Windsor BOE Curriculum Committee

Wednesday, January 9, 2013 4:30 PM
Curriculum Committee, L.P. Wilson Community Center, Room 17, 601 Matianuck Avenue, Windsor, CT 06095

1. **Call to Order, Pledge of Allegiance, Moment of Silence**
2. **Grade 8 Mathematics curriculum**
3. **Adjournment**

Windsor Public Schools
Curriculum Map for the Secondary Level
Grade 8 Mathematics

Purpose of the Course (from CCSS): In Grade 8, instructional time should focus on three critical areas: (1) formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations; (2) grasping the concept of a function and using functions to describe quantitative relationships; (3) analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem.

<table>
<tr><td>Name of the Unit: Congruence and Similarity</td><td>Length of the unit: 7 weeks</td></tr>
<tr><td colspan="2">Purpose of the Unit: In this 8th grade unit on congruence and similarity, students will explore mathematical functions that move objects in specified ways in the coordinate plane. Additionally, students will explore properties of lines and triangles to determine unknown angle measures. Finally, students will explore similarity and congruence by determining whether or not two shapes are similar or congruent. This is the first exposure students will have to transformations and similarity which will be extended when they take geometry in the high school.</td></tr>
<tr><td colspan="2">Common Core State Standards Addressed in the unit:

8.G.2. Understand that a two-dimensional figure is congruent to another if the second can be obtained from the first by a sequence of rotations, reflections and translations; given two congruent figures, describe a sequence that exhibits the congruence between them.

8.G.4. Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.

8.G.1. Verify experimentally the properties of rotations, reflections, and translations:
a. Lines are taken to lines, and line segments to line segments of the same length.
b. Angles are taken to angles of the same measure.
c. Parallel lines are taken to parallel lines.

8.G.3. Describe the effect of dilations, translations, rotations, and reflections on two-dimensional figures using coordinates.

8.G.5. Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.</td></tr>
<tr><td>Big Ideas:
1. Transformations produce similar figures, congruent figures, and in application produce symmetry in design.
2. Angles within triangles or angles created</td><td>Essential Questions:
1. How are geometric transformations related to congruence, similarity, and symmetry?
2. How do you know if shapes are similar or</td></tr>
</table>

by intersecting, parallel, or perpendicular lines have special relationships.	congruent? 3. How does knowing the measure of one angle help determine the measure of another angle?
Students will know: 1. the effects of transformations on congruent and similar figures 2. that a rotation is a turn 3. that a reflection is a flip 4. that a translation is a slide 5. that a dilation is zooming in and out of an object, or a stretch/shrink 6. the angle sums and exterior angles of triangles 7. what angles are created when parallel lines cut by a transversal	Students will be able to: 1. perform rotations, reflections, translations, and dilations on and off the coordinate plane. 2. describe the effects of a transformation on a figure. 3. describe reflectional, and translational symmetry 4. describe reflections and translations with algebraic rules 5. make viable arguments (informal proofs) to determine angle measures in a figure based on information given

Significant task 1: Transformational Symmetry

Significant task 1 is grounded in Investigations 1 and 2 of Kaleidoscopes, Hubcaps, and Mirrors. The students will examine three pictures and then describe what might earn the pictures a symmetry label. They will also examine a pinwheel, and discuss another type of symmetry, rotation symmetry. Working collaboratively, the students will explore and understand the important properties of symmetry and will recognize and describe reflections, rotation, and translation symmetry. It's important in this task to highlight the mathematical process standard of constructing viable arguments. By having students work in smaller collaborative groups, they can develop arguments to support their strategy. Then as a whole class they can discuss the pros and cons of the various strategies.

In this task, students will:
Recognize and describe rotation symmetry, include the center of rotation and the angle of rotation

- find and describe reflection, rotation and translation symmetries in kaleidoscope designs
- design shapes that have specified symmetries
- identify a basic design element that can be used to replicate a design

Reflections:

- use the properties of reflections to perform line reflections
- find a line of reflection given a figure and its image
- find the reflection image of a figure given a line of reflection
- give precise mathematical directions for performing reflections in terms of the effect of the transformation on points of the original figure

Rotations:

- use the properties of rotations to find the rotation image of a figure
- find the center and angle of rotation given a figure and its rotation image
- find the rotation image of a figure given the center and angle of rotation

