUCTED RESPONSE ITEM** What is the probability of rolling a 6 on a standard die and picking a jack of clubs? **SAMPLE SHORT CONSTRUCTED RESPONSE ITEM** A card is randomly selected from a standard deck of 52 cards. a. What is the probability that it is an ace *or* a face card? b. What is the probability that the card is a heart *or* a face card?	

KNOW	UNDERSTAND	DO
Students will know that:	***Students will understand that:***	***Students will be able to:***
	SAMPLE MC RESPONSE ITEM (NJDOE TEST SPECIFICATIONS LINK) A fair spinner has four congruent regions (with equal areas) on its face. They are labeled A, B, C, and D. The spinner is spun 20 times by each member of a class of 24 students. The results are tallied (counted) and then combined  Assume that the class obtained the expected results when they conducted the experiment. • Make a bar graph illustrating the combined class results. • Explain why an individual student's results might be different from the class results. • If the experiment were conducted again, with the regions A, B, C, and D having central angles of 45°, 90°, 90°, and 135° respectively, what might you expect the results to be?	

Assessment Models

- **NOTE: The assessment models provided in this document are suggestions for the teacher. If the teacher chooses to develop his/her own model, *it must be of equal or better quality and at the same or higher cognitive levels (as noted in parentheses*).**
- **Depending upon the needs of the class, the assessment questions may be answered in the form of essays, quizzes, mobiles, PowerPoint, oral reports, booklets, or other formats of measurement used by the teacher.**

Pre-Assessment/Diagnostic Assessment:

- Have students play the "Remove One" game involving dice and a game board. This will help to assess knowledge of sample space, probability, and the effects of each on your decisions to win a game.

Open-Ended (Formative) Assessment:

- Group and individual work is assigned daily, from various sources *(Synthesis, Analysis, and Evaluation).*
- Introductory and Closing Activities will be done every day to pre-assess student knowledge and assess understanding of topics *(Synthesis, Analysis, and Evaluation).*

Summative Assessment:

- Assessment questions should be open-ended and should follow the general format illustrated in the Essential Questions/Sample Conceptual Understanding section. *(Synthesis, Analysis, Evaluation)*
- Students will be given quizzes that provide a brief review of the concepts and skills in the previous lessons.
- Students will take the HSPA again
- Students will participate in the AHSA process

Additional Resources

- http://www.state.nj.us/education/njpep/assessment/hspa/hspa_math/main_menu.htm
- ***Primiani, A. Rose and William Caroscio, Prentice Hall Brief Review for New Jersey: HSPA Mathematics, Pearson: 2008***
- ***Sico, John J., HSPA Success Work-A-Text in Mathematics – Expanded Edition, Instructivision: 2003***

21st Century Skills		
Creativity and Innovation	***Critical Thinking and Problem Solving***	***Communication and Collaboration***
Information Literacy	***Media Literacy***	***ICT Literacy***
Life and Career Skills	***Technology Based Activities***	
http://www.p21.org/index.php?option=com_content&task=view&id=254&Itemid=119 http://www.iste.org/standards/nets-for-students.aspx		

Differentiated Learning Activities

- ***Remove One*** *(Probability and Statistics)*
- ***Declaration of Dependence?*** *(Probability and Statistics)*
- ***Addition Rules Discovery*** *(Probability and Statistics)*
- ***Cooperative Learning Activity*** (*McDougal Littell,* **Algebra 1**, *2004, Chapter 1 Resource Books*, p.90)
- ***Activity Lesson Opener*** (*McDougal Littell,* **Algebra 1**, *2004, Chapter 6 Resource Books*, p.94)
- ***11.4 Activity Lesson Opener*** (*McDougal Littell,* **Algebra 1**, *2004, Chapter 11 Resource Books*, p.56
- ***11.6 Activity Lesson Opener*** (*McDougal Littell,* **Algebra 1**, *2004, Chapter 11 Resource Books*, p.81)
- ***11.3 Graphing Calculator Activity*** (*McDougal Littell,* **Algebra 1**, *2004, Chapter 11 Resource Books*, p.40)

Performance Assessment Task Sample	**Teacher Resources:** ❖ ***Concept Application:*** *Probability* ❖ ***Concept Application:*** *Marbles*

BIG IDEA V: PATTERNS

Curriculum Management System

COURSE NAME: FUNDAMENTALS OF MATH GRADE 12

OVERARCHING GOALS

1. ***Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.***
2. ***Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.***
3. ***Investigate, research, and synthesize various pieces of information from a variety of media sources.***

ESSENTIAL QUESTIONS

- How can systematic listing and counting be useful in the organization of outcomes?
- How can we utilize a small strand of information to help give us information in the grand scheme?
- Does this **make sense?**

SUGGESTED BLOCKS FOR INSTRUCTION: 5-6

<table>
<tr><th colspan="2">KNOW</th><th>UNDERSTAND</th><th>DO</th></tr>
<tr><td colspan="2">Students will know that:</td><td>Students will understand that:</td><td>Students will be able to:</td></tr>
<tr><td></td><td>• Tree Diagrams are a useful tool in listing the outcomes to an event.</td><td rowspan="10">• Theoretical probability is dependent on the sample space of an event.
• Mathematical ideas interconnect and build on one another resulting in a coherent whole.

SAMPLE CONCEPTUAL UNDERSTANDINGS

SAMPLE CONCEPTUAL UNDERSTANDING ITEM
(WWW.STATE.NJ.US)
At Johnny’s Burger Place, a customer can get a customized meal by ordering either: a turkey burger, chicken burger, hamburger, or garden burger with a side order of potato chips or French fries with a choice of either: juice, milk, or soda.
• Use a tree diagram to list all the different combinations of a burger, side order and a drink.
• Describe ways and give examples of how Johnny could change his menu so that a customer would have 30 different choices.

SAMPLE CONCEPTUAL UNDERSTANDING ITEM
(WWW.STATE.NJ.US)
How many different ways can you put 6 books in a row so that one specific book is always in the 4th position?

SAMPLE SHORT CONSTRUCTED RESPONSE ITEM
You and a group of 9 friends are playing pickup basketball in a local park. At the end of the game, if each player shakes hands with every other player, how many handshakes will there be?</td><td>• Calculate combinations with replacement.</td></tr>
<tr><td></td><td>• Permutations and combinations can be used to calculate combinations without replacement.</td><td>• Calculate combinations without replacement.</td></tr>
<tr><td></td><td>• The Fundamental Counting Rule can be used to calculate combinations with replacement.</td><td>• Apply the multiplication rule of counting in complex situations.</td></tr>
<tr><td></td><td>• The multiplication rule for independent events is:
• $P(A\ and\ B) = P(A) \cdot P(B)$</td><td>• Recognize the difference between situations with replacement and without replacement.</td></tr>
<tr><td></td><td>• The multiplication rule for dependent events is:
• $P(A\ and\ B) = P(A) \cdot P(B|A)$</td><td>• Recognize the difference between ordered and unordered counting situations.</td></tr>
<tr><td></td><td>• A sequence is an ordered list of numbers.</td><td>• Justify solutions to counting problems.</td></tr>
<tr><td></td><td>• The sum of terms in a sequence is called a series. There are two types of series: arithmetic and geometric series.</td><td>• Recognize and explain relationships involving combinations and Pascal’s Triangle and apply those methods to situations involving probability.</td></tr>
<tr><td></td><td>• An arithmetic series is when a constant or common difference is being added to each preceding term.
• To find any term in an arithmetic series we use the formula:
$a_n = a_1 + (n-1)d$
• Where a_1 is the first term in a</td><td>• Use models and algebraic formulas to represent and analyze sequences and series.</td></tr>
</table>

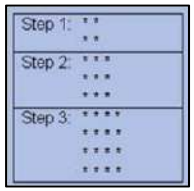
<table>
<tr><th colspan="2">KNOW</th><th>UNDERSTAND</th><th>DO</th></tr>
<tr><th colspan="2">Students will know that:</th><th>Students will understand that:</th><th>Students will be able to:</th></tr>
<tr><td></td><td>sequence, d is the common difference, n is the number of the term to find.</td><td rowspan="3">SAMPLE SHORT CONSTRUCTED RESPONSE ITEM
The Orchid Orchard has 5,000 orchid plants to sell. Each month the orchard plans to sell 12% of its orchids and start 600 new plants. Which of the following statements is true?

