Diocese of Trenton
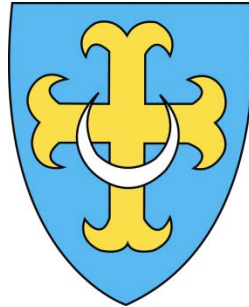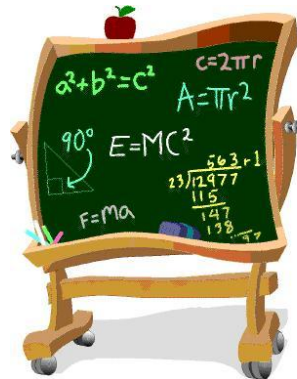
Mathematics Curriculum Guidelines

Pre-Algebra
Grade 7 or Grade 8

September 2011

Introduction

The Pre-Algebra Program is designed for eligible seventh grade students as a prerequisite for Algebra I in grade 8 or as an advanced class for grade 8 students.

The following criteria are critical for success in Pre-Algebra:
- Earn a minimum of 85% in the formative assessments in the previous math course.
- Earn a minimum of 85% in the summative assessment at the end of the school year.
- Score in the proficient category in Mathematics in the Terra Nova testing process.
- Score a minimum of 85% on the mathematics section of the Terra Nova test.
- Express an interest in advancing in mathematics.
- Teacher recommendation.

N.B. There may exceptions to the above criteria given the availability of teachers within a given school culture.

Key Symbols for Standards:

DTM – Diocese of Trenton Mathematics

CC – Counting and Cardinality

NO – Number Operations

G – Geometry

OA – Operations and Algebra

MD – Measurement and Data

SP – Statistics and Probability

CCSSM- Common Core State Standards in Mathematics

CCSM – Common Core Standards in Mathematics

* - Enrichment (Pre-K through Grade 8)

PRE-ALGEBRA

Success in the teaching and learning of mathematics is built on the cumulative understanding of the concepts of fluency and continuity from grade level to grade level.

Instructional time should focus on three critical areas; (1) developing fluency with rational and irrational numbers and properties of exponents applied to solving equations; understanding the concept of a function and its applications; (2) comparing and contrasting 2-D and 3-D figures using spatial visualization techniques, including transformations, and (3) applying probability and statistics using bivariant data, illustrated with various graphing techniques.

N.B. If graphing calculators are not available for students access Microsoft Mathematics (free software) on the internet as a substitute for the graphing utility. www.microsoftmathematics.com/download

Standard:
- Number Operations(PA NO + DTM)

Essential Questions:

- Describe real-life applications of operations of integers.
- Why are symbols important in the study of Algebra?
- Can every real number have a position on a number line?

CONCEPT	CONTENTS
Number Sense	Define, compare and use integers and rational numbers on a number line
	Change numbers between standard form and scientific notation
	Define and apply scientific notation to place value with positive and negative exponents
	Multiply and divide numbers in scientific notation
	Write a decimal as a fraction in simplest form and write fractions or mixed numbers as decimal numbers
	Find the GCF and LCM of two or more numbers and monomials
	Define, compare and use rational and irrational numbers (between any two rational number there is at least one irrational number)
	Determine and explain rational, whether to overestimate or underestimate in problem solving
	Use base, exponent and exponential form
	Express that for all numbers a not equal to 0, $a^0 = 1$ and $a^1 = a$ (0^0 is indeterminate)
	Apply rules for exponents by multiplying and dividing with same base (Multiplication Property of Exponents)
	Express a square or cubed number in standard, factored and exponential form

	Know perfect squares up to 15 (*25) and perfect cubes up to 10
	Apply divisibility rules
	Recognize and apply concept of significant digits
	Express composite numbers as products of prime numbers (e.g., factor tree, Fundamental Theorem of Arithmetic)
Numerical Operations	Define and use commutative and associative properties of addition, distributive, identity (additive and multiplicative), multiplicative inverse (reciprocal) zero product properties using algebraic notation
	Use Order of Operations to simplify expressions
	Apply integers to all numerical operations
	Use inverse relationships of addition-subtraction and multiplication-division
	Use all operations with rational numbers
	Convert fractions, decimals and percents
	Find percent of a given number (percent equation and proportion)
	Find the percent of increase and decrease
	Apply ratio, rate, unit rate, direct proportion and percents in real life situations (consumer applications)
	Use estimation in all operations and problem solving
	Apply rational number operations
	Define absolute value as distance from zero and absolute value of variables, e.g. $\lvert x \rvert = 9$
	Using absolute value in adding and subtracting
	Simple interest and Compound interest

Standard:
- Geometry (PA G + DTM)
- Measurement and Data (PA MD + DTM)

Essential Questions:
- Find the area of a triangle without being given its height.
- How does the area of a triangle change as its side lengths increase or decrease?

