NORTHERN YORK COUNTY SCHOOL DISTRICT

MATHEMATICS PRE-ALGEBRA

May 2013

Implementation of Standards for Mathematical Practice
Northern Middle School

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. At Northern Middle School, we will work diligently and with fidelity to develop our students as outlined in the following eight standards:

1. Make sense of problems and persevere in solving them.

In an effort to create mathematically proficient students, our goal is that all students will be able to

- start by explaining to themselves the meaning of a problem and looking for entry points to its solution
- analyze givens, constraints, relationships, and goals
- make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt
- consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution
- monitor and evaluate their progress and change course if necessary
- explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends
- check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?"
- understand the approaches of others to solving complex problems and identify correspondences between different approaches.

2. Reason abstractly and quantitatively.

In an effort to create mathematically proficient students, our goal is that all students will be able to

- make sense of quantities and their relationships in problem situations
- abstract a given situation and represent it symbolically and manipulate the representing symbols as if they have a life of their own, without necessarily attending to their referents
- create a coherent representation of the problem at hand; consider the units involved; attend to the meaning of quantities, not just how to compute them
- know and flexibly use different properties of operations and objects

3. Construct viable arguments and critique the reasoning of others.

In an effort to create mathematically proficient students, our goal is that all students will be able to

- understand and use stated assumptions, definitions, and previously established results in constructing arguments -make conjectures and build a logical progression of statements to explore the truth of their conjectures
- analyze situations by breaking them into cases, and can recognize and use counterexamples
- justify their conclusions, communicate them to others, and respond to the arguments of others
- reason inductively about data, making plausible arguments that take into account the context from which the data arose
- compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and, if there is a flaw in an argument, explain what it is
- determine domains to which an argument applies
- listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments

4. Model with mathematics.

In an effort to create mathematically proficient students, our goal is that all students will be able to

- apply the mathematics they know to solve problems arising in everyday life, society, and the workplace

- apply proportional reasoning to plan a school event or analyze a problem in the community
- identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas
- analyze those relationships mathematically to draw conclusions
- routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose

5. Use appropriate tools strategically.

In an effort to create mathematically proficient students, our goal is that all students will be able to

- consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software
- detect possible errors by strategically using estimation and other mathematical knowledge
- recognize that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data
- identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems
- use technological tools to explore and deepen their understanding of concepts

6. Attend to precision.

In an effort to create mathematically proficient students, our goal is that all students will be able to

- try to communicate precisely to others
- use clear definitions in discussion with others and in their own reasoning
- state the meaning of the symbols they choose, including using the equal sign consistently and appropriately
- be careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem
- calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context

7. Look for and make use of structure.

In an effort to create mathematically proficient students, our goal is that all students will be able to

- look closely to discern a pattern or structure
- recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems
- step back for an overview and shift perspective
- see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects

8. Look for and express regularity in repeated reasoning.

In an effort to create mathematically proficient students, our goal is that all students will be able to

- notice if calculations are repeated, and look both for general methods and for shortcuts
- maintain oversight of the process as they work to solve a problem, while attending to the details
- continually evaluate the reasonableness of their intermediate results

Summary Statement

The Standards for Mathematical Practice describe the predispositions and mindset that mathematics educators at all levels should foster in their students. As educators, the thinking and actions of our students is at the forefront. The Standards for Mathematical Practice highlight attitudes, capabilities, and procedures exhibited by mathematically proficient students as they approach and work with mathematical content. As educators, we will create lessons which allow students to internalize these Standards over time by ensuring that students have opportunities to problem solve, reason, communicate mathematically, and make connections, as well as to develop skills in performing computational procedures accurately, efficiently, and flexibly. The mathematically proficient student should have such a well-grounded understanding of the Standards that they become habits of mind to be applied as needed when dealing with any mathematics problem. Our instructional activities will be sufficiently rich to promote student growth. Our classroom structures will allow students to mature into mathematically proficient individuals who share common characteristics. Our instruction will be student-centered, authentic, and engaging, based on multiple strategies, representations, and solutions. We will encourage students to explain and defend their work, and to analyze work of peers, while acting in the roles of facilitator and co-explorer. Lastly, we will at all times emphasize one or more Standard(s) for Mathematical Practice.