SAMPLE CONCEPTUAL UNDERSTANDING ITEM
(WWW.STATE.NJ.US)
A garden center is growing bean plants using a new fertilizer. At the end of each week, they record the number of new sprouts.
<table><tr><td>Week</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr><tr><td>New Sprouts</td><td>10</td><td>12</td><td>16</td><td>24</td><td>40</td><td>72</td></tr></table>
Using the information above, how many sprouts should the center expect at the end of the seventh week?

SAMPLE CONCEPTUAL UNDERSTANDING ITEM
(WWW.STATE.NJ.US)
Jessie's business partner set a computer password on the office computer and went on vacation. Jessie remembered that the password is a simple pattern. The first few letters of the password are
A Z D Y G X ___

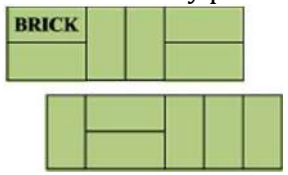
Assuming that the pattern continues, what is the next and final letter of the password?

SAMPLE CONCEPTUAL UNDERSTANDING ITEM
(WWW.STATE.NJ.US)
Kylee and Robin are racing their pet turtles. Kylee's turtle starts at ½ foot from the starting line and moves at 4 inches per minute. Robin's turtle starts at the starting line and moves at 6</td><td></td></tr>
<tr><td></td><td>• To find the sum of a certain number of terms of an arithmetic series we use the formula:
$$S_n = \frac{n(a_1 + a_n)}{2}$$
• Where S_n is the sum of the first n terms, a_1 is the first term in a sequence, and a_n is the n^{th} term to find.</td><td>• Evaluate explicit formulas for nth terms.</td></tr>
<tr><td></td><td>• A geometric series is when a constant or common ratio is being multiplied to each preceding term.
• To find any term in a geometric sequence we use the formula:
$$a_n = a_1 \cdot r^{n-1}$$
where a_1 is the first term of the sequence,
r is the common ratio, n is the number of the term to find.</td><td>• Evaluate sums of finite and infinite geometric series.
• Develop an informal notion of limit.</td></tr>
<tr><td></td><td>• To find the sum of a certain number of terms of a (finite) geometric sequence:
$$S_n = \frac{a_1(1 - r^n)}{1 - r}$$
Where $S_n$is the sum of n terms</td><td></td><td>• Use inductive reasoning to form generalizations.</td></tr>
</table>

KNOW	UNDERSTAND	DO
Students will know that:	***Students will understand that:***	***Students will be able to:***
(n^{th} partial sum), a_1 is the first term, r is the common ratio. • To find the sum of an infinite geometric sequence: $$S = \frac{a_1}{1-r}$$ Where a_1 is the first term, r is the common ratio.	inches per minute. Assuming they move in the same direction, where are the turtles after 5 minutes? **SAMPLE CONCEPTUAL UNDERSTANDING ITEM** (WWW.STATE.NJ.US) Belinda wants to determine the number of dots in the 30th step of the following pattern, but she does not want to actually draw all 30 steps.  Explain how Belinda could find the number of dots in Step 30 without actually drawing them. What would be the number of dots in the 30th step? Write an algebraic expression for the number of dots in the nth step. **SAMPLE CONCEPTUAL UNDERSTANDING ITEM** (WWW.STATE.NJ.US) Analyze the pattern below. What letter will be in the 76th position? Show your work and explain your answer. M A T H M A T H M A T H M A ... **SAMPLE OPEN-ENDED RESPONSE ITEM** (NJDOE TEST SPECIFICATIONS LINK) Assume that you are planning to construct a walkway in front of a house. You have bricks that are two units by one unit in size. The walkway is to be two units wide, as shown in the diagram.	

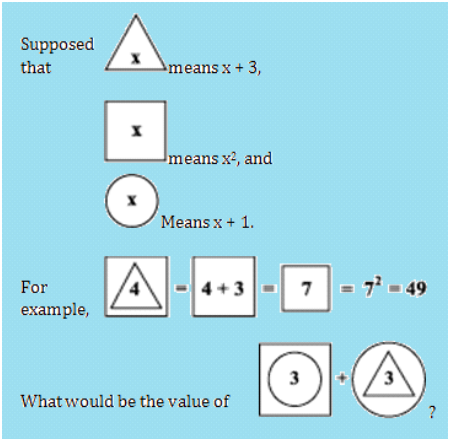
KNOW	UNDERSTAND	DO
Students will know that:	*Students will understand that:*	*Students will be able to:*

It is possible to arrange the bricks vertically or horizontally, as you see in the two different walkway patterns shown below.



- Find out how many different front walk patterns it is possible to construct with 6 bricks, including the two examples above.
- Show all of your work.

SAMPLE SHORT CONSTRUCTED RESPONSE ITEM
(NJDOE TEST SPECIFICATIONS LINK)



Assessment Models

- **NOTE: The assessment models provided in this document are suggestions for the teacher. If the teacher chooses to develop his/her own model, *it must be of equal or better quality and at the same or higher cognitive levels (as noted in parentheses*).**
- **Depending upon the needs of the class, the assessment questions may be answered in the form of essays, quizzes, mobiles, PowerPoint, oral reports, booklets, or other formats of measurement used by the teacher.**

Pre-Assessment/Diagnostic Assessment:

- Cluster 3 problems
- Sample HSPA Tests

Open-Ended (Formative) Assessment:

- Group and individual work is assigned daily, from various sources *(Synthesis, Analysis, and Evaluation).*
- Introductory and Closing Activities will be done every day to pre-assess student knowledge and assess understanding of topics *(Synthesis, Analysis, and Evaluation).*

Summative Assessment:

- Assessment questions should be open-ended and should follow the general format illustrated in the Essential Questions/Sample Conceptual Understanding section. *(Synthesis, Analysis, Evaluation)*
- Students will be given quizzes that provide a brief review of the concepts and skills in the previous lessons.
- Students will take the HSPA again
- Students will participate in the AHSA process

Additional Resources

- http://www.state.nj.us/education/njpep/assessment/hspa/hspa_math/main_menu.htm
- ***Primiani, A. Rose and William Caroscio, Prentice Hall Brief Review for New Jersey: HSPA Mathematics, Pearson: 2008***
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21st Century Skills		
Creativity and Innovation	***Critical Thinking and Problem Solving***	***Communication and Collaboration***
Information Literacy	***Media Literacy***	***ICT Literacy***
Life and Career Skills	***Technology Based Activities***	
http://www.p21.org/index.php?option=com_content&task=view&id=254&Itemid=119 http://www.iste.org/standards/nets-for-students.aspx		