CONCEPT	CONTENTS
Geometry	Identify and complete symmetrical figures on a grid using ordered pairs
	Identify and compare two and three dimensional figures using spatial visualization and visual perception
	Define, draw or construct points, lines and line segments, rays, perpendicular, parallel, intersecting and transversals using correct symbolic notation
	Construct angle and segment bisectors
	Define, draw or construct various types of angles (right,

	acute, obtuse, straight, complementary, supplementary, corresponding and vertical, alternate interior/exterior)
Concept Development	*Finding interior and exterior angles in regular and irregular polygons*
	Construct angles, segments and triangles using straight edge and compass
	Apply ratio and proportion to congruent and similar figures
	Classify all quadrilaterals and triangles (by angles and sides)
	Properties of special quadrilaterals
	Classify solid figures (3-dimensional)
	Identify shape and quantity of faces, edges and vertices of 3-dimensional figures
	Use geometric transformations (rotations, reflections and translations, dilations) on a grid
	Construct a tessellation
	Identify fractals as occurring in nature
Measurement	Estimate and measure length, width, height, weight, area and volume using metric and customary units of measurement to nearest centimeter, meter, inch, foot, kilogram, pound, liter, cup, nearest kilometer, yard, mile, pint, gallon, gram, ounce, ton
	Find area and perimeter of a rectangle, square, triangle, trapezoid, rhombus, parallelogram and kite and find missing sides. Find area of a triangle using only side lengths, Heron's Formula
	Find area and perimeter of irregular shapes and common shaded/unshaded regions
	Apply and use Pythagorean Theorem to find missing sides of a right triangle
	Use Trigonometric ratios to find sides and missing angles of a right triangle (SOHCAHTOA)
	*Special right triangles (30,60,90; 45,45,90)
	Measure and compute volume and surface area of prisms, cylinders, cones and spheres
	Utilize 4 quadrant coordinate geometry
	Choose appropriate units of measurement; measure and make appropriate conversions: • time (hour, minute, second); • customary units of length (inch, foot, yard, mile) • Metric units of length (millimeter, centimeter, meter, kilometer) • Customary capacity (cup, pint, quart, gallon) • Metric capacity (milliliter, liter, kiloliter) • Weight (ounce, pound, ton) • Mass (gram, kilogram)

Standard:
- Operations and Algebra (PA OA + DTM)

Essential Questions:
- How would you express the solution of a word problem graphically?
- Describe how slope applies to real-life applications.

CONCEPT	CONTENT
Patterns	Describe and create compound patterns (e.g., arithmetic and geometric, Fibonacci, Pascal's Triangle)
	Use proper vocabulary when explaining patterns that repeat, grow or compress
	Evaluate infinite sequences (converging and diverging)
	Represent, analyze and predict relations between quantities, especially quantities changing over time
Algebra	Translate phrases into algebraic expressions and equations
	Simplify expressions using order of operations including like terms
	Solve multi step equations and inequalities using rational numbers
	Describe arithmetic operations as functions, including combining operations and inverse operations
	Substitute a number value for a variable
	Find the slope of a line given two points
Concept Development	*Express slope as a rate of change*
	Define and determine x- and y-intercepts
	Use input/output table, x- and y- intercepts, slope-intercept formula and point-slope form to find and graph linear functions or linear inequalities
	Solve multi step inequalities and graph solutions on a number line
	Identify polynomials according to the number of terms (in standard form)
	Add and subtract polynomials
	Use FOIL method or distributive property to find products of binomials

Standard:
- Statistics and Probability (PA SP + DTM)

Essential Questions:
- Describe how the type of data influences the choice of display.
- What type of questions can or cannot be answered from a graph?

CONCEPT	CONTENT
Data Analysis	Collect, organize and interpret data to solve non-routine problems involving world situations(e.g. random sampling)
	Compute measures of central tendency (mean, median, mode and range) with or without a calculator [*graphing calculator, geogebra.com (free on-line), TI Smart View (must purchase)]
	Create, interpret and make inferences based on stem and leaf plots, box and whisker plots, horizontal and vertical bar graphs, line graphs, tree diagrams, frequency distribution, histograms, circle graphs and tables (use available technology to create data displays)
	Draw inferences and construct convincing arguments based on data analysis
Probability	Perform compound probability experiments of simulations, record results and make predictions
	Discuss low or high probability and possibility of various events using real life situations
	Express probability in fraction form using concrete and semi-concrete activities
	Find permutations and combinations using factorial notation
Discrete Math	Utilize Venn Diagrams using multiple classifications (e.g., classifying quadrilaterals)
	Overlapping and disjoint events
	Logic problems
Mathematical History	Research the history of zero; mathematicians and their discoveries; applications of mathematics in other disciplines