- examine and describe the symmetries of a design made from a figure and its rotation image
- give precise mathematical directions for performing rotations in terms of the effect of the transformation on points of the original figure
- draw conclusions about a figure, such as measures of sides and angles, based on what symmetry or symmetries the figure has

Translations:

- use properties of translations to examine whether a given figure has translation symmetry
- find the magnitude and direction of a translation given a figure and its translation image
- find a translation image given the magnitude or direction of a vector specifying the translation
- examine and describe the translation symmetries of a design
- give precise mathematical directions for the performing translations in terms of the effect of the transformation on points of the original figure

This task directly targets the following standards: 8.G.2, 8.G.4, 8.G.3

Timeline: 2 weeks
Key vocabulary: symmetry, reflection symmetry, line of symmetry, rotation symmetry, basic design element, translations, translation symmetry, line of reflection, rotation
Resources: Kaleidoscopes, Hubcaps, and Mirrors Investigations 1 & 2, CMP Transition Kit Investigation 3: Transformations, On Core mathematics page 93-104, unit test and test prep pages 109-110, Transformation, Coach book pages 175-182, Passport page 474-476, passport sections 10.4(symmetry), 11.3(reflections), 11.4(rotations), 11.5(translations)

Significant task 2: Notation and Angle Relationships

Significant task 2 is grounded in Investigations 4 of Kaleidoscopes, Hubcaps, and Mirrors. In this investigation, students will review the sketch of an engineer's plans to build a footbridge across a river. Students will discuss how they think the engineer constructed the diagram and explore what useful information was needed to drawn specific line segments and angles. Students will understand that angles created by lines have special relationships and explore these relationships. Students can work in various types of settings/groups.

In this task, students will:

- develop the insight and ability to use triangle congruence conditions to deduce known side and angle lengths in figures
- explore the sum of exterior angles of a polygon
- use informal arguments to establish facts about the angle sum and exterior angles of triangles
- use informal arguments to establish facts about the angles created when parallel lines are cut by a transversal
- use informal arguments to establish facts about the angle-angle criterion for similarity of triangles

This task directly targets the following standards: 8.G.1, 8.G.5

Timeline: 1.5 weeks
Key vocabulary: interior angle, exterior angle, right triangle, supplementary angles, complementary

angles, alternate angles, corresponding angles, vertical angles
Resources: KHM Investigations 4.1 and 4.2, Shapes and Designs Investigation 3.4, Transition Kit page 23 – Investigations 4.1, 4.2, 4.3 Geometry Topics, Coach book sections 10.2 and 10.3, CMP transition kit investigation 4, Common Core Relationships page 128-153

Significant task 3: Congruence and Similarity on the Coordinate Plane

Significant task 3 is grounded in Investigations 5 of Kaleidoscopes, Hubcaps, and Mirrors. The drawing window in many computer geometry programs is a coordinate grid. In this investigation, students take a design in a computer window and transform the coordinates of its points according to specific rules. Collaboratively, students will explore the transformations of the design in coordinate grids and write algebraic rules for transforming a point (x, y) from the design to its image under translations, rotations, and reflections. The students will also explore the results of combining transformations on the design. In whole class discussion, groups can share the various strategies they developed while discussing the various portions of the task.

In this task, students will:

- use algebraic rules to produce similar figures on a coordinate grid
- focus student attention on both lengths and angles as criteria for similarity
- contrast similar figures with non-similar figures
- understand the role multiplication plays in similarity relationships
- understand the effect on the image if a number is added to the *x*- and *y*-coordinates

This task directly targets the following standards: 8.G.4, 8.G. 5

Timeline: 3 weeks
Key vocabulary:
Resources: Stretching and Shrinking Investigations 2.1 and 2.2, KHM Investigations 5.1 and 5.2, Coach book lesson 26 Reflections, Rotations, and Translations, Common Core Transition Kit page 13 Investigation 3: Transformation, Coach pages 163-168, Passport section 8.2, pages 368-375, page 381 (#5-8,17-19), Common Core Coach page 120-123(dilations)

Common learning experiences:

- Brain Pop – Transformation (Significant Task 1)
- KHM Problem 3.1 (p. 49) - Identify corresponding sides & angles and notation (during Significant Task 1)
- Brain Pop – Angles (Immediately prior to starting Significant Task 2 as a review)
- Brain Pop – Parallel and Perpendicular Lines (Significant Task 2)
- Brain Pop – Similar Figures (Significant Task 3 – question #5!)
- Pizzaz worksheets for skill practice
- Warm Ups (2013-2014 warm ups will be CMT skill review, and for years after, spiraling of skills and “Getting Ready” sections in CMP text KHM, S&D, S&S)