Differentiated Learning Activities

- ***Towers***
- ***Tower of Hanoi***
- ***A "Numbers" Puzzle***
- ***Pizza Halves Problem***
- ***Pizza Problem***

Performance Assessment Task Sample	***Teacher Resources:*** ❖ ***Concept Application:*** *Senior Class Meeting* ❖ ***Concept Application:*** *Triangular Numbers* ❖ ***Concept Application:*** *Display of Dots* ❖ ***Concept Application:*** *Design* ❖ ***Concept Application:*** *Exam Scores* ❖ ***Concept Application:*** *Patterns*

BIG IDEA VI: DATA ANALYSIS

Curriculum Management System

COURSE NAME: FUNDAMENTALS OF MATH GRADE 12

OVERARCHING GOALS

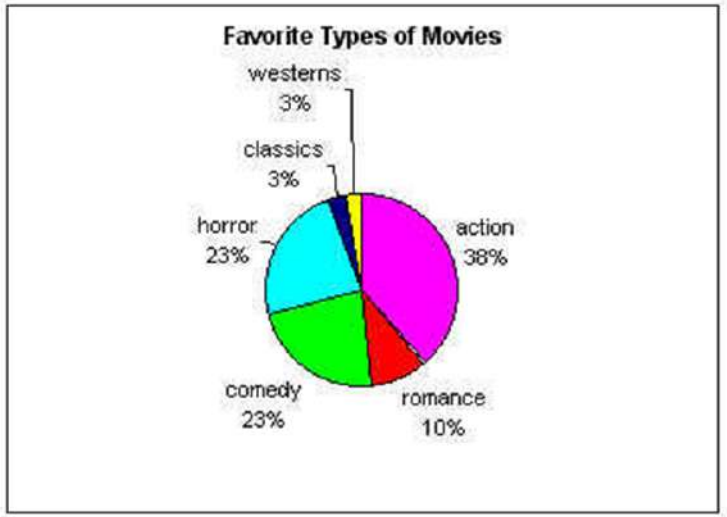
1. ***Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.***
2. ***Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.***
3. ***Investigate, research, and synthesize various pieces of information from a variety of media sources.***

ESSENTIAL QUESTIONS

- How does the type of data influence the choice of display?
- How can various statistical techniques be used to organize, display, and compare sets of data?
- How can advertisers intentionally create data displays that mislead consumers?
- Does this **make sense**?

SUGGESTED BLOCKS FOR INSTRUCTION: 5-6

KNOW	UNDERSTAND	DO
Students will know that:	***Students will understand that:***	***Students will be able to:***
• Sample selection methods include convenience sampling, responses to survey, random sampling.	• Visual representations of data are essential in analyzing data. • An effective analysis is comprised of the mean, median, mode, and range of the data. • Trends and strengths of relationships are apparent in the visual representations of data. • Mathematical ideas **interconnect** and build on one another resulting in a **coherent whole**.	• Use surveys and sampling techniques to generate data and draw conclusions about large groups.
• **Histograms** and **box-and-whisker** plots are used to represent numerical data.		• Identify advantages/disadvantages of sample selection methods.
• **Bar graphs** and **pie graphs** are used to represent categorical or qualitative variables.	**SAMPLE CONCEPTUAL UNDERSTANDINGS**	• Evaluate the use of data in real-world contexts.
• The **mean** of data is computed by dividing the sum of the data values by the number of data values.	**SAMPLE SHORT CONSTRUCTED RESPONSE ITEM** Five houses on my street have been sold in the last two months. They have sold for the following prices: $450,000, $480,000, $465,000, $440,000, and $625,000. Is the average the best way to describe the houses market value?	• Evaluate the accuracy and reasonableness of conclusions drawn.
• The **median** of a set of data is the middle value when the data is placed in ascending order.	**SAMPLE SHORT CONSTRUCTED RESPONSE ITEM**	• Evaluate the bias in conclusions drawn (e.g., influence of how data is displayed)
• The **mode** of a set of data is the value that occurs most often in a data set.	If Sally scored 80, 77, 83, 90, and 95 on her last 5 tests and there is one test left in the marking period. What must she score on her next test to have a test average of 88? • Determine which measure is the best measure of central tendency based on a given set of data. (Look for outliers that skew data)	• Evaluate statistical claims based on sampling.
• The **range** of a data set is the minimum value subtracted from the maximum value in the data set. • Range = maximum value – minimum value	**SAMPLE SHORT CONSTRUCTED RESPONSE ITEM**	• Design a statistical experiment, conduct the experiment, and interpret and communicate the outcome.
• Measures of dispersion include: variance, standard deviation, outliers • The Normal distribution states that approximately 95% of the	Create a set of data with the following information: Mean = 5 Median = 6 Mode = 8 and 3	• Use data to draw bar graphs, line graphs, and double line graphs. • Use a scatter plot to identify the correlation by a set of data; approximate the line of best fit for a

KNOW	UNDERSTAND	DO
Students will know that:	*Students will understand that:*	*Students will be able to:*
sample lies between two standard deviations on either side of the mean.	**SAMPLE CONCEPTUAL UNDERSTANDING ITEM** (WWW.STATE.NJ.US) The 315 members of the Smithfield High School Sophomore class voted to see what kinds of movies the class liked. Their results are below. If they had an "Action Movie Night" fundraiser and sell tickets for $4 each, approximately how much money should they expect to raise? Assume that students who like the type of movie will be the only ones in attendance.  **SAMPLE CONCEPTUAL UNDERSTANDING ITEM** (WWW.STATE.NJ.US) A liquid substance in a science experiment doubles in volume every two minutes. The experiment begins at 1:00PM with a small amount of the substance being placed in a large beaker. At 2:00PM the container is full. At what time was the container one-eighth filled?	set of data. • Estimate or determine lines of best fit (or curves of best fit if appropriate) with technology, and use them to interpolate within the range of the data. • Analyze data using technology, and use statistical terminology to describe conclusions.

KNOW	UNDERSTAND	DO
Students will know that:	*Students will understand that:*	*Students will be able to:*
	SAMPLE SHORT CONSTRUCTED RESPONSE ITEM Researchers decided to see if there was a relationship between the number of flu shots each year and the number of cases of the flu that year. Sketch a data display of how you might display this data and what type of relationship the data would demonstrate. Describe the relationship between the variables in words **SAMPLE OPEN-ENDED ITEM** (NJDOE TEST SPECIFICATIONS LINK) **HOURS** 1.0 1.25 1.5 1.75 2.0 2.25 **SCORE** 60 70 68 85 90 98 **HOURS** 2.5 2.75 3.0 3.25 3.5 3.75 **SCORE** 85 92 91 87 85 72 The data provided shows test scores for twelve students and the number of hours they studied for the test during the three days prior to taking it. • Make a scatter plot of this data. • Does there appear to be a relationship between a student's test score and the time spent studying? Use the scatter plot to support your answer. Do any of the points appear to be outliers? Explain	

