Stamford Public Schools

EXCELLENCE IS THE POINT.

Mathematics Handbook

Geometry

2015-2016

High School Mathematics Curriculum Committee (Summer 2015)

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Directions for the Geometry Handbook

There is a great deal of information contained in this handbook which will enhance the implementation of the Geometry curriculum. It is imperative to take time in the beginning of the school year to read the entire handbook to familiarize yourself with its components.

Please tab or mark pages in the handbook that will serve as necessary references. These include the curriculum for the units (for College Preparatory and Honors classes), the pacing guide, grading practice, and notebook set-up. Assessments are not included in this handbook but will be distributed from Central Office in a timely manner.

During the first days of school, set aside time for classroom organization and math notebook set-up. Classroom expectations should be reviewed and posted; student texts should be numbered and recorded when distributed; students should set up their notebook which should be used on a daily basis; the district grading practice should be reviewed and implemented.

Before the start of each unit, it is necessary to review the unit curriculum and pacing guide. The curriculum has been written for each course and it is intended to guide each teacher through the year in terms of required topics and pacing for all levels of instruction. The length of time for each unit is stated in the "Pacing Guide" section and is specific to this school year. The time frames for the units should be adhered to and any issues that may arise can be documented on the feedback template and/or forwarded to the respective committee members.

There are activities included in this handbook for classroom use. These can also be used during the block periods on the high school level. The activities in the handbook should not just be photocopied and used as "worksheets" for students to complete individually. Instead, they should be used in the workshop model. This means that small groups of students work on the activity collaboratively or certain parts of the activity are assigned to certain groups of students. While students are working, the teacher should be helping each group and determining which students will present their work and solutions to the class. If teachers feel that they need help with the workshop model, they can contact their Math Department Head/Coach.

This handbook is a working document created by Stamford Public School math teachers who value your feedback. At any time, you are encouraged to forward ideas, feedback, suggestions and/or comments to any member of the HS Math Committee. Please make notes/comments on the Course Feedback Document provided (Appendix A) and/or give any suggestions to your Math Department Head/Coach. These curricular documents are all "works-in progress" which need attention from all teachers. Together we can make these curricula the best that they can be. Be vocal and be committed!

In the summer of 2015, the mathematics committee added the topic of Quadratics to the geometry curriculum. It can be found as Unit 10. Resources can be found in the Algebra 1 textbook as well as the Geometry textbook. Also noteworthy is the new time frame for each unit. In this section you will find the new time frame for each unit in terms of calendar days and number of class periods and block periods corresponding to the block scheduling for Stamford High and Westhill High School.

Thank you,

High School Mathematics Curriculum Committee
Summer 2015

STAMFORD PUBLIC SCHOOLS

21st Century Mathematics
Learning and Instruction

Vision
All SPS students will participate in a rigorous, standards-based mathematics program and will be prepared for college-level mathematics coursework and competition in the global workforce.

Goal
All students will achieve at or above “goal” on the State of Connecticut’s mathematics assessments.

Guiding Principles
- Higher-level mathematics for everyone
- Learning mathematics by doing mathematics
- Student-centered teaching and learning
- Systematic, on-going job-embedded learning opportunities for teachers

High Quality Mathematics Learning and Instruction
Teachers will:
- project a belief that all students can successfully achieve in mathematics
- acknowledge divergent ideas of and multiple perspectives by students
- shift from a traditional approach to mathematics to a more student-centered approach
- receive ongoing, embedded content and instructional professional development
- identify and emphasize interdisciplinary connections
- provide assessment *of* and assessment *for* student learning
- infuse instructional technology to enhance instruction and learning

Students will:
- learn by doing through the use of manipulatives, interactive technology or other mathematics tools in the classroom
- work both individually and collaboratively with a partner or in a group
- be engaged in and actively do mathematics
- maintain mathematics journals
- be independent learners and thinkers
- use technology for learning

Parents will:

- Provide a supportive learning environment at home,
- Be actively involved with student learning and achievement,
- Establish early and open communication with teacher
- Review student assignments for daily completion
- Support and encourage extra help when necessary
- Encourage good organizational skills and positive in-class behavior

<u>Traditional vs. Student-Centered Teaching and Learning of Mathematics</u>

Traditional Math Instruction	**Student-Centered Math Instruction**
• Students work individually • Students discuss only the answer to the problem • Students are shown one way to solve a problem (the algorithm) • Math problems and examples do not always relate to the real world or to the way students think about mathematics • Procedural knowledge is emphasized • Teacher leads, directs, or dictates • Some students are "good" at math and others just are not	• Students work in pairs and groups as well as individually • Students discuss mathematical ideas and processes to understand the "how" and "why" of mathematics • Students use a variety of materials to develop their own mathematical understanding • There is a focus on making sense of the math and how it applies to real world situations • There is a balance between procedural and conceptual knowledge • Teacher facilitates and guides • All students are capable of succeeding in mathematics

Professional Development will:

- focus on standards-based mathematics
- focus on effective instructional practices as well as content
- be designed based on student outcome data and teacher needs
- be designed collaboratively with teachers and administrators
- be timely, responsive, and flexible

Implementation and Action Plan

We outline three stages in the implementation of a high quality mathematics program for all SPS students.

Stage One: Standardized Mathematics Curriculum

- identify grade-level mathematics standards and expectations
- identify available mathematics resources at each school
- identify appropriate technology hardware and software resources to support teaching and learning

Stage Two: Develop and Share Best Practices in Mathematics Teaching and Learning

- identify best practices in mathematics instruction
- identify high quality mathematics instructional materials
- develop and implement classroom assessments to provide students with on-going feedback

Stage Three: Continuous Learning

- foster continual learning opportunities for students
- develop innovative and relevant courses (e.g., statistics of sport, architectural design, biometrics, etc.)
- organize continual professional development opportunities for teachers

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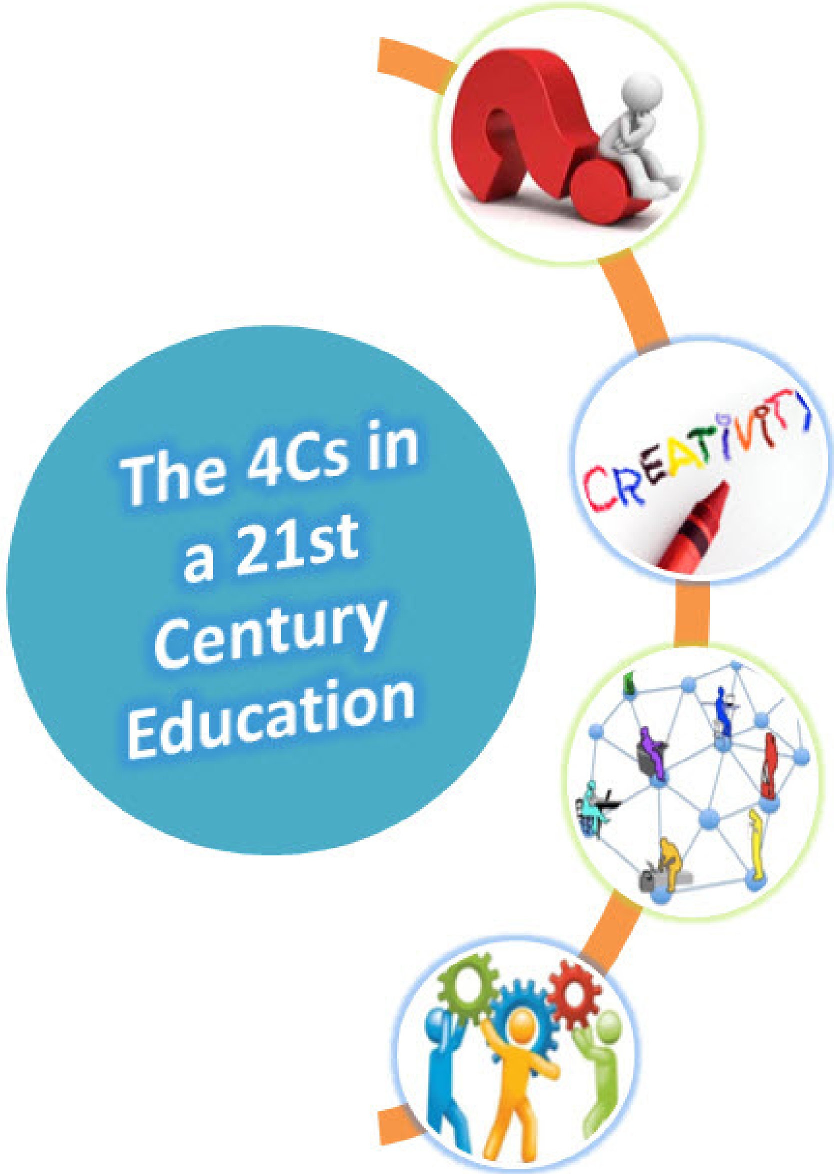


CRITICAL THINKING

Make Judgments and Decisions Using Evidence

- Analyze and evaluate evidence, arguments, claims and beliefs, including point(s) of view
- Interpret information and draw conclusions
- Synthesize information and arguments
- Reflect critically on learning experiences to advance critical thinking skills