Common assessments including the end of unit summative assessment:

- KHM Mathematical Reflection 1, question 1
- KHM Unit Project – assessment for significant task 1 – Students create an origami wreath or pinwheel design. Using the polygon shapes that are created by the paper folding and the end products, students need to describe the reflection and rotational symmetry that the figure has. This project summarizes the explorations in symmetry from KHM Investigation 1. Students will be allowed to pick their design and then be grouped with students who also selected that design. Working in groups of 3 or 4 students will complete one final product with analysis for their group.
- KHM Unit Assessment (assessing knowledge, skill and application required for significant task 2 & 3 only)

Teacher notes:

- Process standards to highlight through instruction: use appropriate tools strategically, construct viable argument and critique the reasoning of others, attend to precision.
- Students will struggle with the new vocabulary in this unit. Teachers should develop a vocabulary sheet or word wall to assist students.
- Teachers need to reinforce proper vocabulary to assist with student development
- Teachers need to instruct students in the proper use of protractors.
- Need for continual formative assessment in this unit since students often present as if they understand the material when in fact they don't. This is more pronounced in this unit than others.

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Name of the Unit: Pythagorean Theorem & Real Numbers	Length of the unit: 9 weeks
Purpose of the Unit: This unit has a focus on number, operations, and geometry. This unit builds on previous fraction units from grades 6 & 7, and order of operations and working with formulas from grade 7.	

Common Core State Standards Addressed in the unit:

(Bold standards are priority standards, non-bolded are supporting standards.)

8.NS.1. Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.

8.EE.3. Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. *For example, estimate the population of the United States as* 3×10^8 *and the population of the world as* 7×10^9*, and determine that the world population is more than 20 times larger.*

8.EE.4. Perform operations with numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (e.g., use millimeters per year for seafloor spreading). Interpret scientific notation that has been generated by technology.

8.G.7. Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.

8.G.6. Explain a proof of the Pythagorean Theorem and its converse.

8.G.8. Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

8.EE.1. Know and apply the properties of integer exponents to generate equivalent numerical expressions. *For example,* $3^2 \times 3^{-5} = 3^{-3} = 1/3^3 = 1/27$.

8.EE.2 Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube

roots of small perfect cubes. Know that √2 is irrational. 8.NS.2. Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g., √2). *For example, by truncating the decimal expansion of √2, show that √2 is between 1 and 2, then between 1.4 and 1.5, and explain how to continue on to get better approximations.*

Big Ideas: 1. Formulas and theorems in mathematics are proven. 2. Numbers can be represented in multiple ways and for a variety of purposes. 3. Benchmarks are helpful in estimation.	Essential Questions: 1. How do you know that a formula or theorem is valid? 2. What are the benefits of representing a number in any given way? 3. What benchmarks can you use to estimate?
Students will know: 1. Pythagorean Theorem 2. classifications of real numbers 3. approximations of irrational numbers as rational numbers 4. Scientific Notation 5. exponent rules	Students will be able to: 1. use the Pythagorean Theorem to solve a variety of problems 2. prove the Pythagorean Theorem and informally prove the converse 3. classify with reasoning real numbers as rational or irrational. 4. approximate irrational numbers as rational numbers 5. express numbers in scientific notation 6. apply the properties of integer exponents to perform operations on two or more numbers expressed in scientific notation 7. apply the properties of integer exponents to generate equivalent numerical expressions

Significant task 1: Driving Distances vs. Flying Distances Significant task 1 is grounded in two investigations in Looking for Pythagoras. In both investigations, students will explore concepts collaboratively regarding the city of Euclid, the map of which is laid out on a coordinate plane. Working in small groups or pairs, students will develop various methods and strategies to solve each problem in the investigations. At the conclusion of each investigation, there will be a class discussion focused on the various solutions and strategies used to answer the problems. Students will discover the differences between driving distances and helicopter distances and will be able to relate this information to the length of the hypotenuse versus the length of the legs, which leads to discovering the Pythagorean Theorem. Students are also developing strategies for finding areas of squares that are laid out diagonally on grid paper so that they will be able to prove the Pythagorean

Theorem in the next significant task.