Assessment Models

- **NOTE: The assessment models provided in this document are suggestions for the teacher. If the teacher chooses to develop his/her own model, *it must be of equal or better quality and at the same or higher cognitive levels (as noted in parentheses*).**
- **Depending upon the needs of the class, the assessment questions may be answered in the form of essays, quizzes, mobiles, PowerPoint, oral reports, booklets, or other formats of measurement used by the teacher.**

Pre-Assessment/Diagnostic Assessment:

- KWL chart on data displays and statistics

Open-Ended (Formative) Assessment:

- Group and individual work is assigned daily, from various sources *(Synthesis, Analysis, and Evaluation).*
- Introductory and Closing Activities will be done every day to pre-assess student knowledge and assess understanding of topics *(Synthesis, Analysis, and Evaluation).*

Summative Assessment:

- Assessment questions should be open-ended and should follow the general format illustrated in the Essential Questions/Sample Conceptual Understanding section. *(Synthesis, Analysis, Evaluation)*
- Students will be given quizzes that provide a brief review of the concepts and skills in the previous lessons.
- Students will take the HSPA again
- Students will participate in the AHSA process

Additional Resources

- http://www.state.nj.us/education/njpep/assessment/hspa/hspa_math/main_menu.htm
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21st Century Skills		
Creativity and Innovation	***Critical Thinking and Problem Solving***	***Communication and Collaboration***
Information Literacy	***Media Literacy***	***ICT Literacy***
Life and Career Skills	***Technology Based Activities***	
http://www.p21.org/index.php?option=com_content&task=view&id=254&Itemid=119 http://www.iste.org/standards/nets-for-students.aspx		

Differentiated Learning Activities	
Centers Activity: Have students go to different centers and collect different types of data. At each center, they should create an appropriate data display and describe the data using measures of center and dispersion. **Sampling Techniques:** Have students compare and contrast the different surveying techniques by having them survey topics around the school. Assign students to use two different sampling techniques and compare and contrast the effectiveness/bias of each.	
Performance Assessment Task Sample	**Teacher Resources:** **Classroom Survey:** Have students write as many x's on a sheet of paper as they can in 60 seconds, all students must use their right hand. Then repeat, this time all students must use their left hand. Plot results on board to demonstrate scatter plot and trend line. ❖ ***Concept Application: Scatter plot*** ❖ ***Concept Application: Record Times*** ❖ ***Concept Application: Taxes***

BIG IDEA VII: RELATIONSHIPS

Curriculum Management System

COURSE NAME: FUNDAMENTALS OF MATH GRADE 12

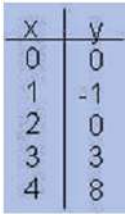
OVERARCHING GOALS

1. ***Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.***
2. ***Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.***
3. ***Investigate, research, and synthesize various pieces of information from a variety of media sources.***

ESSENTIAL QUESTIONS

- How is a linear model used to approximate a real life situation?
- Explain how to use a linear model to make predictions from given data.
- How do the different forms of linear functions and the concept of slope help solve real world situations?
- How can transformations be used in architecture and various types of art?
- Does this **make sense**?

SUGGESTED BLOCKS FOR INSTRUCTION: 7-8

KNOW	UNDERSTAND	DO
Students will know that:	***Students will understand that:***	***Students will be able to:***
• The **slope** of a line is defined as the rate of change over an interval. It is the ration of vertical change to horizontal change. • $m = \frac{rise}{run} = \frac{y_2 - y_1}{x_2 - x_1}$	• Equations model patterns that occur in real life problems and are used to solve for unknown quantities. • A graph and its equation are in an interdependent relationship. • Formulas are direct representations of real life applications that help to solve for an unknown quantity. • A solution of a system of equations models a unique outcome for two or more real-life situations. • Mathematical ideas **interconnect** and build on one another resulting in a **coherent whole**.	• Understand relations and functions and select, convert flexibly among, and use various representations for them, including equations or inequalities, tables, and graphs.
• The **domain** of a function is the set of possible x values. The **range** of a function is the set of possible y values.		• Analyze and explain the general properties and behavior of functions of one variable, using appropriate graphing technologies.
• The **intercepts** of a function is where the graph has a value where $y = 0$.	**SAMPLE CONCEPTUAL UNDERSTANDINGS** **SAMPLE CONCEPTUAL UNDERSTANDING ITEM** (WWW.STATE.NJ.US) The table below shows a pattern. What type of model represents the function shown? How do you know?	• Understand and perform translations, reflections, and dilations on commonly-used functions.
• **Continuity** of a function is described as not having to lift your pencil off the paper to draw it; for instance, it has no jumps or breaks.		• Understand and perform transformations on the effects on linear and quadratic graphs of parameter changes in equations.
• Estimates of the roots of equations can be done by finding the x-intercepts.		• Use graphing calculators or computers for transformations on more complex functions.
• **A solution** to system of equations is a point where the graphs of all the equations in the system intersect (i.e. a common point).	**SAMPLE CONCEPTUAL UNDERSTANDING ITEM** (WWW.STATE.NJ.US) A local jewelry dealer calculates the price at which he will buy back gold jewelry based on the following formula: $B = .75(G - 15) + .15G$, where B is the "buyback" price and G is the current market value of the gold. You bring in a gold	• Understand and compare the properties of classes of functions, including exponential, polynomial, rational, and trigonometric functions.
• Slope represents rate of change.		• Identify a linear function vs. a non-linear function.
• The **translation** of a graph is a horizontal and/or vertical shift		• Define symmetry in a given graph or figure.

KNOW	UNDERSTAND	DO
Students will know that:	***Students will understand that:***	***Students will be able to:***
of a figure or graph on a coordinate plane.	bracelet with a current market value of $105. What will the dealer pay you for the bracelet?	
• The **reflection** of a graph is when a figure is reflected over an axis or line.	**SAMPLE CONCEPTUAL UNDERSTANDING ITEM** (WWW.STATE.NJ.US) James came home from school with 16 hours of homework. He had three times as much English homework as he had math. How much math homework did he have?	• Identify increasing or decreasing on an interval of a graph.
• The **dilation** of a graph is a transformation in which all distances on the coordinate plane are lengthened by multiplying either all X-coordinates (horizontal dilation) or all Y-coordinates (vertical dilation) by a common factor greater than 1. *(http://www.mathwords.com)*	**SAMPLE CONCEPTUAL UNDERSTANDING ITEM** Judge Esther Odometer developed a formula to determine the fine for speeding on the parkway in her town. The formula she developed is: $F = 12(R - 60) + 55$ In this equation, F represents the total amount of fine, R represents how fast (rate of speed) the car was going in miles per hour.	
	SAMPLE CONCEPTUAL UNDERSTANDING ITEM (WWW.STATE.NJ.US) A car has been stopped for traveling 75 mph, 80 mph, 87 mph, 90 mph, and 100 mph over the course of the past year. Show the domain and range for this relation. Judge Esther charges you a fine of $175 for speeding. Is this a reasonable fine? Why or why not	
	SAMPLE CONCEPTUAL UNDERSTANDING ITEM (WWW.STATE.NJ.US) Sharifa is offered two jobs: one at Tom's World of Music and one at Rosie's Café. Tom's promises her a salary of $30,000 and a raise of $500 each year. Rosie's offers her a salary of $30,000 and a raise of 4% of her current salary each year. Which job	

KNOW		UNDERSTAND	DO
Students will know that:		*Students will understand that:*	*Students will be able to:*
		should she accept? Explain your answer. Show all work. **SAMPLE CONCEPTUAL UNDERSTANDING ITEM** (WWW.STATE.NJ.US) Mike dropped a basketball ball from his bedroom window a height of 20 feet. Each time the ball bounced, it reached a maximum height of approximately half that of its previous height. 1. Draw a graph to represent the relationship between the number of times the ball bounces and the height reached by the ball. 2. What is the total of the heights the ball reached after the 4th bounce? 3. What do you think this total would have been if the ball had bounced 20 times?	