Solve Problems

- Solve problems in a variety of ways
- Identify, ask, and answer clarifying and/or probing questions

CREATIVITY

Think Creatively

- Use a variety of creative strategies
- Elaborate, refine, analyze, and evaluate ideas
- Demonstrate originality

Work Creatively with Others

- Develop and communicate new ideas
- Be open and responsive to new and diverse perspectives
- Assess and evaluate real world limits
- View failure as an opportunity to learn; creativity is a process of small successes and frequent mistakes

COMMUNICATION

- Articulate thoughts and ideas using oral, written, and/or nonverbal communication skills
- Listen actively
- Communicate for a range of purposes
- Utilize multiple media and technologies, and determine effectiveness as well as impact

COLLABORATION

- Establish roles and responsibilities
- Demonstrate ability to work respectfully with others
- Value individual contributions and accept shared responsibility for work
- Exercise willingness to compromise in order to achieve a common goal

The "Four Cs" for 21st Century Education

CRITICAL THINKING

Make Judgments and Decisions Using Evidence

- Analyze and evaluate evidence, arguments, claims and beliefs, including multiple points of view
- Synthesize information and arguments
- Interpret information and draw conclusions
- Reflect critically on learning experiences to improve

Problem Solve

- Solve problems in a variety of ways
- Identify, ask, and answer clarifying and/or probing questions

CREATIVITY

Think Creatively

- Use a variety of creative strategies (such as brainstorming, analyzing sources, experimentation) to generate ideas (i.e. models, an argument, a visual, solutions, etc.)
- Elaborate, refine, analyze, and evaluate ideas
- Demonstrate originality

Work Creatively with Others

- Develop and communicate new ideas to others
- Be open and responsive to new and diverse perspectives (incorporate group input and feedback into the work)
- Demonstrate originality and inventiveness in work and explore real world limits
- View failure as an opportunity to learn; creativity is a process of small successes and frequent mistakes

COMMUNICATION

- Articulate thoughts and ideas using oral, written, and/or nonverbal communication skills
- Listen actively (consider and respond)
- Use communication for a range of purposes (e.g., to inform, instruct, motivate, and persuade) and audiences
- Utilize multiple media and technologies, and determine their effectiveness as well as their impact

COLLABORATION

- Establish roles and responsibilities
- Demonstrate ability to work respectfully with others
- Value individual contributions and accept shared responsibility for work
- Exercise willingness to compromise in order to achieve a common goal

CCSS Shifts, Mathematical Practices, & Webb's DOK

CCSS Three Shifts in Mathematics:

1. **FOCUS strongly where the Standards focus**

2. **COHERANCE: Think across grades, and link to major topics within grades**

3. **RIGOR: In major topics pursue conceptual understanding, procedural skill and fluency, and application with equal intensity**

Common Core State Standards for Mathematics: Mathematical Practices

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important "processes and proficiencies" with longstanding importance in mathematics education. The first of these are the NCTM process standards of problem solving, reasoning and proof, communication, representation, and connections. The second are the strands of mathematical proficiency specified in the National Research Council's report Adding It Up: adaptive reasoning, strategic competence, conceptual understanding (comprehension of mathematical concepts, operations and relations), procedural fluency (skill in carrying out procedures flexibly, accurately, efficiently and appropriately), and productive disposition (habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy).

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

Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points to its solution. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can 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. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

2. Reason abstractly and quantitatively.

Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to 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—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

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

Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to 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. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can 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.

Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They 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.

Mathematically proficient students 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. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

6. Attend to precision.

Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

7. Look for and make use of structure

Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see 7×8 equals the well-remembered $7 \times 5 + 7 \times 3$, in preparation for learning about the distributive property. In the expression $x2 + 9x + 14$, older students can see the 14 as 2×7 and the 9 as $2 + 7$. They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see $5 - 3(x - y)^2$ as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers x and y.

8. Look for and express regularity in repeated reasoning.

Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through (1, 2) with slope 3, middle school students might abstract the equation $\frac{y-2}{x-1} = 3$. Noticing the regularity in the way terms cancel when expanding $(x - 1)(x + 1)$, $(x - 1)(x^2 + x + 1)$, and $(x - 1)(x^3 + x^2 + x + 1)$ might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

CCSS Mathematical Practices (Version 1.0)

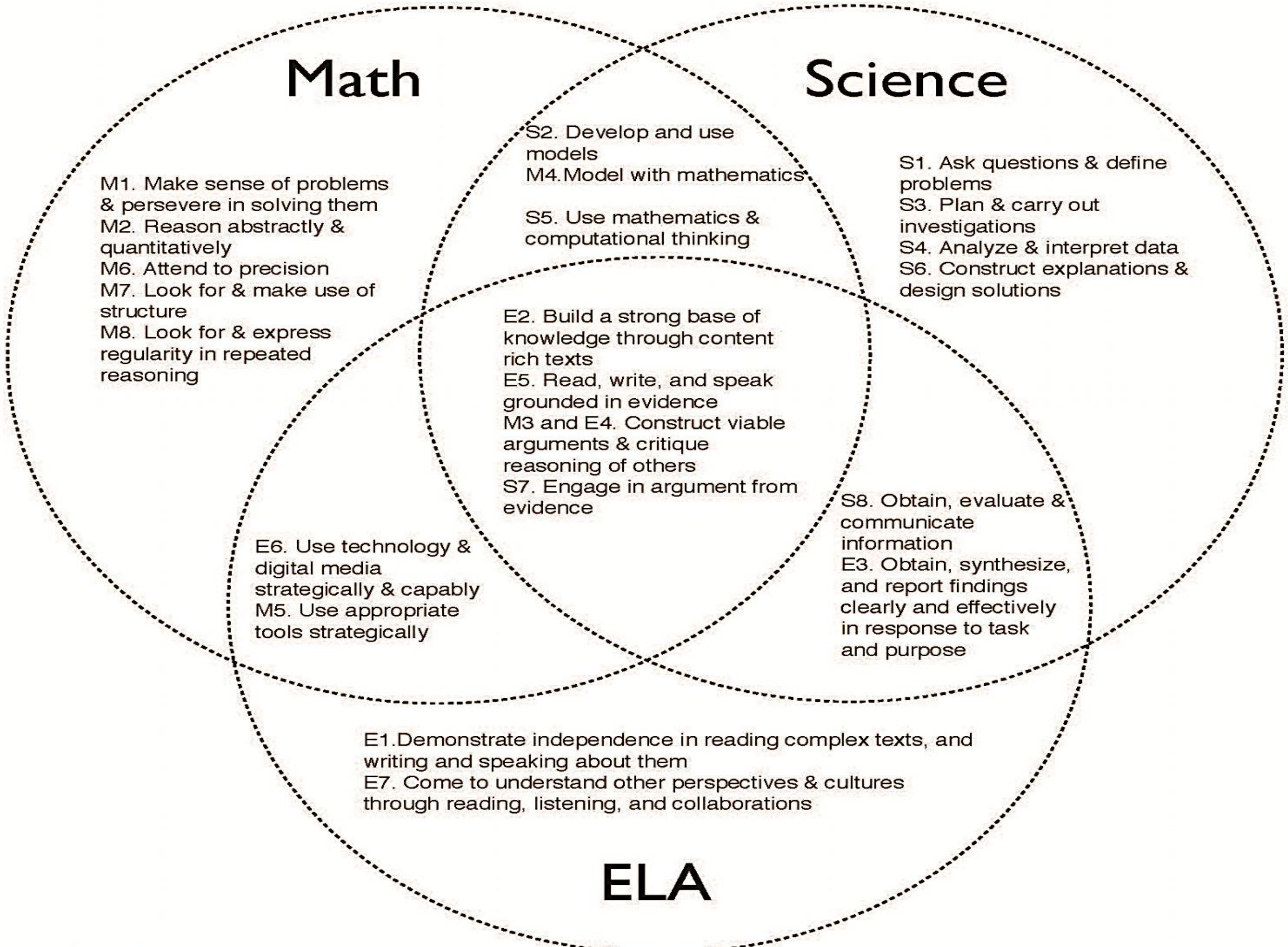
CCSS – Mathematical Practice	**Strands of Mathematical Proficiency (NCTM Processes)**	**Look-For: Teacher**	**Look-For: Student**
Make sense of problems and persevere in solving them.	Strategic, Competence, **(Problem Solving)**	Provides time for and facilitates the discussion of problem solutions.	Are actively engaged in solving problems.
Reason abstractly and quantitatively.	Adaptive Reasoning **(Reasoning & Proof)**	Provides a range of representations of mathematical ideas and problem situations and encourages varied solution paths.	Use varied representations and approaches when solving problems.
Construct viable arguments and critique the reasoning of others.	Adaptive Reasoning **(Reasoning & Proof)**	Provides opportunities for students to listen to or read the conclusions and arguments of others.	Understand and use prior learning in constructing arguments.
Model with mathematics.	Strategic Competence **(Connections)**	Provides a variety of contexts for students to apply the mathematics learned.	Apply mathematics learned to problems they solve and reflect on results.
Use appropriate tools strategically.	Strategic competence & Conceptual Understanding **(Representation)**	Use appropriate tools (manipulatives) instructionally to strengthen the development of mathematical understanding.	Use technological tools to deepen understanding.
Attend to precision.	Procedural Fluency **(Communication)**	Emphasizes the importance of mathematical vocabulary and models precise communication.	Based on a problem's expectation, students calculate with accuracy and efficiency.
Look for and make use of structure.	Strategic Competence **(Connections)**	Provides time for applying and discussing properties.	Look for, develop, and generalize arithmetic expressions.
Look for and express regularity in repeated reasoning.	Adaptive Reasoning **(Reasoning & Proof)**	Models and encourages students to look for and discuss regularity in reasoning.	Use repeated applications to generalize properties.