In this task, students will:

- review coordinate plane graphing in the context of a map and explore distances on a coordinate grid
- review properties of quadrilaterals, connect properties of figures to coordinate representations, and draw shapes on a coordinate grid
- develop strategies for finding areas of irregular figures on a grid
- explore the concept of square root (understand square root geometrically, as the side length of a square with a known area) and cube root

This task directly targets the following Common Core Standards: 8.G.7 and 8.G.8

Timeline: 7 days
Key vocabulary: coordinate plane, vertices, ordered pairs, square root, cube root, area, square
Resources: Looking for Pythagoras Investigations 1 (1.1, 1.2, and 1.3) and 2 (2.1 and 2.2), Passport section 9.1, CMT coach lesson 25

Significant task 2: Exploring the Pythagorean Theorem

Significant task 2 is grounded in Investigation 3 in Looking for Pythagoras. Students will investigate the relationship of the areas of squares on the sides of right triangles that they drew on grid paper. This will lead students to make a conjecture that the sum of the areas of the two smaller squares equal the area of the larger square. They will also prove the Pythagorean Theorem using a visual puzzle. The students will develop the converse of the Pythagorean Theorem through exploration and will use this converse to determine if 3 side measures form a right triangle.

In this task, students will:

- deduce the Pythagorean Theorem through exploration and prove using a visual puzzle
- use Pythagorean Theorem to find unknown side lengths of right triangles
- gain historical appreciation of Pythagoras and his society
- use the Pythagorean Theorem to find the distance between two points
- relate areas of squares to the lengths of the sides
- deduce the converse of the Pythagorean Theorem through exploration

This task directly targets the following Common Core Standards: 8.G. 6 and 8.G.8

Timeline: 5 days
Key vocabulary: hypotenuse, legs, conjecture, theorem
Resources: Looking for Pythagoras Investigations 3.1, 3.3, 3.4, History Packet, A Pythagorean Puzzle

Significant task 3: Real Numbers

In this significant task, students will start by classifying real numbers as rational or irrational. Students will use their understanding of real numbers to explore decimal expansion, powers of ten, scientific notation, and rules of exponents. The focus of this task is more procedural in nature and is a time to differentiate in terms of complexity of content. Students can be stretched to work with more complex problems that utilize the skills out lined below.

In this task, students will:

- classify real numbers as rational and irrational
- understand informally that every number has a decimal expansion and classify decimals as terminating, repeating, or non-repeating, and as rational or irrational
- write numbers in scientific notation, expand numbers written in scientific notation to decimal form, and perform operations with numbers expressed in scientific notation
- use rules of exponents to generate equivalent numerical expressions
- calculate square roots and cube roots of rational numbers

This task directly targets the following Common Core Standards: 8.NS.1, 8.EE.3, 8.EE.4, 8.EE.1, 8.EE.2, and 8.NS.2

Timeline: 4 weeks
Key vocabulary: rational number, irrational number, decimal expansion, power of ten, scientific notation, square root, perfect square, cube root, perfect cube, exponents
Resources: Passport textbook sections 1.3, 6.6, 6.7, 6.8, 9.1,9.2 CMT Coach Lessons 1 and 4

Common learning experiences:

- BrainPop videos (rational/irrational, scientific notation, and Pythagorean Theorem)
- Pizzaz worksheets (skill practice) D-71 through D-76
- Clickers (Student Response System) – for reinforcement and review of skills
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Common assessments including the end of unit summative assessment:

- Floor Plan open response problem (adapted from Passport 1.3 practice workbook #25) – assessment (during significant task 1)
- Looking for Pythagoras unit test (after significant task 3)
- **Performance Task: Your Front Walkway** Students will need to determine whether a quote for a front walkway installation is reasonable. They will calculate the area and the total cost based on square footage, apply Connecticut state sales tax, and decide if the quote is something they would recommend. Their recommendations have to be justified with mathematics from the problem. Finding the area of this irregular shaped front walkway requires use of Pythagorean Theorem. Students will work in small groups for one period and then complete an individual recommendation on their own within one week. The final product will be a letter to the homeowner who should be a person of interest to the student. The performance task will be graded using the middle school performance task rubric.

Teacher notes:

- Process standards to highlight through instruction: reason abstractly and quantitatively, construct viable arguments and critique the reasoning of others, and attend to precision.

- Students assume that negative exponents mean you have a negative number.
- Students may assume that they can take the square root of a negative number.