Northern York County School District Curriculum

Course Name	Pre-Algebra
Grade Level	7th-8th Grade
Instructional Procedures	8th Grade Course/Compacted 7th Grade Course Pre-requisite course to Algebra I (Keystone-based course)

Unit 1	**2.1 Number System**			
Time Frame	**6-8 Weeks**			
1.1	**Rational and Irrational Numbers**			
Key Concepts	**Essential Questions**	**PA Common Core Content Standard**	**Eligible Content**	**Terminology**
Apply concepts of rational and irrational numbers.	How can you determine whether a number is rational or irrational? How do you convert a terminating or repeating decimal into a rational number? How do you estimate the value of irrational numbers without a calculator?	**CC.2.1.8.E.1** Distinguish between rational and irrational numbers using their properties.	**M08.A-N.1.1.1** Determine whether a number is rational or irrational. For rational numbers, show that the decimal expansion terminates or repeats (limit repeating decimals to thousandths). **M08.A-N.1.1.2** Convert a terminating or repeating decimal into a rational number (limit repeating decimals to thousandths). **M08.A-N.1.1.3** Estimate the value of irrational numbers without a calculator (limit whole number radicand to less than 144). **M08.A-N.1.1.4** Use rational approximations of irrational numbers to compare and order	Rational Irrational Square Root Cube Root Perfect Square Perfect Cubes Radicand

	How do you compare and order irrational numbers using rational approximations of irrational numbers? How do you identify and locate irrational numbers at their approximate locations on a number line.		irrational numbers. **M08.A-N.1.1.5** Locate/identify rational and irrational numbers at their approximate locations on a number line.	
		CC.2.1.8.E.4 Estimate irrational numbers by comparing them to rational numbers.	**M08.A-N.1.1.3** Estimate the value of irrational numbers without a calculator (limit whole number radicand to less than 144). **M08.A-N.1.1.4** Use rational approximations of irrational numbers to compare and order irrational numbers. **M08.A-N.1.1.5** Locate/identify rational and irrational numbers at their approximate locations on a number line.	

Unit 2	2.2 Algebraic Concepts			
Time Frame	**16-18 weeks**			
2.1	**Expressions and Equations**			
Key Concepts	**Essential Questions**	**PA Common Core Content Standard**	**Eligible Content**	**Terminology**
Represent and use expressions and equations to solve problems involving radicals and integer exponents.	How do you apply the properties of exponents to find equivalent expressions? How do you solve equations using square roots and cube roots? How do you express numbers in standard and scientific notation? How do you perform operations with numbers expressed in scientific notation?	**CC.2.2.8.B.1** Apply concepts of radicals and integer exponents to generate equivalent expressions.	**M08.B-E.1.1.1** Apply one or more properties of integer exponents to generate equivalent numerical expressions without a calculator (with final answers expressed in exponential form with positive exponents). **Properties will be provided.** **M08.B-E.1.1.2** Use square root and cube root symbols to represent solutions to equations of the form $x2 = p$ and $x3 = p$, where p is a positive rational number. Evaluate square roots of perfect squares (up to and including 122) and cube roots of perfect cubes (up to and including 53) without a calculator. **M08.B-E.1.1.3** Estimate very large or very small quantities by using numbers expressed in the form of a single digit times an integer power of 10, and express how many times larger or smaller one number is than another. **M08.B-E.1.1.4** Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Express answers in scientific notation and choose units of appropriate size for measurements of very large or very small quantities	Exponents Positive Negative Integers Scientific Notation Standard Notation

2.2	Linear Relationships between lines and equations			
Analyze and describe linear relationships between two variables, using slope.	How do you compare proportional relationships? How do you use similar right triangles to show and explain why the slope *m* is the same between any two distinct points on a non-vertical line in the coordinate plane? How do you use Slope-Intercept Form to represent a linear equation?	**CC.2.2.8.B.2** Understand the connections between proportional relationships, lines, and linear equations.	**M08.B-E.2.1.1** Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. **M08.B-E.2.1.2** Use similar right triangles to show and explain why the slope *m* is the same between any two distinct points on a non-vertical line in the coordinate plane. **M08.B-E.2.1.3** Derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at b.	Unit Rate Slope Coordinate Plane Slope Intercept Form Direct Variation
2.3	**Analyzing and Solving Linear Equations**			
Write, solve, graph, and interpret linear equations in one or two variables, using various methods.	How do you solve linear equations? How do you solve a system of linear equations? How do you use a system of linear equations to solve real-world problems?	**CC.2.2.8.B.3** Analyze and solve linear equations and pairs of simultaneous linear equations.	**M08.B-E.3.1.1** Write and identify linear equations in one variable with one solution, infinitely many solutions, or no solutions. Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers). **M08.B-E.3.1.2** Solve linear equations that have rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms. **M08.B-E.3.1.3** Interpret solutions to a system of two linear equations in two variables as points of intersection of their graphs, because points of intersection satisfy both equations simultaneously. **M08.B-E.3.1.4** Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection.	Linear Equations Null Set / Empty Set Equivalent Equations Distributive Property Like Terms System of Linear Equations