CCSS Mathematical Practices (Version 2.0)

Standards for Mathematical Practice	Students:	Teachers:
1. Make sense of problems and persevere in solving them.	• Analyze information and explain the meaning of the problem • Actively engaged in problem solving (Develop, carry out, and refine a plan) • Show patience and positive attitudes • Ask if their answers make sense • Check their answers with a different method	• Pose rich problems and/or ask open-ended questions • Provide wait-time for processing/finding solutions • Circulate to pose probing questions and monitor student progress • Provide opportunities and time for cooperative problem solving and reciprocal teaching
2. Reason abstractly and quantitatively.	• Represent a problem symbolically • Explain their thinking • Use numbers and quantities flexibly by applying properties of operations and place value • Examine the reasonableness of their answers/calculations	• Ask students to explain their thinking regardless of accuracy • Highlight flexible use of numbers • Facilitate discussion through guided questions and representations • Accept varied solutions/representations
3. Construct viable arguments and critique the reasoning of others.	• Make conjectures to explore their ideas • Justify solutions and approaches • Listen to the reasoning of others, compare arguments, and decide if the arguments of others makes sense • Ask clarifying and probing questions	• Provide opportunities for students to listen to or read the conclusions and arguments of others • Establish a safe environment for discussion • Ask clarifying and probing questions • Avoid giving too much assistance (e.g., providing answers or procedures)
4. Model with mathematics.	• Apply prior knowledge to new problems and reflect • Use representations to solve real life problems • Apply formulas and equations where appropriate • Ask questions about the world around them and attempt to attach meaningful mathematics to the world	• Pose problems connected to previous concepts • Provide a variety of real world contexts • Use intentional representations • Provide students the space to ask questions and pose problems about the world around them
5. Use appropriate tools strategically.	• Select and use tools strategically (and flexibly) to visualize, explore, and compare information • Use technological tools and resources to solve problems and deepen understanding	• Make appropriate tools available for learning (calculators, concrete models, digital resources, pencil/paper, compass, protractor, etc.) • Embed tools with their instruction
6. Attend to precision.	• Calculate accurately and efficiently • Explain thinking using mathematics vocabulary • Use appropriate symbols and specify units of measure	• Recognize and model efficient strategies for computation • Use (and challenging students to use) mathematics vocabulary precisely and consistently
7. Look for and make use of structure.	• Look for, develop, and generalize relationships and patterns • Apply conjectures about patterns and properties to new situations	• Provide time for applying and discussing properties • Ask questions about the application of patterns • Highlight different approaches for solving problems
8. Look for and make use of regularity in repeated reasoning.	• Look for methods and shortcuts in patterns in repeated calculations • Evaluate the reasonableness of intermediate results and solutions	• Provide tasks and problems with patterns • Ask about possible answers before, and reasonableness after computations

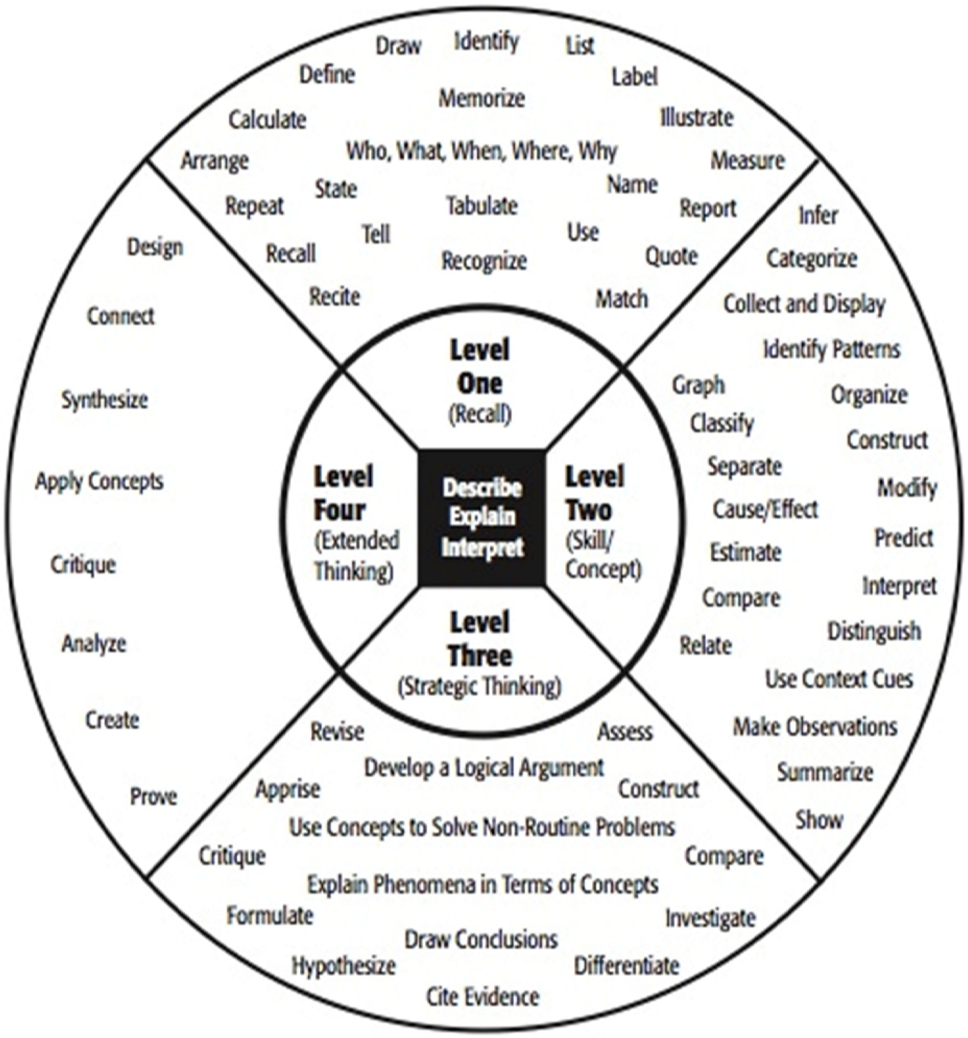
Relationships and Convergences Found in the Common Core State Standards in Mathematics (practices), Common Core State Standards in ELA/Literacy*(student portraits), and A Framework for K-12 Science Education (science & engineering practices)

These student practices and portraits are grouped in a Venn diagram. The letter and number set preceding each phrase denotes the discipline and number designated by the content standards or framework. The Science Framework will be used to guide the production of the Next Generation Science Standards.



Sources:
Common Core State Standards for English Language Arts & Literacy* in History/Social Studies, Science, and Technical Subjects, p7.
Common Core State Standards for Mathematical Practice p6-8.
A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas, ES-3 and chapter 3: 1-32.

Depth of Knowledge (DOK) Levels



Level One Activities	Level Two Activities	Level Three Activities	Level Four Activities
Recall elements and details of story structure, such as sequence of events, character, plot and setting. Conduct basic mathematical calculations. Label locations on a map. Represent in words or diagrams a scientific concept or relationship. Perform routine procedures like measuring length or using punctuation marks correctly. Describe the features of a place or people.	Identify and summarize the major events in a narrative. Use context cues to identify the meaning of unfamiliar words. Solve routine multiple-step problems. Describe the cause/effect of a particular event. Identify patterns in events or behavior. Formulate a routine problem given data and conditions. Organize, represent and interpret data.	Support ideas with details and examples. Use voice appropriate to the purpose and audience. Identify research questions and design investigations for a scientific problem. Develop a scientific model for a complex situation. Determine the author's purpose and describe how it affects the interpretation of a reading selection. Apply a concept in other contexts.	Conduct a project that requires specifying a problem, designing and conducting an experiment, analyzing its data, and reporting results/ solutions. Apply mathematical model to illuminate a problem or situation. Analyze and synthesize information from multiple sources. Describe and illustrate how common themes are found across texts from different cultures. Design a mathematical model to inform and solve a practical or abstract situation.