Assessment Models

- **NOTE: The assessment models provided in this document are suggestions for the teacher. If the teacher chooses to develop his/her own model, *it must be of equal or better quality and at the same or higher cognitive levels (as noted in parentheses*).**
- **Depending upon the needs of the class, the assessment questions may be answered in the form of essays, quizzes, mobiles, PowerPoint, oral reports, booklets, or other formats of measurement used by the teacher.**

Pre-Assessment/Diagnostic Assessment:

- Give students a system of equations word problem and ask them to solve it to the best of their ability (without instructing them to use equations or algebra).
- Ask students to reflect, dilate, and translate a geometric figure in a coordinate plane.

Open-Ended (Formative) Assessment:

- Group and individual work is assigned daily, from various sources *(Synthesis, Analysis, and Evaluation).*
- Introductory and Closing Activities will be done every day to pre-assess student knowledge and assess understanding of topics *(Synthesis, Analysis, and Evaluation).*

Summative Assessment:

- Assessment questions should be open-ended and should follow the general format illustrated in the Essential Questions/Sample Conceptual Understanding section. *(Synthesis, Analysis, Evaluation)*
- Students will be given quizzes that provide a brief review of the concepts and skills in the previous lessons.
- Students will take the HSPA again
- Students will participate in the AHSA process

Additional Resources

- http://www.state.nj.us/education/njpep/assessment/hspa/hspa_math/main_menu.htm
- ***Primiani, A. Rose and William Caroscio, Prentice Hall Brief Review for New Jersey: HSPA Mathematics, Pearson: 2008***
- ***Sico, John J., HSPA Success Work-A-Text in Mathematics – Expanded Edition, Instructivision: 2003***

21st Century Skills		
Creativity and Innovation	***Critical Thinking and Problem Solving***	***Communication and Collaboration***
Information Literacy	***Media Literacy***	***ICT Literacy***
Life and Career Skills	***Technology Based Activities***	
http://www.p21.org/index.php?option=com_content&task=view&id=254&Itemid=119 http://www.iste.org/standards/nets-for-students.aspx		

Differentiated Learning Activities

- ***Towers***
- ***Tower of Hanoi***
- ***Graphing Calculator activities to explore transformations of various functions***

Performance Assessment Task Sample	**Teacher Resources:** ❖ ***Concept Application: Frame*** ❖ ***Concept Application: Fundraiser*** ❖ ***Released PATs: Prom Expenses*** ❖ ***Released PATs: Profit Percent***

BIG IDEA VIII: MODELING

Curriculum Management System

COURSE NAME: FUNDAMENTALS OF MATH GRADE 12

OVERARCHING GOALS

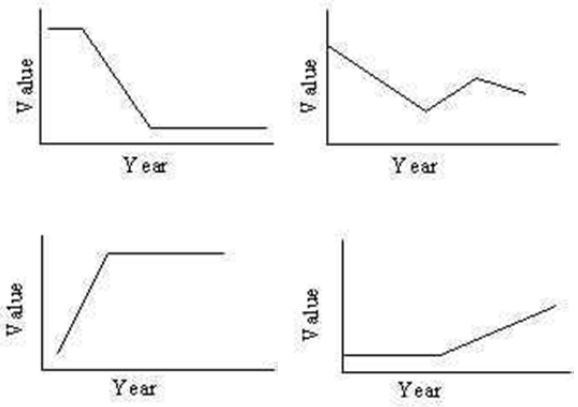
1. ***Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.***
2. ***Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.***
3. ***Investigate, research, and synthesize various pieces of information from a variety of media sources.***

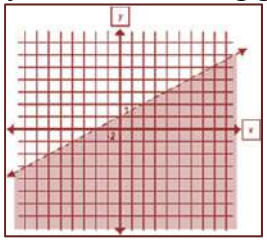
ESSENTIAL QUESTIONS

- Why is it necessary to utilize different types of functions in order to model real-world phenomena?
- How are functions useful in making predictions?
- Does this **make sense**?

SUGGESTED BLOCKS FOR INSTRUCTION: 5-6

KNOW	UNDERSTAND	DO
Students will know that:	***Students will understand that:***	***Students will be able to:***
• Linear, quadratic, exponential, periodic (sine and cosine) and step functions can be used to model real – world situations.	• Functions model real-life patterns to enable us to make predictions • Equations describe the relationship between a dependent and an independent variable. • Mathematical ideas **interconnect** and build on one another resulting in a **coherent whole**.	• Use functions to model real-world phenomena and solve problems that involve varying quantities.
• **Direct variation** is when the variable x and y vary directly if for a constant k; $\frac{y}{x} = k$ or $y = kx\ ;\ k \neq 0$ • k Is the constant of variation.	**SAMPLE CONCEPTUAL UNDERSTANDINGS**	• Analyze and describe how a change in an independent variable leads to change in a dependent one.
• **Inverse variation** is when the variable x and y vary inversely if for a constant k; $xy = k$ or $y = \frac{k}{x}\ ;\ k \neq 0$.	**SAMPLE CONCEPTUAL UNDERSTANDING ITEM** (WWW.STATE.NJ.US) The weekly pay a worker at a restaurant earns, *P*, varies directly as the number of hours, *h*, which they work. Express this relation as a formula.	• Convert recursive formulas to linear or exponential functions.
• **Absolute value** of a number is the distance of a value from zero on the number line.	**SAMPLE CONCEPTUAL UNDERSTANDING ITEM** (WWW.STATE.NJ.US) In 2000, a particular technology stock dropped quickly, and then leveled off. Which of the graphs below best represents that stock's performance?	
• The graph of a linear inequality in one variable is the set of points on a number line that represent all solutions of the inequality.		
• An **ordered** pair, (x, y) is a solution of a linear inequality if the inequality is true when the values of x and y are substituted into the inequality.		