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Name of the Unit: Systems of Linear Relationships	Length of the unit: 4 weeks
Purpose of the Unit: This unit builds on the linear relationships unit because they need to have an understanding of solving an equation in one variable before than can solve multiple equations with two variables. Solving a system of equations means finding values for each variable that make all the equations in the system true. This unit is students' first introduction to systems, and will be followed by a more formal study of systems in Algebra I.	

Common Core State Standards Addressed in the unit:

8.EE.8. Analyze and solve pairs of simultaneous linear equations.

a. **Understand that solutions to a system of two linear equations in two variables correspond to points of intersection of their graphs, because points of intersection satisfy both equations simultaneously.**

b. **Solve systems of two linear equations in two variables algebraically, and estimate solutions by graphing the equations. Solve simple cases by inspection.** ***For example, $3x + 2y = 5$ and $3x + 2y = 6$ have no solution because $3x + 2y$ cannot simultaneously be 5 and 6.***

c. **Solve real-world and mathematical problems leading to two linear equations in two variables.** ***For example, given coordinates for two pairs of points, determine whether the line through the first pair of points intersects the line through the second pair.***

8.EE.7. Solve linear equations in one variable.

a. Give examples of 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).

Solve linear equations with rational number coefficients, including equations whose solutions require expanding expressions using the distributive property and collecting like terms.

8.F.2. Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine* *which function has the greater rate of change.*

8.F.4. 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.

Big Ideas:	Essential Questions:
1. Relationships can be represented as tables, graphs, and equations. 2. Properties of equality and inverse operations are used to solve equations. 3. Problems involving more than one constant rate of change can be modeled with systems of linear equations.	1. What does the intersection point of two lines represent? 2. How can you use systems of equations to compare two similar functions? 3. What does it mean when a systems of linear equations has one solution, infinitely many solutions, or no solutions?
Students will know: 1. strategies to solve and analyze linear equations. 2. some equations have one solution, infinitely many solutions, or no solution. 3. strategies to compare functions represented differently 4. how to solve systems of equations using a graphing calculator 5. the most effective strategy for solving a particular system of equations depending on how that system is presented	Students will be able to: 1. graph and analyze linear equations 2. explore patterns among lines with the same slope (parallel lines) 3. explore patterns among lines whose slopes are negative reciprocals of each other (perpendicular lines) 4. solve systems of equations graphically and algebraically using all four strategies 5. model and solve problems using a system of linear equations 6. determine the most effective strategy for solving a particular system of equations depending on how that system is presented

Significant task 1: Exploring systems through graphing

Significant task 1 is grounded in investigations 3.5 and 4.3 of Moving Straight Ahead, where students compare the pricing plans of two t-shirt companies, No Shrink and Mighty Tee and work to determine a point of intersection where the two plans equal the same cost for the same number of shirts. Through this context, students will develop an understanding of the point of intersection of two lines. The teacher should use a mixture of instructional strategies as students work through these problems, including small groups, pairs and whole class discussions.

Students will also graph the solutions of a linear equation and see that when they do so, the points fall on a line. They will take it further and solve a system of two equations by graphing as they graph the solutions of each equation. Students will see that if a point lies on both lines at the same time (the lines intersect at one or more points), then that point is a solution of both equations. Students will also explore patterns among parallel lines and perpendicular lines.

Graphing calculators should be used throughout this significant task to reinforce the skills and check the accuracy of answers.

In this task students will:

- Explore patterns among lines with the same slope – parallel lines
- Explore patterns among lines whose slopes are negative reciprocal of another – perpendicular lines
- Develop an understanding of the point of intersection of two lines
- Apply the understanding of solving system of equations to solving real-world application problems

This tasks directly targets the following standards: CC.EE.8a, CC.EE.8b, CC.EE, 8c

Timeline: 7 days
Key vocabulary: point of intersection, function, intersecting lines, parallel lines, perpendicular lines
Resources: Moving Straight Ahead investigations 3.5 and 4.3

Significant task 2: Solving systems of linear equations by substitution

Significant task 2 is grounded in Investigation 4.3 of The Shapes of Algebra. Using the idea of airplane travel paths and the role of an air traffic control station, students will see a real-world application to solving systems of equations. Students will discover that substitution is an effective strategy in solving linear systems with two equations and two unknowns, if one equation is already solved for one variable. It is important to allow students time to struggle with making sense of content. The teacher should use a mixture of instructional strategies as students work through these problems, including small groups, pairs and whole class discussions.