Webb, Norman L. and others. "Web Alignment Tool" 24 July 2005. Wisconsin Center of Educational Research. University of Wisconsin-Madison. 2 Feb. 2006. <http://www.wcer.wisc.edu/WAT/index.aspx>

Table 1: *Math Descriptors* – Applying Depth of Knowledge Levels for Mathematics (Webb, 2002) & NAEP 2002 Mathematics Levels of Complexity (M. Petit, Center for Assessment 2003, K. Hess, Center for Assessment, updated 2006)

Level 1 **Recall**	**Level 2** **Skills/Concepts**	**Level 3** **Strategic Thinking**	**Level 4** **Extended Thinking**
a. Recall, observe, or recognize a fact, definition, term, or property b. Apply/compute a well-known algorithm (e.g., sum, quotient) c. Apply a formula d. Determine the area or perimeter of rectangles or triangles given a drawing and labels e. Identify a plane or three dimensional figure f. Measure g. Perform a specified or routine procedure (e.g., apply rules for rounding) h. Evaluate an expression i. Solve a one-step word problem j. Retrieve information from a table or graph k. Recall, identify, or make conversions between and among representations or numbers (fractions, decimals, and percents), or within and between customary and metric measures l. Locate numbers on a number line, or points on a coordinate grid m. Solve linear equations n. Represent math relationships in words, pictures, or symbols o. Read, write, and compare decimals in scientific notation	a. Classify plane and three dimensional figures b. Interpret information from a simple graph c. Use models to represent mathematical concepts d. **Solve a routine problem** requiring multiple steps/decision points, or the application of multiple concepts e. Compare and/or contrast figures or statements f. Construct 2-dimensional patterns for 3-dimensional models, such as cylinders and cones g. Provide justifications for steps in a solution process h. Extend a pattern i. Retrieve information from a table, graph, or figure and use it solve a problem requiring multiple steps j. Translate between tables, graphs, words and symbolic notation k. Make direct translations between problem situations and symbolic notation l. Select a procedure according to criteria and perform it m. Specify and explain relationships between facts, terms, properties, or operations n. Compare, classify, organize, estimate, or order data	a) Interpret information from a complex graph b) Explain thinking when more than one response is possible c) Make and/or justify conjectures d) Use evidence to develop logical arguments for a concept e) Use concepts to solve non-routine problems f) Perform procedure with multiple steps and multiple decision points g) Generalize a pattern h) Describe, compare, and contrast solution methods i) Formulate a mathematical model for a complex situation j) Provide mathematical justifications k) Solve a multiple- step problem and provide support with a mathematical explanation that justifies the answer l) Solve 2-step linear equations/inequalities in one variable over the rational numbers, interpret solution(s) in the original context, and verify reasonableness of results m) Translate between a problem situation and symbolic notation that is not a direct translation n) Formulate an original problem, given a situation o) Analyze the similarities and differences between procedures p) Draw conclusion from observations or data, citing evidence	a) Relate mathematical concepts to other content areas b) Relate mathematical concepts to real-world applications in new situations c) Apply a mathematical model to illuminate a problem, situation d) Conduct a project that specifies a problem, identifies solution paths, solves the problem, and reports results e) Design a mathematical model to inform and solve a practical or abstract situation f) Develop generalizations of the results obtained and the strategies used and apply them to new problem situations g) Apply one approach among many to solve problems h) Apply understanding in a novel way, providing an argument/justification for the application ***NOTE**: Level 4 involves such things as complex restructuring of data or establishing and evaluating criteria to solve problems.*

	PREPARING	GETTING STARTED	MOVING ALONG	IN PLACE
1. Instructional Shifts				
Alignment of Content	❑ None of the content in the lesson is found in the appropriate grade level standards. ❑ Learning intentions/targets and success criteria are not posted.	❑ Some of the content in the lesson is found in the appropriate grade level standards. ❑ Learning intentions/targets and success criteria are posted but not tied to the CCSS.	❑ Most of the content in the lesson is found in the appropriate grade level standards. ❑ Learning intentions/targets and success criteria are posted and tied to the CCSS.	❑ All of the content in the lesson is found in the appropriate grade level standards. ❑ Learning intentions/targets and success criteria are posted, clearly tied to the CCSS, and used during the lesson.
Connections	❑ The content of the lesson is not connected to the major mathematical topics at the grade level. ❑ There are no connections to other grade level content.	❑ The content of the lesson is minimally connected to the major mathematical topics at the grade level. ❑ There are only tangential connections to other grade level content.	❑ The content of the lesson is moderately connected to the major mathematical topics at the grade level. ❑ There are some connections to other grade level content.	❑ The content of the lesson is clearly connected to the major mathematical topics at the grade level. ❑ There are strong connections to other grade level content.
Cognitive demand of lesson content	❑ The content of the lesson is not conceptually demanding for students. ❑ The lesson focuses on memorization of mathematical facts and procedures.	❑ The content of the lesson is somewhat conceptually demanding. ❑ The lesson may introduce conceptual understanding but focuses primarily on practicing procedures during learning activities. ❑ Teacher asks low level questions and does not require students to explain their thinking.	❑ The content of the lesson is conceptually demanding. ❑ The mathematics involved is primarily conceptual in nature or involves procedures with explicit underlying conceptual connections. ❑ Teacher asks a mix of higher and lower level questions that limit students opportunity to explain their thinking.	❑ The content of the lesson is very conceptually demanding. ❑ The teacher maintains high cognitive demand throughout the lesson, requiring students to deeply engage with making sense of the mathematics and justifying their thinking. ❑ Teacher consistently asks higher-level questions that require students to explain their thinking. ❑ Teacher begins lesson with a review of critical prerequisite skills and concepts.

	PREPARING	GETTING STARTED	MOVING ALONG	IN PLACE
Procedural Skill and Fluency	❑ Few students know the procedural skills needed to solve mathematical problems. ❑ Students demonstrate a lack of fluency of math facts.	❑ Some students have learned procedural skills. ❑ Students have limited fluency of math facts and are slow when solving mathematical problems.	❑ Many students have learned procedural skills. ❑ Students are fluent in their math facts but unable to use those facts effectively within higher-level procedures and/or when solving problems of a conceptual nature.	❑ Most students have learned the procedural skills required by the Standards. ❑ Students demonstrate fluency of math facts and are able to apply those facts to higher-level procedures and mathematical thinking when problem-solving.
Application	❑ Teacher makes no connection between the topic of the lesson and real world situations.	❑ Teacher makes some attempts to connect the topic of the lesson with real world situations.	❑ Teachers consistently make connections between the topic of the lesson and real world situations.	❑ Teachers and students co-construct the application of math concepts to real world situations.
2. Mathematical Practices				
Making sense of problems & persevering in solving them	❑ Not observed	❑ Limited and only tangential attention or use is more of an afterthought.	❑ Some evidence of use, but inconsistent, missed opportunities to use or without focus or emphasis.	❑ Teachers take every opportunity to develop number sense by ask for estimates, mental calculations, and equivalent forms of numbers. ❑ Students persevere in solving difficult and worthwhile problems. ❑ Teachers elicit, value, and celebrate alternative approaches to solving problems; students are taught that mathematics is a sense making process for understanding.
Reason abstractly and quantitatively	❑ Not observed	❑ Limited and only tangential attention or use is more of an afterthought.	❑ Some evidence of use, but inconsistent, missed opportunities to use or without focus or emphasis.	❑ Students make sense of quantities and their relationships in problem situations ❑ Student use varied representations and approaches when solving problems. ❑ Students know and flexibly use different properties of operations and objects.

	PREPARING	GETTING STARTED	MOVING ALONG	IN PLACE
Construct viable arguments and critique the reasoning of others	❑ Not observed	❑ Limited and only tangential attention or use is more of an afterthought.	❑ Some evidence of use, but inconsistent, missed opportunities to use or without focus or emphasis.	❑ Students explain their thinking. ❑ Students build upon their own and others' thinking. ❑ Students critique the arguments and reasoning of others.
Model with mathematics	❑ Not observed	❑ Limited and only tangential attention or use is more of an afterthought. ❑	❑ Some evidence of use, but inconsistent, missed opportunities to use or without focus or emphasis.	❑ Students apply the mathematics they know to solve problems arising in everyday life and the workplace. ❑ Students analyze mathematical relationships to draw conclusions. ❑ Students can apply what they know and are comfortable making assumptions and approximations.
Use appropriate tools strategically	❑ Not observed	❑ Limited and only tangential attention or use is more of an afterthought.	❑ Some evidence of use, but inconsistent, missed opportunities to use or without focus or emphasis.	❑ Teachers provide multiple ❑ Teachers provide multiple representations (models, number lines, tables, graphs, as well as symbols) to support visualization of skills and concepts. ❑ Students consider the available tools when solving a mathematical problem.
Attend to precision	❑ Not observed	❑ Limited and only tangential attention or use is more of an afterthought.	❑ Some evidence of use, but inconsistent, missed opportunities to use or without focus or emphasis.	❑ Teachers and students use mathematical terminology and vocabulary with precision.
Look for and make sense of structure	❑ Not observed	❑ Limited and only tangential attention or use is more of an afterthought.	❑ Some evidence of use, but inconsistent, missed opportunities to use or without focus or emphasis. .	❑ Students can look for, develop, generalize and describe a pattern orally, symbolically, graphically, and in written form.