KNOW	UNDERSTAND	DO
Students will know that:	*Students will understand that:*	*Students will be able to:*
	SAMPLE CONCEPTUAL UNDERSTANDING ITEM (WWW.STATE.NJ.US) A bag of jelly beans includes only r red and y yellow jellybeans. If Violet removes 1 red jellybean, what fractional part of the jelly beans in the bag is red? **SAMPLE CONCEPTUAL UNDERSTANDING ITEM** (WWW.STATE.NJ.US) If @ is defined for all positive numbers $\boldsymbol{a}$ and $\boldsymbol{b}$ by $\boldsymbol{a@b = 2ab - b^2}$, then $\mathbf{5@3} =$ **SAMPLE CONCEPTUAL UNDERSTANDING ITEM** (WWW.STATE.NJ.US) What is the inequality for the following graph?  **SAMPLE CONCEPTUAL UNDERSTANDING ITEM** (WWW.STATE.NJ.US) A Web designer is building pages that are 600 pixels wide and 480 pixels high. She wishes to place an image on the page that is proportionate to those dimensions. The image is 320 pixels wide. How high will it have to be? **SAMPLE CONCEPTUAL UNDERSTANDING ITEM** (WWW.STATE.NJ.US) Diana had $1200 in her checking account. She withdrew the	

KNOW		UNDERSTAND	DO
Students will know that:		*Students will understand that:*	*Students will be able to:*
		same amount each month for 5 months to pay for a car loan. At the end of 6 months, she deposited an additional $600 into her account. Her new balance was $800. How much money did she withdraw each month? What was her account balance after the 6 months before her deposit of $600? Explain and show all your work. **SAMPLE CONCEPTUAL UNDERSTANDING ITEM** (WWW.STATE.NJ.US) John and Ellen work in a clothing store after school. John's boss told him to reduce every item in the store for a 2-day sale by 30%. After the sale, John's boss told her to increase every sale item's sale price by 30%. John started marking each item with the original price. Ellen said, "That is wrong! If you increase the sale price by 30% you will not get the original price." Who is right? Show your work. You may wish to include a simple, specific example to support your answer **SAMPLE CONCEPTUAL UNDERSTANDING ITEM** (WWW.STATE.NJ.US) You are the service manager at an auto repair shop. You charge $22 per hour for labor plus the cost of any parts. A car needed $256 of new parts. The final bill for the car was $421. How long did it take to repair the car? Explain your answer. Write an algebraic equation to solve this problem. Show all work.	

Assessment Models

- **NOTE: The assessment models provided in this document are suggestions for the teacher. If the teacher chooses to develop his/her own model, *it must be of equal or better quality and at the same or higher cognitive levels (as noted in parentheses*).**
- **Depending upon the needs of the class, the assessment questions may be answered in the form of essays, quizzes, mobiles, PowerPoint, oral reports, booklets, or other formats of measurement used by the teacher.**

Pre-Assessment/Diagnostic Assessment:

- Given a set of numerical sequences, try to come up with an equation to fit each.

Open-Ended (Formative) Assessment:

- Group and individual work is assigned daily, from various sources *(Synthesis, Analysis, and Evaluation).*
- Introductory and Closing Activities will be done every day to pre-assess student knowledge and assess understanding of topics *(Synthesis, Analysis, and Evaluation).*

Summative Assessment:

- Assessment questions should be open-ended and should follow the general format illustrated in the Essential Questions/Sample Conceptual Understanding section. *(Synthesis, Analysis, Evaluation)*
- Students will be given quizzes that provide a brief review of the concepts and skills in the previous lessons.
- Students will take the HSPA again
- Students will participate in the AHSA process

Additional Resources

http://www.state.nj.us/education/njpep/assessment/hspa/hspa_math/main_menu.htm
Primiani, A. Rose and William Caroscio, Prentice Hall Brief Review for New Jersey: HSPA Mathematics, Pearson: 2008
Sico, John J., HSPA Success Work-A-Text in Mathematics – Expanded Edition, Instructivision: 2003
McDougal-Littell: Algebra 1 2004
McDougal-Littell: Algebra 1 *Chapter Resource Books*
www.classzone.com

21st Century Skills		
Creativity and Innovation	***Critical Thinking and Problem Solving***	***Communication and Collaboration***
Information Literacy	***Media Literacy***	***ICT Literacy***
Life and Career Skills	***Technology Based Activities***	
http://www.p21.org/index.php?option=com_content&task=view&id=254&Itemid=119 http://www.iste.org/standards/nets-for-students.aspx		

Differentiated Learning Activities

- *7.4 Cooperative Learning Activity* (*McDougal Littell,* Algebra 1*, 2004, Chapter 7 Resource Books*, p.60)
- *7.5 Graphing Calculator Lesson Opener* (*McDougal Littell,* Algebra 1*, 2004, Chapter 7 Resource Books*, p.66)
- *9.3 Graphing Calculator Lesson Opener* (*McDougal Littell,* Algebra 1*, 2004, Chapter 9 Resource Books*, p.37)
- *9.3 Graphing Calculator Activity* (*McDougal Littell,* Algebra 1*, 2004, Chapter 9 Resource Books*, p.40)
- *9.4 Visual Approach Lesson Opener* (*McDougal Littell,* Algebra 1*, 2004, Chapter 9 Resource Books*, p.55)
- *9.6 Activity Lesson Opener* (*McDougal Littell,* Algebra 1*, 2004, Chapter 9 Resource Books*, p.85)

Performance Assessment Task Sample	**Teacher Resources:** ❖ ***Concept Application: Sale*** ❖ ***Concept Application: Catering*** ❖ ***Released PATs: Counting Numbers***

BIG IDEA IX: EQUIVALENCE

Curriculum Management System

COURSE NAME: FUNDAMENTALS OF MATH GRADE 12

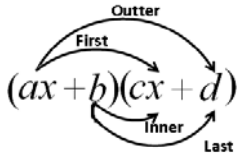
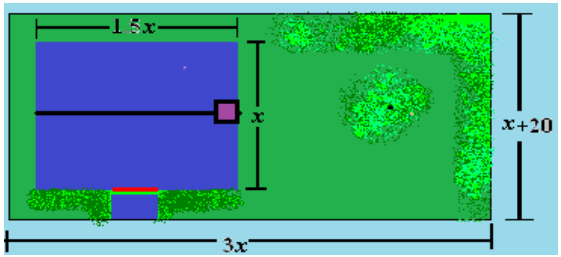
OVERARCHING GOALS

1. ***Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.***
2. ***Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.***
3. ***Investigate, research, and synthesize various pieces of information from a variety of media sources.***

ESSENTIAL QUESTIONS

- Why can't you solve for the zeros of a polynomial if the polynomial equation is set equal to anything other than zero?
- How are factoring a polynomial and multiplying a polynomial related?
- How does factoring a polynomial help to yield information from a real-life model?
- Does this **make sense**?

SUGGESTED BLOCKS FOR INSTRUCTION: 5-6

KNOW	UNDERSTAND	DO
Students will know that:	***Students will understand that:***	***Students will be able to:***
• When adding or subtracting polynomials, combine like terms.	• The factors and x-intercepts of a polynomial are directly related • Multiplying polynomials and factoring polynomials are reverse processes of each other.	• Evaluate and simplify expressions.
• The **degree** of a polynomial is the highest exponent.		• Add and subtract polynomials
• The **leading coefficient** is the number next to the variable with the highest exponent.	**SAMPLE CONCEPTUAL UNDERSTANDINGS**	• Multiply a polynomial by a monomial or binomial
• A term is called a monomial, involving multiplication between constants which can be multiplied by variables.	**SAMPLE CONCEPTUAL UNDERSTANDING ITEM** *(Mcdougal-Littell: Algebra 1, 2004)*	• Divide a polynomial by a monomial
• **FOIL** is a double distributing method of multiplication for two binomials $(ax + b)(cx + d)$: 	You plan to build a house that is 1 ½ times as long as it is wide. You want the land around the house to be 20 feet wider than the width of the house, and twice as long as the length of the house. 	• Select and use appropriate methods to solve equations and inequalities. • Linear equations - algebraically • Quadratic equations - factoring (when the coefficient of x^2 is 1) and using the quadratic formula • All types of equations using graphing, computer, and graphing calculator techniques
• **Zero product property** states that if $ab = 0$ then $a = 0$ or $b = 0$.	Write an expression for the area of the land surrounding the house. If $x = 30$ feet, what is the area of the house? What is the area of the entire property?	• Judge the meaning, utility, and reasonableness of the results of symbol manipulations, including those carried out by technology.
• **Greatest common factor** is the common factor of all the terms. • A polynomial is prime if it is not the product of polynomials having integer coefficients. • To factor a polynomial completely write as the product	**SAMPLE CONCEPTUAL UNDERSTANDING ITEM** *(Mcdougal-Littell: Algebra 1, 2004)* Consider a circle whose radius is greater than 9 and whose area is given by $A = \pi(x^2 - 18x + 81)$. Use factoring to find an Expression for the radius of the circle.	