In this task students will:

- Develop and use the strategy for solving linear equations by substitution
- Apply the understanding of solving system of equations to solving real-world application problems

This tasks directly targets the following standards: CC.EE.8a, CC.EE.8b, CC.EE, 8c

Timeline: 7 days
Key vocabulary: Properties of Equality, system of equation, substitution
Resources: The Shapes of Algebra Investigation 4.3

Significant task 3: Solving systems of linear equations by using elimination

Significant task 3 is grounded in Investigation 4.4 of The Shapes of Algebra. Collaboratively, students will explore the steps taken to solve a system of equations using elimination and then deduce reasons as to why those steps were used. Students should understand the benefits of these steps in solving these types of systems. In this investigation, students will also review the prior methods (graphing, substitution, and using a graphing calculator) and compare all four methods with a goal of knowing which method is best to solve a given system. Some individual guided practice should be done when reviewing the four methods.

In this task, students will:

- Use linear combinations (elimination) to solve systems of linear equations
- Choose strategically among the four methods (graphing, calculator, substitution, and elimination) to use for a particular system of equations
- Apply the understanding of solving system of equations to solving real-world application problems

This tasks directly targets the following standards: CC.EE.8a, CC.EE.8b, CC.EE, 8c

Timeline: 7 days
Key vocabulary: Properties of Equality, system of equation, elimination/combination
Resources: The Shapes of Algebra Investigation 4.4

Common learning experiences:

- TBD Pizzazz/OnCore or other skill based worksheets

Common assessments including the end of unit summative assessment:

- **Performance Assessment: Team T-shirts!** Students are asked to decide between two companies to order their team t-shirts for next year. Students are asked to provide recommendations for which company they should choose based on their calculations to the school principal. Students will be able to work in small groups for one class period with minimal teacher support and then will develop their own final product with options for format (letter, poster, presentation, etc.) within a one-week time frame. The performance task will be graded using the middle school performance task rubric.

Teacher notes:

- Process standards to highlight through instruction: model with mathematics, look for and make use of structure, look for and express regularity in repeated reasoning.
- Some students will gravitate to one method that is most comfortable to them in solving. However, that often will be more difficult to execute in some cases. Coaching towards identifying the best method will help students be able to identify the best method before solving.
- Have a reference sheet for how to solve using the TI.
- Students have difficulty determining if there is infinitely many or no solution when solving algebraically.
- When modeling real world problems students have difficulty interpreting the meaning of the

slope and y-intercept.

- When modeling real world problems students often forget to title and label their graph.

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Name of the Unit: Volume	Length of the unit: 3 weeks
Purpose of the Unit: To solve real-world and mathematical problems involving the volumes of cylinders, cones and spheres. This builds on the concept of volume which begins in grade 5 and is reinforced in grade 6 with rectangular prisms.	
Common Core State Standards Addressed in the unit: **8.G.9** Know the formulas for the volumes of cones, cylinders, and spheres, and use them to solve real-world and mathematical problems.	
Big Ideas: 1. Volume is the amount of space inside a three-dimensional object measured in unit cubes. 2. All formulas for volume are built upon the idea that the area of the base is multiplied by the number of layers in the object (the height).	Essential Questions: 1. What does volume measure? 2. Where in the real world will you need measure volume?
Students will know: 1. formulas for volume of cones, cylinders, and spheres	Students will be able to: 1. use the formulas for volume of cones, cylinders, and spheres to solve problems

Significant task 1: Volume of Cylinders Significant task 1 is grounded in Investigation 3 of Filling and Wrapping. In this investigation, students will develop an understanding of volume and a strategy for finding the volume of a cylinder using its dimensions. Collaboratively, students will explore the concept of volume and the idea that volume can be determined by multiplying the area of the base by the number of layers (height) in an object by constructing physical models. Students will use a variety of materials to construct the net of a cylinder and can use the net to derive the formula for volume of a cylinder.

In this task, students will:

- develop an understanding of volume of cylinders and derive formula
- develop a strategy for finding the volume of cylinders using its dimensions
- connect this strategy to the idea of layers in cylinders
- calculate the volume of cylinders using the formula

This task directly targets the following standard: 8.G.9

Timeline: 1 week
Key vocabulary: volume, cylinder, unit cube
Resources: Filling and Wrapping Investigations 3.1 and 3.2, Passport section 12.5, OnCore page 133 (teacher and student), Common Core Coach page 150, page 155 #2

Significant task 2: Volume of Cones and Spheres

Significant task 2 is grounded in Investigation 4 of Filling and Wrapping. Collaboratively, students will discover and derive the formulas for volume of cones and spheres in relationship to cylinders by using manipulatives such as plastic hollow shapes and clay. There is also rich application in the end of the investigation related to ice cream in cones and cups. This is an introduction to later concepts in high school where you would fill or empty geometric shapes.