	PREPARING	GETTING STARTED	MOVING ALONG	IN PLACE
Look for regularity in repeated reasoning	❑ Not observed	❑ Limited and only tangential attention or use is more of an afterthought.	❑ Some evidence of use, but inconsistent, missed opportunities to use or without focus or emphasis.	❑ Students notice if calculations are repeated and look both for general methods and for short cuts. ❑ Students maintain oversight of the mathematical process while attending to detail.
3. Level of Student Engagement				
	❑ Teacher does not appear to have control of classroom management. ❑ Few students are on task during the course of the lesson. ❑ Lesson allows students little opportunity to engage with the lesson content. ❑ Teacher does not facilitate any classroom discussion among students.	❑ Class is organized and routines are evident. ❑ Some students are on task; others are off-task and some are being disruptive. ❑ Lesson allows students some opportunity to engage with the lesson content. ❑ Students have some opportunities to participate in classroom discussions.	❑ Class routines are clearly established and followed. ❑ Most students are actively engaged in lesson activities. Some students may be off task when working independently. ❑ Most aspects of the lesson provide students with opportunities to engage with the lesson's central content. ❑ Students make some connections to others' thinking during classroom discussions.	❑ Class routines are working effectively to facilitate learning. ❑ All students are actively engaged in lesson activities. Students are on task even when working independently. ❑ All aspects of the lesson provide opportunities for students to engage with the central content. ❑ Students engage in productive classroom discussions making connections and collaborating with others. ❑ Teachers have carefully planned tasks, activities, questions, and assessments for coherence.
4. Differentiation				
	❑ There is little evidence of differentiation. Instruction is oriented toward a single level of difficulty. ❑ There is little evidence of varied learning activities/instructional strategies. ❑ There is little evidence of varied assessment methods.	❑ Instruction is differentiated for some students. Instruction is primarily oriented toward a single level of difficulty. ❑ Different learning activities/instructional strategies are provided for groups. ❑ Some different assessment methods are used.	❑ Instruction is differentiated for all students. Instruction is oriented to more than one level of difficulty. ❑ Some choices are available for student learning. A range of different instructional strategies is used. ❑ Different assessment methods are offered to students.	❑ Instruction is oriented toward multiple levels of difficulty. All students are working at an appropriate level. ❑ Multiple activities and choices are available for student learning. A comprehensive set of strategies is used. ❑ Students choose how they will demonstrate their learning. ❑ Teachers use formative assessment to consistently to check on lesson objectives/targets.

	PREPARING	GETTING STARTED	MOVING ALONG	IN PLACE
5. Classroom Environment				
	❑ Room contains mostly generic educational posters. No actual student work is posted in the room. ❑ Room contains limited resources (e.g. word walls, academic language, procedural explanations) for students.	❑ Examples of student work are posted in the classroom, but many are outdated or with no teacher commentary or connection to the standards. ❑ Room contains some resources (e.g. word walls, academic language, procedural explanations) that can be used by students	❑ Reasonably current student work is posted in the classroom with some teacher commentary. No connections to the Standards are evident. ❑ Room contains multiple resources that can be used by students.	❑ Current student work is posted in the classroom with teacher commentary. Teacher comments show connections to the Standards. ❑ Room contains multiple resources that can be used by students AND there is evidence that students regularly access these resources.
6. Culturally Responsive Teaching				
Students' lives	❑ No evidence of students' lives, interests, families, communities and/or cultures are connected to the standards being taught.	❑ Little evidence of students' lives, interests, families, communities and/or cultures are connected to the standards being taught.	❑ Some evidence of students' lives, interests, families, communities and/or cultures are connected to the standards being taught.	❑ Strong evidence that students' lives, interests, families, communities and/or cultures are connected to the standards being taught.
Diverse experiences	❑ Delivery of content does not support diverse experiences and perspectives.	❑ Delivery of content occasionally supports diverse experiences and perspectives.	❑ Delivery of content inconsistently supports diverse experiences and perspectives.	❑ Delivery of content is consistently supports diverse experiences and perspectives.
Respect and rapport	❑ Limited evidence of respect and rapport among students and between teacher and students.	❑ Some evidence of respect and rapport is among students and between teacher and students.	❑ Most interactions among students and between teacher and students are positive and supportive.	❑ Interactions among students and between teacher and students are consistently positive and supportive.

Stamford Public Schools

EXCELLENCE IS THE POINT.

Geometry Syllabus

Geometry Syllabus

Introduction:
All Stamford Public Schools students will participate in a rigorous, standards-based mathematics program and will be prepared for college-level mathematics coursework and competition in the global economy. Stamford Public Schools has created a curriculum that allows students to become mathematical problem solvers, learn to communicate mathematically, learn to reason mathematically, learn to value mathematics, and become confident in their ability to do mathematics. This curriculum has been developed through recommendations of the National Council of Teachers of Mathematics (NCTM), Program for International Student Assessment (PISA), and Trends in International Mathematics and Science Study (TIMSS). These organizations encourage school systems to provide students with greater focus and more depth in the context of real world situations.

Stamford Public Schools Department of Mathematics follows a blended curriculum that is technology based and application driven. This means that although there is a specific focus for each mathematics course, problems are introduced which cause students to revisit other strands of the mathematics curriculum. This highlights and reinforces the connections among different math topics and courses. Technology is used throughout the curriculum enabling teachers to provide visual and physicals components to abstract mathematical concepts. This gives students the opportunity to learn more quickly and in more depth. Application driven approaches provide students with problems relating to the objectives to real-world situations.

Textbook:
Larson, Boswell, Kanold, Stiff (2004, 2007). Geometry. McDougal Littell
The textbook is available online at www.classzone.com.

Units and Topics

Unit 1 - Essentials of Geometry

- Vocabulary & Symbolic Notation
- Definition & Symbolic Notation
- Distance Formula
- Pythagorean Theorem
- Midpoint Formula
- Vertical Angles/Linear Pair
- Complementary & Supplementary Angles
- Properties of Equivalence and Congruence-Reflexive, Symmetric, Transitive, Substitution, etc
- Logic-Negation, Conditional, Inverse, Converse, Contrapositive
- Definition Proofs
- Constructions
    - Copy a segment
    - Copy an angle
    - Bisect a segment
    - Bisect an angle

Unit 2 - Parallel & Perpendicular Lines

- Identifying pairs of lines and angles
- Slopes of parallel lines using coordinates
- Constructions
  - Parallel lines
  - Perpendicular lines
- Finding slopes of parallel and perpendicular lines
- Use parallel lines and transversals
- Prove lines are parallel using angles
- Prove lines are parallel
- Prove lines are perpendicular

Unit 3 - Congruent Triangles & Proofs

- Identify Congruent Figures
- Methods to Prove Triangles Congruent
- Write Proofs to Show Congruency Using SSS, SAS, ASA, AAS, HL
- Write Proofs to Show Corresponding Parts of Congruent Triangles are Congruent
- Properties and Theorems concerning Isosceles and Equilateral Triangles

Unit 4 - Triangles

- Perpendicular Bisector Theorem
- Definition/Recognition of Points of Concurrency
- Centroid Theorem
- Midsegment Theorem
- Inequalities in One Triangle
- Hinge Theorem (Inequalities of Two Triangles)
- Constructions
  - Construct the Perpendicular Bisector of a segment

Unit 5 - Polygons

- Angle measures in Polygons
- Classification and Properties of Parallelograms
- Classification and Properties of Special Parallelograms
- Properties of Trapezoids and Kites
- Coordinate Proofs with Quadrilaterals
- Parallelogram Proofs

Unit 6 - Transformations
- Reflections
- Rotations
- Vectors and Translations
- Composite Transformations
- Tessellations
- Symmetry

Unit 7 - Similarity
- Review Ratio & Proportion
- Similar Polygons & Similar Triangles
- Writing Similarity Statements & Proportionality Statements
- Prove Triangles are Similar (SSS, SAS, AA)
- Proportionality Theorems
- Properties of Dilations

Unit 8 - Right Triangles & Trigonometry
- Proportions in Similar Triangles
- Geometric Mean-Similarity in Right Triangles
- Pythagorean Triples
- Use of Pythagorean Theorem
- Special Right Triangles
- Introduction to Trigonometric Ratios & Solving Right Triangles
- Word Problems/Application

Unit 9 - Circles
- Parts of a Circle
- Properties of Tangents & Common Tangents
- Apply Properties of Chords & Arc Length
- Central Angles
- Inscribed Angles, Intercepted Arcs, & Inscribed Quadrilaterals
- Angle Relationships with Tangents, Secants, & Chords
- Segment Relationships in Circles
- Circles in the Coordinate Plane
- Equation of a Circle
- Area of Circles & Sectors

Unit 10 - Quadratics

- Perform Operations on Polynomials
- Solve Quadratic Equations (using graphing or algebraic methods)
- Graph Quadratic Functions
- Find the Vertex, Axis of Symmetry, Zeros of a Quadratic Function

Unit 11 - Surface Area & Volume

- Review of Area and Perimeter, if needed
- Define Solids
- Nets of Solids
- Surface Areas of Prisms, Cylinders, Pyramids, and Cones
- Volumes of Prisms, Cylinders, Pyramids, and Cones
- Surface Area and Volume of a Sphere

Unit 12 - Probability

- Theoretical & Experimental Probability
- Geometric Probability
- Samples Spaces
- Independence of Events and The Counting Principle
- Conditional Probability

Math Class Expectations

All students will:

- Communicate their reasoning and justifications for mathematical ideas with their peers and the teacher
- Use mathematical vocabulary during discussions
- Be engaged during the explore section of the lesson
- Use concrete representations or manipulatives when appropriate for the problem
- Provide multiple methods and solutions for problems
- Use technology when appropriate for the problem
- Organize their materials in a notebook
- Use math talk and explain their thinking
- Show confidence in explaining their solutions
- Show mathematics proficiency in understanding, computing, applying, and reasoning
- Be engaged throughout the lesson
- -Be empowered to *THINK!*

All teachers will:

- Be knowledgeable about their mathematics content standards and expectations,
- Use common mathematical language,
- Understand and incorporate student-centered instructional practices,
- Continually assess student learning using a variety of strategies,
- Implement school and district mathematics initiatives,
- Integrate technology to enhance instruction.