KNOW		UNDERSTAND	DO
Students will know that:		***Students will understand that:***	***Students will be able to:***
	of monomial factors or prime factors with at least two terms.	**SAMPLE CONCEPTUAL UNDERSTANDING ITEM** *(Mcdougal-Littell: Algebra 1, 2004)* Using the vertical motion equation $h = 16t^2 - vt$, you toss a tennis ball from a height of 96 feet with an initial velocity of 16 feet per second. How long will it take for the tennis ball to reach the ground?	

Assessment Models

- **NOTE: The assessment models provided in this document are suggestions for the teacher. If the teacher chooses to develop his/her own model, *it must be of equal or better quality and at the same or higher cognitive levels (as noted in parentheses*).**
- **Depending upon the needs of the class, the assessment questions may be answered in the form of essays, quizzes, mobiles, PowerPoint, oral reports, booklets, or other formats of measurement used by the teacher.**

Pre-Assessment/Diagnostic Assessment:

- Ask students to describe the relationship between the product of two prime numbers and the product of two prime factors of a polynomial. (i.e. Describe the relationship between the following statements: "$3 \cdot 2 = 6$" and "$(x + 3) \cdot (x + 2) = x^2 + 5x + 6$")

Open-Ended (Formative) Assessment:

- Group and individual work is assigned daily, from various sources *(Synthesis, Analysis, and Evaluation).*
- Introductory and Closing Activities will be done every day to pre-assess student knowledge and assess understanding of topics *(Synthesis, Analysis, and Evaluation).*

Summative Assessment:

- Assessment questions should be open-ended and should follow the general format illustrated in the Essential Questions/Sample Conceptual Understanding section. *(Synthesis, Analysis, Evaluation)*
- Students will be given quizzes that provide a brief review of the concepts and skills in the previous lessons.
- Students will take the HSPA again
- Students will participate in the AHSA process

Additional Resources

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Sico, John J., HSPA Success Work-A-Text in Mathematics – Expanded Edition, Instructivision: 2003
McDougal-Littell: Algebra 1 2004
McDougal-Littell: Algebra 1 *Chapter Resource Books*
www.classzone.com

21st Century Skills		
Creativity and Innovation	***Critical Thinking and Problem Solving***	***Communication and Collaboration***
Information Literacy	***Media Literacy***	***ICT Literacy***
Life and Career Skills	***Technology Based Activities***	
http://www.p21.org/index.php?option=com_content&task=view&id=254&Itemid=119 http://www.iste.org/standards/nets-for-students.aspx		

Differentiated Learning Activities

- *10.1 Application Lesson Opener (McDougal Littell,* Algebra 1*, 2004, Chapter 10 Resource Books*, p.13)
- *10.2 Graphing Calculator Activity (McDougal Littell,* Algebra 1*, 2004, Chapter 10 Resource Books*, p.27)
- *10.3 Application Lesson Opener (McDougal Littell,* Algebra 1*, 2004, Chapter 10 Resource Books*, p.40)
- *10.3 Cooperative Learning Activity (McDougal Littell,* Algebra 1*, 2004, Chapter 10 Resource Books*, p.47)
- *10.5 Activity Lesson Opener (McDougal Littell,* Algebra 1*, 2004, Chapter 10 Resource Books*, p.68)
- *10.7 Activity Lesson Opener (McDougal Littell,* Algebra 1*, 2004, Chapter 10 Resource Books*, p.95)

Performance Assessment Task Sample	**Teacher Resources:** ❖ ***Concept Application: Quadratic Function*** ❖ ***Concept Application: Scientific Notation***

BIG IDEA X: NETWORKS

Curriculum Management System

COURSE NAME: FUNDAMENTALS OF MATH GRADE 12

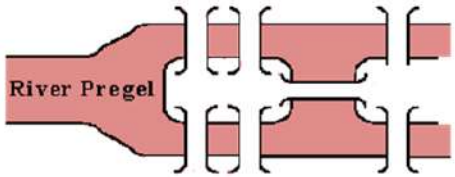
OVERARCHING GOALS

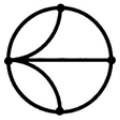
1. ***Communicate mathematical ideas in clear, concise, organized language that varies in content, format and form for different audiences and purposes.***
2. ***Comprehend, understand, analyze, evaluate, critique, solve, and respond to a variety of real-life, meaningful problems.***
3. ***Investigate, research, and synthesize various pieces of information from a variety of media sources.***

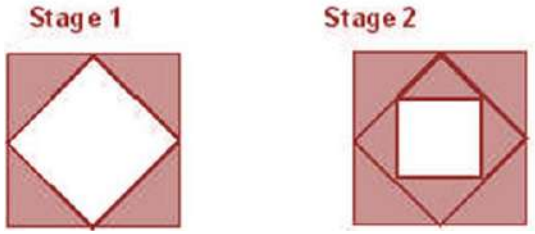
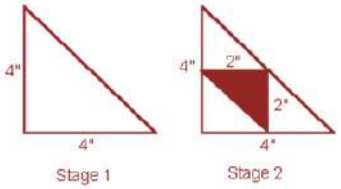
ESSENTIAL QUESTIONS

- How can visual tools such as networks be used to optimize the answer to questions?
- How can algorithmic thinking be used to solve problems?
- Does this **make sense**?

SUGGESTED BLOCKS FOR INSTRUCTION: 3-4

KNOW	UNDERSTAND	DO
Students will know that:	***Students will understand that:***	***Students will be able to:***
• **Vertex-edge graphs**, consisting of dots (vertices) and lines joining them (edges), can be used to represent and solve problems based on real-world situations. • *(http://www.ntuaft.com/njcccs)*	• A Vertex Edge Graph is a visual vehicle that helps to optimize a solution within given constraints. • Discrete information can be quantified and interpreted effectively using algorithms. **SAMPLE CONCEPTUAL UNDERSTANDINGS**	• Use vertex-edge graphs and algorithmic thinking to represent and solve practical problems. • Circuits that include every edge in a graph • Circuits that include every vertex in a graph
• **Optimization** is finding the best solution within given constraints.	**SAMPLE CONCEPTUAL UNDERSTANDING ITEM** (WWW.STATE.NJ.US) Your science class' pet mice Mickey and Minnie just gave birth to 6 babies: 3 males and 3 females. The teacher informs you that the baby mice can breed when they are 6 weeks old and the babies are born 3 weeks later. If each female mouse has a litter of 6 babies, half males and half females, how many mice will you have 12 weeks from now? **SAMPLE OPEN-ENDED RESPONSE ITEM** (NJDOE TEST SPECIFICATIONS LINK) Below is a diagram of the Bridges of Königsberg.  Königsberg • If bridges are edges, and land is represented by vertices, draw a network diagram representing the Königsberg bridge problem.	• Explore strategies for making fair decisions. • Follow and devise lists of instructions, called "algorithms," and use algorithmic thinking to find the best solution to problems like those involving vertex-edge graphs, but also to solve other problems. • *(http://www.ntuaft.com/njcccs)*