In this task, students will:

- explore the relationship between cylinders, spheres and cones
- explore the concept that volume looks at the area of the base of the object and the number of layers in the object (height)
- calculate the volume of cones and spheres using their formulas
- know the formulas for volumes of cones, cylinders and spheres and use them to solve problems

This task directly targets the following standards: 8.G.9

Timeline: 1 week
Key vocabulary: cone, sphere
Resources: Filling and Wrapping Investigations 4.1 - 4.3, Common Core Transition Kit Investigation 4.4, OnCore page 133-136, Passport sections 12.6 and 12.7, Common Core Coach page 151-155

Common learning experiences:

- Start unit with a quick review of volume of rectangular prisms (from 7th grade)
- BrainPop: Circles (for review – includes circumference and area), Volume of Cylinders
- Filling and Wrapping Skill Sheets from Investigation 2
- Pizzaz worksheets and Passport page 608-609 #16-24, page 611 #4-5 to reinforce skills
- Problem solving – OnCore page 137 (student)

Common assessments including the end of unit summative assessment:

- **Performance Task: Cross Country Team Fundraiser** Students will need to compare the volumes of two containers, a cylinder and a cone, to make the decision of which container the team should buy for their frozen yogurt sale. The two containers cost the same and the cross country team has already planned what to charge students. The task requires students to create a viable argument with a clear rationale for their recommendation. Students will be able to work in small groups for one class period with minimal teacher support and then will develop their own final product with options for format (letter, poster, model, presentation, etc.) within a one-week time frame. The performance task will be graded using the middle school performance task rubric.

Teacher notes:

- Process standards to highlight through instruction: make sense of problems and persevere in solving them, reason abstractly and quantitatively, use appropriately tools strategically.
- Students will struggle with the new vocabulary in this unit. Teachers should develop a vocabulary sheet or word wall to assist students.
- Teachers need to reinforce proper vocabulary to assist with student development

Windsor Public Schools
Curriculum Map for the Secondary Level
Grade 8 Mathematics

Purpose of the Course (from CCSS): In Grade 8, instructional time should focus on three critical areas: (1) formulating and reasoning about expressions and equations, including modeling an association in bivariate data with a linear equation, and solving linear equations and systems of linear equations; (2) grasping the concept of a function and using functions to describe quantitative relationships; (3) analyzing two- and three-dimensional space and figures using distance, angle, similarity, and congruence, and understanding and applying the Pythagorean Theorem.

Name of the Unit: Patterns in Data	Length of the unit: 4 weeks
Purpose of the Unit: In this unit, students will explore linear and non-linear relationships between two variables through the use of scatter plots and lines of best fit. This unit builds on the linear functions unit and is their first introduction to two variable data analysis which they will continue to explore in Algebra 1.	
Common Core State Standards Addressed in the unit: **8.SP.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 association, linear association, and nonlinear association.** **8.SP.3. Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept.** *For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.* **8.F.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.** *For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.* 8.SP.4. Understand that patterns of association can also be seen in bivariate categorical data by displaying frequencies and relative frequencies in a two-way table. 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 association between the two variables. *For example, collect data from students in your class on whether or not they have a curfew.* 8.SP.2 Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line. 8.F.1. Understand that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output. 8.F.5. 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 a graph that exhibits the qualitative features of a function that has been described verbally.	
Big Ideas: 1. A regression model is the function that best generalizes the pattern in the data. 2. When data represents the population and can be generalized you can make predictions about future or past events. 3. Not all rates of change between two variables are constant.	Essential Questions: 1. How can you use a trend line to make a prediction from the scatter plot? 2. How do you know if the data represents the population? Can you make a prediction? 3. Is the rate of change constant? Would you model it with a line?
Students will know: 1. scatter plots 2. linear functions – tables, equations, and graphs 3. types of sampling techniques that would generate samples that would represent a population	Students will be able to: 1. construct and interpret scatter plots to compare two variables 2. investigate and describe patterns such as clustering, outliers, positive or negative association, linear association, and non-linear association 3. construct a line of best fit for a scatter plot, and determine the equation of the line (including slope and y-intercept) 4. use graphing calculators and other technology to create scatter plots and regression models 5. determine if a relationship has a constant rate of change and determine if it is linear or non-linear 6. explore problems that generate data that is quadratic and exponential