All parents will:

- Provide a supportive learning environment at home,
- Be actively involved with student learning and achievement,
- Establish early and open communication with teacher,
- Review student assignments for daily completion,
- Support and encourage extra help when necessary,
- Encourage good organizational skills and positive in-class behavior.

What is Being Graded	Range
1. Formal Assessments: Tests & Quizzes	60-65%
2. Homework	10%
3. Alternative Assessments: Projects, Performance Tasks, Math Notebooks (evidence of student learning, not just copying notes) Presentations	25-30%

Stamford Public Schools

EXCELLENCE IS THE POINT.

Geometry Curriculum

Geometry

Unit 1- Introduction to Geometry

Timeframe:
15 School Days
Aug 31 – Sept 24, 2015

Depth of Knowledge	Essential Questions For Unit
	1. How do we communicate in the language of geometry? 2. How do we construct segments and angles? 3. How do we use technology to explore geometry? 4. How is logical reasoning used to develop the ability to formulate mathematical proof?
	Enduring Understandings
	1. The Distance Formula is an application of the Pythagorean Theorem. 2. The measures of geometric figures can be calculated and analyzed using a variety of strategies, tools, and technologies. 3. Proof is a justification that is logically valid and based on definitions, postulates, and theorems. 4. Logical arguments consist of a set of premises or hypotheses and a conclusion. 5. Points, lines and planes are the foundation of geometry.
	Content Knowledge Objectives
Recall Describe, Draw, Identify, Label, Locate, Match, Measure, Evaluate, Compute, Perform, Retrieve	1. Identify and discuss Undefined terms: point, line, plane, between. 2. Define terms such as: postulate, segment, ray, collinear points, coplanar points, as well as concurrent, parallel, perpendicular, intersecting, and skew lines. 3. Define angle and types of angles such as acute, obtuse, right, straight and reflexive. 4. Define vertical angles, linear pair, complementary & supplementary and adjacent angles. 5. Define and explain Distance Formula, Pythagorean Theorem, and Midpoint Theorem. 6. Create constructions of basic geometric elements such as: point, segment, ray, line, perpendicular bisector & angle bisector with the use of geometric tools/ technology. 7. Define Logic terms such as: conditional, inverse, converse, contrapositive, biconditional statements, and algebraic properties. 8. Define properties such as Reflexive, Symmetric, Transitive, Substitution, etc…
Skill/Concept Categorize, Classify, Compare, Contrast, Describe Cause/Effect, Describe Patterns, Describe Relationships, Estimate, Generalize, Infer, Interpret, Make Observations, Predict, Summarize, Organize, Collect and Display	1. Compare and contrast postulate, point, segment, ray, line, plane, collinear points, coplanar points, as well as concurrent, parallel, perpendicular, intersecting, and skew lines. Utilize geometric symbolic notation to express geometric concepts. 2. Use measurement in describing the relationships which occur when a midpoint is found on a segment. 3. Utilize geometric symbolic notation to name an angle in various ways. Categorize angles according to measurement. 4. Create constructions of basic geometric elements such as: plane, collinear points, coplanar points, as well as concurrent, parallel, perpendicular, intersecting, and skew lines with the use of geometric tools/technology. 5. Given a conditional statement, write the corresponding negation, inverse, converse, contrapositive, and biconditional

Strategic Thinking Revise, Assess, Critique, Draw Conclusion, Investigate, Differentiate, Hypothesize, Cite Evidence	1. Make inferences related to the midpoint of a segment. 2. Utilize the midpoint formula on the coordinate plane and solve for its coordinates. Given a midpoint, use arithmetic or simple algebra to solve for segment lengths. 3. Make inferences based on measurement data from geometric constructions involving postulates such as: Midpoint, Bisectors of Segments, Perpendicular Bisectors. 4. Give reasons for the steps of an algebraic proof.
Extended Thinking Analyze, Apply Concepts, Connect, Prove, Synthesize, Create, Connect	1. Apply the Midpoint Formula to real world problems. 2. Draw conclusions based on measurement data from geometric constructions involving definitions such as: Midpoint, Bisectors of Segments, Perpendicular Bisectors. 3. Write steps and reasons in algebraic proof.

VOCABULARY

postulate, point, segment, endpoints, ray, opposite rays, line, plane, intersection, collinear points, coplanar points, as well as concurrent, parallel, perpendicular, intersecting, skew lines, congruent segments, coordinate, distance

midpoint, segment bisector, angle, vertex of an angle, acute, right, obtuse, straight, measure of an angle, hypothesis, conclusion, inductive reasoning, deductive reasoning,

protractor, straight edge, compass, geometer sketchpad, conditional, inverse, converse, contrapositive, subtraction, multiplication, division, substitution, distributive, reflexive, symmetric, transitive properties

MATHEMATICAL PRACTICES

Mathematical Practices #1 and #3 describe a classroom environment that encourages thinking mathematically and are critical for quality teaching and learning.

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

REQUIRED ACTIVITIES, SUGGESTED RESOURCES and ACTIVITIES

See Public Folders and List of Possible Websites

ASSESSMENTS/FORMATIVE ASSESSMENTS

Pretest/Post Test
Quizzes (individual and partner)
Teacher-generated assessments
Notebook quizzes
Exit slips
Participation sheets

Geometry

Unit 2 – Parallel and Perpendicular Lines

	Timeframe: 14 School Days Sept 25- Oct 15, 2015

Depth of Knowledge	**Essential Questions For Unit**
	1. How do we prove theorems about lines and angles? 2. What are the names and definitions of simple angle relationships? 3. How are angle relationships used to discover unknown angles measurement and congruent angles?x 4. How do we use what we know about angle relationships to construct proofs?
	Enduring Understandings
	1. Two intersecting lines form angles with specific relationships. 2. Parallel lines cut by a transversal form angles with specific relationships. 3. Linear relationships can be defined on the coordinate plane.
	Content Knowledge Objectives
Recall Describe, Draw, Identify, Label, Locate, Match, Measure, Evaluate, Compute, Perform, Retrieve	1. Name, draw, and describe: parallel lines, angle pairs formed by angle bisect orbs, vertical angles, angles formed by transversal cutting parallel lines. 2. Identify angles formed by parallel lines and a transversal.
Skill/Concept Categorize, Classify, Compare, Contrast, Describe Cause/Effect, Describe Patterns, Describe Relationships, Estimate, Generalize, Infer, Interpret, Make Observations, Predict, Summarize, Organize, Collect and Display	1. Describe characteristics of parallel lines; interpret when conditions are met. 2. Classify angle pairs formed by parallel lines. 3. Examine graphical representations and algebraic expressions/equations with definitions to explain and predict angle congruence. 4. Given angle congruence, show parallel lines. 5. Construct parallel lines using a straight edge and compass.
Strategic Thinking Revise, Assess, Critique, Draw Conclusion, Investigate, Differentiate, Hypothesize, Cite Evidence	1. Describe angle relationships in real-world situations. 2. Model with diagrams, pictures, and maps. 3. Investigate situations via models. 4. Draw conclusions using models and calculations to solve real-world design and planning problems. 5. Apply definitions and Angle Addition Postulate to solving real-world problems.
Extended Thinking Analyze, Apply Concepts, Connect, Prove, Synthesize, Create, Connect	1. Prove lines are parallel by applying angle theorems. 2. Prove lines are perpendicular by applying angles theorems. 3. Prove lines are parallel or perpendicular using coordinate geometry. 4. Analyze academic and practical solutions for errors. 5. Critique proofs for errors.

VOCABULARY

Vertical Angles	Angle Pairs	Consecutive
Linear Pairs	Angle Bisector	Same-Side Interior
Parallel	Perpendicular	Corresponding
transversal	Alternate Interior/Exterior	Mathematical Symbolism for Angle Congruency

MATHEMATICAL PRACTICES

Mathematical Practices #1 and #3 describe a classroom environment that encourages thinking mathematically and are critical for quality teaching and learning.