KNOW		UNDERSTAND	DO
Students will know that:		*Students will understand that:*	*Students will be able to:*
		• The Königsberg network is not traversable. (A network is traversable if it can be drawn without any breaks in the curve and without repeating any edges.) Change the diagram so that it is traversable. *One possible answer to the first bullet:*  **SAMPLE CONCEPTUAL UNDERSTANDING ITEM** (HSPA SUCCESS WORK-A-TEST IN MATHEMATICS) Draw a network of roads connecting the six cities below so that it is possible to drive between any two of the cities without passing through another city. **SAMPLE CONCEPTUAL UNDERSTANDING ITEM** (WWW.STATE.NJ.US) Your science class' pet mice Mickey and Minnie just gave birth to 6 babies: 3 males and 3 females. The teacher informs you that the baby mice can breed when they are 6 weeks old and the babies are born 3 weeks later. If each female mouse has a litter of 6 babies, half males and half females, how many mice will you have 12 weeks from now? **SAMPLE CONCEPTUAL UNDERSTANDING ITEM** (WWW.STATE.NJ.US) A design follows this pattern: a square is divided in half by drawing another square inside of it on a 45 degree rotation. The outer area is then shaded. Then, the unshaded area is divided again in the same manner. Assume that the pattern stays the same, what is the ratio	

KNOW	UNDERSTAND	DO
Students will know that:	*Students will understand that:*	*Students will be able to:*
	of the shaded area to the unshaded area in Stage 3? 	
	SAMPLE CONCEPTUAL UNDERSTANDING ITEM (WWW.STATE.NJ.US) Cass has $4,000 that she is saving to buy a $7,000 car. She has decided to invest this money in an investment that will return 12% each year. . She makes no withdrawals but she doesn't deposit any more money. If all of her earnings are reinvested, how many years will it be until she can buy her car? (Assume that the price of $7,000 includes all extras: license plates, taxes, etc.)	
	SAMPLE CONCEPTUAL UNDERSTANDING ITEM (WWW.STATE.NJ.US) The picture below shows stages 1 and 2 of a geometric progression that follows this rule: In a triangle, a line is drawn from the middle of each leg to the middle of the hypotenuse. The legs of the new triangles are 1/2 the length of the previous triangle's legs. Stage 1 and Stage 2 of an right triangle are shown below: 	

KNOW		UNDERSTAND	DO
Students will know that:		*Students will understand that:*	*Students will be able to:*
		Find the area of the triangle in Stage 1. Draw stage 3 and Stage 4 Find the total area of the all shaded triangles in Stage 3 and Stage 4. Will the total area of the shaded triangles in any stage ever exceed the area of the triangle in Stage 1? Explain your answer. **SAMPLE CONCEPTUAL UNDERSTANDING ITEM** (WWW.STATE.NJ.US) Before Jason pays 25% tax on the 8% commission he makes on every house he sells at Top Notch Real Estate Agency, he deducts 12% of the commission for expenses to determine the amount of taxes to be paid. Write a set of steps that any Top Notch employee could follow, using the same procedure as Jason. Test out your steps by computing the amount of taxes Jason would pay on a $250,000 home.	

Assessment Models

- **NOTE: The assessment models provided in this document are suggestions for the teacher. If the teacher chooses to develop his/her own model, *it must be of equal or better quality and at the same or higher cognitive levels (as noted in parentheses*).**
- **Depending upon the needs of the class, the assessment questions may be answered in the form of essays, quizzes, mobiles, PowerPoint, oral reports, booklets, or other formats of measurement used by the teacher.**

Pre-Assessment/Diagnostic Assessment:

- HSPA Practice tests
- AHSA performance tasks

Open-Ended (Formative) Assessment:

- Group and individual work is assigned daily, from various sources *(Synthesis, Analysis, and Evaluation).*
- Introductory and Closing Activities will be done every day to pre-assess student knowledge and assess understanding of topics *(Synthesis, Analysis, and Evaluation).*

Summative Assessment:

- Assessment questions should be open-ended and should follow the general format illustrated in the Essential Questions/Sample Conceptual Understanding section. *(Synthesis, Analysis, Evaluation)*
- Students will be given quizzes that provide a brief review of the concepts and skills in the previous lessons.
- Students will take the HSPA again
- Students will participate in the AHSA process

Additional Resources

http://www.state.nj.us/education/njpep/assessment/hspa/hspa_math/main_menu.htm

Primiani, A. Rose and William Caroscio, Prentice Hall Brief Review for New Jersey: HSPA Mathematics, Pearson: 2008

Sico, John J., HSPA Success Work-A-Text in Mathematics – Expanded Edition, Instructivision: 2003

21st Century Skills		
Creativity and Innovation	***Critical Thinking and Problem Solving***	***Communication and Collaboration***
Information Literacy	***Media Literacy***	***ICT Literacy***
Life and Career Skills	***Technology Based Activities***	
http://www.p21.org/index.php?option=com_content&task=view&id=254&Itemid=119 http://www.iste.org/standards/nets-for-students.aspx		

Differentiated Learning Activities

- **Concept Applications:** ***Classroom Networks***

Performance Assessment Task Sample	**Teacher Resources:** ❖ http://www.themathworkshop.com/assets/DiscreteMathC.pdf ❖ ***Concept Application: Nets*** ❖ ***Concept Application: Vertices and Edges***

COURSE NAME: FUNDAMENTALS OF MATH GRADE 12

1. Mathematical ideas **interconnect** and build on one another resulting in a **coherent whole**.
2. Properties of **geometric figures** are vital to erecting **structures** and proper **portrayal**. Geometric **figures** are defined by **unique properties**.
3. **Area**, **perimeter**, and **volume** define **space**. **Trigonometric ratios** and the **Pythagorean Theorem** are **interconnected** in **defining** the properties of a right triangle**.**
4. **Probability** is a way of **predicting** outcomes, but does not assure outcomes. **Risk** and **fairness** are interrelated. **Profit** is determined by the delicate **balance** of human perception of odds and underlying probability.
5. **Theoretical probability** is dependent on the **sample space** of an event.
6. Visual **representations** of data are essential in **analyzing** data. An effective analysis is comprised of the mean, median, mode, and range of the data. **Trends** and strengths of **relationships** are apparent in the visual representations of data.
7. Equations **model** patterns that occur in real life problems and are used to **solve** for unknown quantities. A graph and its equation are in an **interdependent** relationship. Formulas are direct **representations** of real life applications that help to **solve** for an unknown quantity. A solution of a system of equations **models** a unique **outcome** for two or more real-life situations.
8. Functions model real-life **patterns** to enable us to make **predictions**. Equations describe the **relationship** between a dependent and an independent variable.
9. The factors and x-intercepts of a polynomial are directly **related**. Multiplying polynomials and factoring polynomials are reverse **processes** of each other.
10. A **Vertex Edge Graph** is a visual vehicle that helps to optimize a solution within given constraints. **Discrete information** can be quantified and interpreted effectively using **algorithms**.
11. Problems solving and application are **interconnected**.