Significant task 1: Scatter Plots and Lines of Best Fit

In this significant task, students will explore in small groups or partners the relationship between quality and price of regular brands vs. the natural brands of peanut butter. They will analyze a scatter plot of the (quality rating, price) data. Students will also explore three different but related proportional relationships: height and arm span for people, body length and wingspan for airplanes, and body length and wingspan for birds. For each, they each consider fitting a line to describe the pattern for the relationship and write an equation to describe the relationship. In each case, a whole class discussion to summarize the findings should be included.

This task directly targets the following standards: 8.SP.1, 8.SP.2, 8.SP.3, 8.SP.4,

Timeline: 5 days
Key vocabulary: scatter plot, variables, line of best fit, trend line, equation, data, frequency, two-way table
Resources: Samples and Populations Investigations 4.1 and 4.2, ACE Questions Investigation 4 #1 – 2, 4 – 8, 10 – 13, OnCore pages 145 – 160

Significant task 2: Exploring Scatter Plots with Technology

This significant task builds upon significant task 1 with the exploration of scatter plots and trend lines through the use of technology. Students will use technology such as Excel, graphing calculators, and/or Google Docs to perform regression analysis and draw conclusions about the relationships between two data sets. Students will work in partners and have a wide range of choice in data sets.

This task directly targets the following standards: 8.SP.1, 8.SP.2, 8.SP.3, 8.SP.4

Timeline: 5 days
Key vocabulary: same vocabulary as Significant Task 1, plus: graphing calculator, Excel, Google Doc
Resources: graphing calculators, Excel, teacher-created labsheets

Significant task 3: Linear vs. Non-Linear Functions

This significant task is grounded in the idea that not all relationships are linear. In small groups, students will explore relationships and graphs that may be linear, quadratic, or exponential. Although students are not necessarily developing the equations (which would happen in Algebra 1 and Algebra 2), emphasis will be placed on identifying and comparing non-linear functions and talking about the shapes of the graphs. Class discussions will be grounded in the idea that rate of change can be constant or non-constant, and this rate of change dictates the shape of the function's graph.

Students will participate in different hands on activities throughout this significant task. They will model the quadratic relationship through a lab in which factor pairs are used to create a rectangular garden with a given area which, when graphed, creates a parabola. Students will model the exponential relationship through an M&M lab that simulates exponential growth and decay that might be done in a biology lab.

Since this is the last task of the year, you may be able to have all students go through all of the investigations in this task. You may find time limited and in which case you may want to have different groups explore either model and then share their findings as a whole class presentation. The key here is that students are exposed to relationships that are not linear so they gain an appreciation that not all data is modeled with a linear function.

This task directly targets the following standards: 8.SP.1, 8.F.1, 8.F.3, 8.F.5

Timeline: 5 days
Key vocabulary: linear, line, non-linear, quadratic, parabola, exponential, exponential growth, exponential decay
Resources: teacher-created labs

Common learning experiences:

- TBD video resources which will show applications of non-linear models (PBS has a video on conic sections and their application)

Common assessments including the end of unit summative assessment:

- **Performance Assessment**: Is it Linear? In this performance task, students are asked to gather at least 12 data points and prove graphically and descriptively that the two sets of data can be modeled using a linear equation. In this task, students will record their data, create an equation that can be used to predict values of data outside their data range of values and interpret the slope and y- intercept in the context of their data. Students can work in groups and complete one presentation/product for their group. Students can gather any type of data of interest to them. Students will also be encouraged to use technology skills developed in significant task 2 and lab time will be provided for groups to complete their work.

Teacher notes:

- Process standards to highlight through instruction: make sense of problems and persevere in solving them, reason abstractly and quantitatively, model with mathematics.
- Many students will assume at the start of this unit that all data has a constant rate of change and can be modeled using linear regression.
- Many students tend to not title and label portions of their graphs.
- Many students do not use appropriate scales when creating their graph.
- All students should be provided with a reference sheet for how to create the scatter plot and regression model on their TI.
- When modeling real world problems students have difficulty interpreting the meaning of the slope and y-intercept.