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

REQUIRED ACTIVITIES, SUGGESTED RESOURCES and ACTIVITIES

See Public Folders and List of Possible Websites

ASSESSMENTS/FORMATIVE ASSESSMENTS

Pretest/Post Test
Quizzes (individual and partner)
Teacher-generated assessments
Notebook quizzes
Exit slips
Participation sheets

Geometry

Unit 3 – Congruent Triangles & Proof

Timeframe:
14 School Days
Oct 16 – Nov 5, 2015

Depth of Knowledge	Essential Questions For Unit
	1. How do we use congruence criteria to solve problems and prove relationships in geometric figures? 2. How do we classify triangles by sides and angles? 3. How do we construct logical arguments to prove triangles congruent?
	Enduring Understandings
	1. Comparing the corresponding parts of two figures can show whether the figures are congruent. 2. Two triangles can be proven to be congruent without having to show that all corresponding parts are congruent. 3. If two triangles are congruent, then every pair of their corresponding parts is also congruent.
	Content Knowledge Objectives
Recall Describe, Draw, Identify, Label, Locate, Match, Measure, Evaluate, Compute, Perform, Retrieve	1. Classify triangles by sides and angles. 2. Identify congruent figures and corresponding parts. 3. Explain the criteria for triangle congruence including AAS, ASA, SAS, SSS and HL.
Skill/Concept Categorize, Classify, Compare, Contrast, Describe Cause/Effect, Describe Patterns, Describe Relationships, Estimate, Generalize, Infer, Interpret, Make Observations, Predict, Summarize, Organize, Collect and Display	1. Write statements listing congruent parts . 2. Analyze a diagram to identify congruent triangles.
Strategic Thinking Revise, Assess, Critique, Draw Conclusion, Investigate, Differentiate, Hypothesize, Cite Evidence	1. Investigate properties of congruent triangles. 2. Investigate properties of isosceles and equilateral triangles. 3. Write formal and informal proofs of congruence 4. Use the definition of congruence to show that triangles are congruent if and only if corresponding parts of sides and corresponding angles are congruent. 5. Apply the properties of isosceles triangle to write formal and informal proofs. 6. Apply the properties of right triangle to write formal and informal proofs.
Extended Thinking Analyze, Apply Concepts, Connect, Prove, Synthesize, Create, Connect	1. Evaluate and correct proofs. 2. Apply coordinate geometry to prove triangles are congruent.

VOCABULARY

equilateral, isosceles, scalene, acute, right, obtuse

AAS, ASA, SSS, SAS, HL, CPCTC

MATHEMATICAL PRACTICES

Mathematical Practices #1 and #3 describe a classroom environment that encourages thinking mathematically and are critical for quality teaching and learning.

1. Make sense of problems and persevere in solving them
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

REQUIRED ACTIVITIES, SUGGESTED RESOURCES and ACTIVITIES

See Public Folders and List of Possible Websites

ASSESSMENTS/FORMATIVE ASSESSMENTS

Pretest/Post Test
Quizzes (individual and partner)
Teacher-generated assessments
Notebook quizzes
Exit slips
Participation sheets

Geometry

Unit 4 – Triangles

Timeframe:
14 School Days
Nov 6 – Nov 30, 2015

Depth of Knowledge	
	Essential Questions For Unit 1. How do we prove theorems about triangles? 2. How do we use software to investigate triangle properties?
	Enduring Understandings 1. The midsegment of a triangle can be used to uncover relationships within a triangle. 2. Geometric figures such as angle bisectors and perpendicular bisectors can be used to cut the measure of an angle or segment in half.
	Content Knowledge Objectives
Recall Describe, Draw, Identify, Label, Locate, Match, Measure, Evaluate, Compute, Perform, Retrieve	1. Know and apply that the sum of the angles in a triangle equals 180^0. 2. Use relative side length to identify relative angle measure in triangles. 3. Identify points of concurrency in triangles including the incenter, circumcenter, orthocenter and centroid.
Skill/Concept Categorize, Classify, Compare, Contrast, Describe Cause/Effect, Describe Patterns, Describe Relationships, Estimate, Generalize, Infer, Interpret, Make Observations, Predict, Summarize, Organize, Collect and Display	1. Apply the base angles theorem to solve problems involving isosceles triangles. 2. Apply the triangle inequality theorem to algebraically calculate the range of values for the remaining side. 3. Construct an equilateral triangle.
Strategic Thinking Revise, Assess, Critique, Draw Conclusion, Investigate, Differentiate, Hypothesize, Cite Evidence	1. Investigate and draw conclusions about the locations of points of concurrency on Euler's Line 2. Investigate and discover that the segment joining the midpoints of two sides of a triangle are parallel to the third side and half the length. 3. Investigate and discover the location of the centroid in a triangle. 4. Investigate and prove the exterior angle theorem using algebraic methods.
Extended Thinking Analyze, Apply Concepts, Connect, Prove, Synthesize, Create, Connect	1. Solve real world problems involving center of gravity and placement of structures within triangles. 2. Apply knowledge of congruent triangles to prove the perpendicular bisector theorem.

VOCABULARY

Midsegment, Perpendicular Bisector, Angle Bisector, Altitude, Median, Equidistant
Triangle Inequality Theorem
Hinge Theorem
Exterior Angle Theorem

Concurrent, Circumcenter, Incenter, Centroid, Orthocenter, Euler's Line

Midsegment Theorem
Centroid Theorem
Perpendicular Bisector Theorem

MATHEMATICAL PRACTICES

Mathematical Practices #1 and #3 describe a classroom environment that encourages thinking mathematically and are critical for quality teaching and learning.

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

REQUIRED ACTIVITIES, SUGGESTED RESOURCES and ACTIVITIES

See Public Folders and List of Possible Websites

ASSESSMENTS/FORMATIVE ASSESSMENTS

Pretest/Post Test
Quizzes (individual and partner)
Teacher-generated assessments
Notebook quizzes
Exit slips
Participation sheets

Geometry

Unit 5 – Polygons

Timeframe:
14 School Days
Dec 1 – Dec 18, 2015

Depth of Knowledge	
	Essential Questions For Unit
	How do we prove the properties of parallelograms?
	Enduring Understandings
	1. The sum of the angle measures of a polygon depends on the number of sides the polygon has. 2. Parallelograms have special properties regarding their sides, angles and diagonals. 3. If a quadrilateral's sides, angles, and diagonals have certain properties, it can be shown that the quadrilateral is a parallelogram. 4. The special parallelograms, rhombus, rectangle, and square, have basic properties of their sides, angles, and diagonals that help identify them. 5. The angles, sides, and diagonals of a trapezoid have certain properties. 6. Variables can be used to name the coordinate of a figure in the coordinate plane. This allows relationships to be shown to be true for a general case.
	Content Knowledge Objectives
Recall Describe, Draw, Identify, Label, Locate, Match, Measure, Evaluate, Compute, Perform, Retrieve	1. Identify polygons by sides and angles 2. Identify special quadrilaterals such as parallelograms, rectangles, rhombi, squares, trapezoids, kites 3. Identify convex vs. concave polygons 4. Compute the area and perimeter of various quadrilaterals
Skill/Concept Categorize, Classify, Compare, Contrast, Describe Cause/Effect, Describe Patterns, Describe Relationships, Estimate, Generalize, Infer, Interpret, Make Observations, Predict, Summarize, Organize, Collect and Display	1. Draw conclusions about whether a figure is a parallelogram using algebraic methods
Strategic Thinking Revise, Assess, Critique, Draw Conclusion, Investigate, Differentiate, Hypothesize, Cite Evidence	1. Investigate the relationships between the sum of the angles in a polygon and the number of sides. 2. Investigate the properties of parallelograms and special parallelogram (rectangles, rhombi, squares).
Extended Thinking Analyze, Apply Concepts, Connect, Prove, Synthesize, Create, Connect	1. Use coordinate geometry to prove a quadrilateral is a parallelogram, rectangle, rhombus or square. 2. Use coordinate geometry to prove a quadrilateral is a trapezoid or kite. 3. Analyze the notation in a diagram to determine if a figure is a parallelogram. 4. Solve problems by applying the midsegment theorem for trapezoids.

VOCABULARY

Polygon, Parallelogram, Rectangle, Rhombus, Square, Trapezoid, Kite

Equiangular, Equilateral, Regular, Convex, Concave

Base Angles, Bases of a trapezoid, Legs of a trapezoid, Midsegment of a trapezoid.

MATHEMATICAL PRACTICES

Mathematical Practices #1 and #3 describe a classroom environment that encourages thinking mathematically and are critical for quality teaching and learning.

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

REQUIRED ACTIVITIES, SUGGESTED RESOURCES and ACTIVITIES

See Public Folders and List of Possible Websites

ASSESSMENTS/FORMATIVE ASSESSMENTS

Pretest/Post Test
Quizzes (individual and partner)
Teacher-generated assessments
Notebook quizzes
Exit slips
Participation sheets

Geometry

Unit 6 – Transformations

Timeframe:
8 School Days
Dec 21 – Jan 8, 2016

Depth of Knowledge

Essential Questions For Unit

1. How do translation, reflection and rotation work, and how do we show them on the coordinate plane?
2. How do we use vectors to describe translation on the coordinate plane?
3. How do we combine transformations to create composite transformations and tessellations?
4. How do we understand similarity in terms of transformations?