			M08.B-E.3.1.5 Solve real-world and mathematical problems leading to two linear equations in two variables.	
2.4	**Functions**			
Define, evaluate, and compare functions displayed algebraically, graphically, numerically in tables, or by verbal descriptions.	How do you determine whether a relation is a function? How do you compare Linear and Non-Linear Functions?	**CC.2.2.8.C.1** Define, evaluate, and compare functions.	**M08.B-F.1.1.1** Determine whether a relation is a function. **M08.B-F.1.1.2** Compare properties of two functions each represented in a different way (i.e., algebraically, graphically, numerically in tables, or by verbal descriptions). **M08.B-F.1.1.3** Interpret the equation $y = mx + b$ as defining a linear function whose graph is a straight line; give examples of functions that are not linear.	Relation Function X/Y Table Non-Linear Functions
Represent or interpret functional relationships between quantities using tables, graphs, and descriptions.	How do you create a function to model a linear relationship between two quantities? How do you describe and analyze a functional relationship between two quantities by analyzing a graph?	**CC.2.2.8.C.2** Use concepts of functions to model relationships between quantities.	**M08.B-F.2.1.1** Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models and in terms of its graph or a table of values. **M08.B-F.2.1.2** Describe qualitatively the functional relationship between two quantities by analyzing a graph (e.g., where the function is increasing or decreasing, linear or nonlinear). Sketch or determine a graph that exhibits the qualitative features of a function that has been described verbally.	Rate of Change

Unit 3	**2.3 Geometry**
Time Frame	**6-8 Weeks**

3.1	Congruence, similarity and transparencies			
Key Concepts	**Essential Questions**	**PA Common Core Content Standard**	**Eligible Content**	**Terminology**
Apply volume formulas of cones, cylinders, and spheres.	How do you use the formulas for the volumes of cones, cylinders and spheres to solve real-world problems?	**CC.2.3.8.A.1** Apply the concepts of volume of cylinders, cones, and spheres to solve realworld and mathematical problems.	**M08.C-G.3.1.1** Apply formulas for the volumes of cones, cylinders, and spheres to solve real world and mathematical problems. **Formulas will be provided.**	Volume Cone Cylinder Sphere
Apply properties of geometric transformations to verify congruence or similarity.	How do you identify and apply properties of rotations, reflections and translations? How do you describe a sequence of transformations from two congruent or similar figures?	**CC.2.3.8.A.2** Understand and apply congruence, similarity, and geometric transformations using various tools.	**M08.C-G.1.1.1** Identify and apply properties of rotations, reflections, and translations. **M08.C-G.1.1.2** Given two congruent figures, describe a sequence of transformations that exhibits the congruence between them. **M08.C-G.1.1.3** Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures, using coordinates. **M08.C-G.1.1.4** Given two similar two-dimensional figures, describe a sequence of transformations that exhibits the similarity between them.	Rotation Reflection Translation Dilation Congruent Two-dimensional Similar
Solve problems involving right triangles by the Pythagorean theorem.	How do you use the Pythagorean Theorem to solve real-world problems?	**CC.2.3.8.A.3** Understand and apply the Pythagorean Theorem to solve problems.	**M08.C-G.2.1.1** Apply the converse of the Pythagorean theorem to show a triangle is a right triangle. **M08.C-G.2.1.2** Apply the Pythagorean theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions. **M08.C-G.2.1.3** Apply the Pythagorean theorem to find the distance between two points in a coordinate system.	Converse Pythagorean Theorem Right Triangle

Unit 4	2.4 Statistics and Probability			
Time Frame	**5-6 weeks**			
4.1	**Investigating Patterns of bivariate data**			
Key Concepts	**Essential Questions**	**PA Common Core Content Standard**	**Eligible Content**	**Terminology**
Analyze and interpret bivariate data displayed in multiple representations.	How do you construct and interpret scatter plots? How do you identify and apply the line of best fit for scatter plots that suggest a linear association?	**CC.2.4.8.B.1** Analyze and/or interpret bivariate data displayed in multiple representations.	**M08.D-S.1.1.1** Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative correlation, linear association, and nonlinear association. **M08.D-S.1.1.2** For scatter plots that suggest a linear association, identify a line of best fit by judging the closeness of the data points to the line. **M08.D-S.1.1.3** Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept.	Scatter Plot Correlation Best Fit Line Linear Model
Understand that patterns of association can be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table.	How do you determine if there is a relationship between two categorical variables using a two-way table?	**CC.2.4.8.B.2** Understand that patterns of association can be seen in bivariate data utilizing frequencies.	**M08.D-S.1.2.1** Construct and interpret a two-way table summarizing data on two categorical variables collected from the same subjects. Use relative frequencies calculated for rows or columns to describe possible associations between the two variables.	
		CC.2.4.7.B.3 Investigate chance processes and develop, use, and evaluate probability models.		