Enduring Understandings

1. The distance between any two points and the angles in a geometric figure stays the same when its location and orientation changes; it is flipped across a line, or it is turned about a point.
2. Congruent figures in a plane can be mapped onto one another by a single reflection, translation, rotation or glide reflection.

Content Knowledge Objectives

Recall Describe, Draw, Identify, Label, Locate, Match, Measure, Evaluate, Compute, Perform, Retrieve	1. Name, draw and describe translation, reflection and rotation. 2. Use Pythagorean Theorem on coordinate plane to define vector of translation. 3. Define vector notation. 4. Combine transformations to create composite transformations.
Skill/Concept Categorize, Classify, Compare, Contrast, Describe Cause/Effect, Describe Patterns, Describe Relationships, Estimate, Generalize, Infer, Interpret, Make Observations, Predict, Summarize, Organize, Collect and Display	1. Perform translation, reflection and rotation on various shapes on the coordinate plane. 2. Translate when given vector. 3. Find vector when given translation. 4. Analyze composite transformations to identify sequence of transformations.
Strategic Thinking Revise, Assess, Critique, Draw Conclusion, Investigate, Differentiate, Hypothesize, Cite Evidence	1. Identify translation, reflection and rotation of various shapes in real world situations. 2. Use vectors to specify or identify translation in real world situations on maps and diagrams. 3. Combine multiple transformations and composite transformations to create tessellations.
Extended Thinking Analyze, Apply Concepts, Connect, Prove, Synthesize, Create, Connect	1. Identify and correct erroneously labeled transformations. 2. Analyze tessellations to identify individual and composite transformations.

VOCABULARY		
translation, reflection, rotation, translate, reflect, rotate	vector, vector notation	tessellation, tessellate, composite transformation

MATHEMATICAL PRACTICES

Mathematical Practices #1 and #3 describe a classroom environment that encourages thinking mathematically and are critical for quality teaching and learning.

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively.
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics.
5. Use appropriate tools strategically.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

REQUIRED ACTIVITIES, SUGGESTED RESOURCES and ACTIVITIES

See Public Folders and List of Possible Websites

ASSESSMENTS/FORMATIVE ASSESSMENTS

Pretest/Post Test
Quizzes (individual and partner)
Teacher-generated assessments
Notebook quizzes
Exit slips
Participation sheets

Geometry

Unit 7 – Similarity

Timeframe:
14 School Days
Jan 25 – Feb 11, 2016

Depth of Knowledge

Essential Questions For Unit

1. How are proportions used to solve problems involving similar polygons?
2. How is similarity of geometric figures applied and verified?
3. How do you use proportions to find side lengths in similar polygons?
4. How do you prove two triangles are similar?
5. What is a dilation, and how does it produce similar polygons?
6. How are proportions used to solve problems involving similar parts formed by a transversal?

Enduring Understandings

1. Ratios and proportions can be used to decide whether two polygons are similar and to find unknown side lengths of similar figures.
2. Similar geometric figures have proportional attributes.

Depth of Knowledge	Content Knowledge Objectives
Recall Describe, Draw, Identify, Label, Locate, Match, Measure, Evaluate, Compute, Perform, Retrieve	1. Define terms such as: ratio, proportion, means, extreme, cross product property, geometric mean, scale, similar polygons, corresponding parts, scale factor. 2. Define terms such as: dilation, center of dilation, scale factor of a dilation, reduction, enlargement, and transformation. 3. Define relevant theorems and concepts such as Two Transversal Proportionality, Triangle Proportionality Theorem and its converse and Triangle Angle Bisector Theorem.
Skill/Concept Categorize, Classify, Compare, Contrast, Describe Cause/Effect, Describe Patterns, Describe Relationships, Estimate, Generalize, Infer, Interpret, Make Observations, Predict, Summarize, Organize, Collect and Display	1. Given similar polygons, identify corresponding parts. 2. Solve a proportion using the cross product property. 3. Set up the ratio of perimeter, area, volume of similar polygons. 4. Given parallel lines and a transversal, identify corresponding parts. 5. Given a triangle/trapezoid intercepted by a midsegment, identify corresponding parts. 6. Given the required coordinates, construct the image of a dilation. 7. Find the Geometric Mean of two triangles.
Strategic Thinking Revise, Assess, Critique, Draw Conclusion, Investigate, Differentiate, Hypothesize, Cite Evidence	1. Given similar polygons, set up a proportion according to corresponding parts and solve for an unknown measurement. 2. Determine the scale factor of similar polygons. 3. Solve problems involving proportions within a real world context. 4. Use proportionality statements to calculate segment lengths. 5. Given parallel lines and a transversal, set up a proportion according to corresponding parts and solve for an unknown measurement. 6. Given a triangle/trapezoid intercepted by a midsegment, set up a proportion according to corresponding parts and

	solve for an unknown measurement. 7. Apply the use of dilation and scale factor to a real world problem. Ex: scale drawing 8. Apply a scale factor to construct a dilation.
Extended Thinking Analyze, Apply Concepts, Connect, Prove, Synthesize, Create, Connect	1. Conclude that polygons are similar according to the similarity postulates. 2. Apply the scale factor to create similar polygons. 3. Apply the ratio of perimeter, area, and volume to create similar polygons.

VOCABULARY

ratio, proportion, means, extreme, cross product property, geometric mean, scale, similar polygons, corresponding parts, scale factor

parallel lines, transversal, midsegment of a triangle/trapezoid

dilation, center of dilation, scale factor of a dilation, reduction, enlargement, transformation

MATHEMATICAL PRACTICES

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ASSESSMENTS/FORMATIVE ASSESSMENTS

Pretest/Post Test
Quizzes (individual and partner)
Teacher-generated assessments
Notebook quizzes
Exit slips
Participation sheets

Geometry

Unit 8 – Right Triangles and Trigonometry

Timeframe:
13 School Days
Feb 17 – Mar 4, 2016

Depth of Knowledge	Essential Questions For Unit
	1. How do we prove similarity relationships in right triangles? 2. How do we use trigonometry to solve right triangles?
	Enduring Understandings
	1. Certain right triangles have properties that allow their lengths to be determined without using the Pythagorean Theorem. 2. Ratios can be used to find side lengths and angles measures of a right triangle when certain combinations of side lengths and angle measures are known. 3. The characteristics of trigonometric and circular functions and their representatives are useful in solving real-world problems.
	Content Knowledge Objectives
Recall Describe, Draw, Identify, Label, Locate, Match, Measure, Evaluate, Compute, Perform, Retrieve	1. Identify hypotenuse and legs of right triangles. 2. Apply the Pythagorean Theorem to find missing side lengths. 3. Define sine, cosine and tangent as ratios of sides in right triangles. 4. Compute trigonometric ratios using technology. 5. Use trigonometric ratios to find missing side lengths. 6. Use inverse trig functions to find missing angle measures.
Skill/Concept Categorize, Classify, Compare, Contrast, Describe Cause/Effect, Describe Patterns, Describe Relationships, Estimate, Generalize, Infer, Interpret, Make Observations, Predict, Summarize, Organize, Collect and Display	1. Solve right triangles using trigonometric ratios and the Pythagorean Theorem. 2. Classify angles as angles of elevation or depression.
Strategic Thinking Revise, Assess, Critique, Draw Conclusion, Investigate, Differentiate, Hypothesize, Cite Evidence	1. Investigate and discover the product law for radicals. 2. Investigate and discover geometric means in similar right triangles. 3. Use the Pythagorean Theorem to investigate patterns in special right triangles. 4. Solve real life word problems involving distances and angles of elevation and depression. 5. Investigate and discover the relationship between the sine and cosine of complementary angles.

Extended Thinking Analyze, Apply Concepts, Connect, Prove, Synthesize, Create, Connct	1. Prove that an altitude drawn to the hypotenuse of a right triangle results in two triangles that are similar to the original triangle.

VOCABULARY

Square root, radical, rationalize, means, extremes, geometric mean,	hypotenuse, leg, Pythagorean Triple, special right triangle,	Trigonometry, trigonometric ratios, sine, cosine, tangent, inverse trigonometric ratios, angle of elevation, angle of depression,

MATHEMATICAL PRACTICES

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Geometry

Unit 9 – Circles

	Timeframe: 15 School Days Mar 7 – Mar 28, 2016

Depth of Knowledge	**Essential Questions For Unit**
	How do we apply theorems about circles?
	Enduring Understandings
	1. The length of part of a circle's circumference can be found by relating it to an angle in the circle. 2. The area of parts of a circle formed by radii and arcs can be found when the circle's radius is known. 3. Angles formed by intersecting lines have a special relationship to the arcs the intersecting lines intercept. This includes (a) arcs formed by chords that inscribe angles, (b) angles and arcs formed by intersecting either within a circle or outside a circle and (c) intersecting chords, intersecting secants, or a secant that intersects a tangent. 4. The information in the equation of a circle allows the circle to be graphed. The equation of a circle can be written if its center and radius are known.
	Content Knowledge Objectives
Recall Describe, Draw, Identify, Label, Locate, Match, Measure, Evaluate, Compute, Perform, Retrieve	
Skill/Concept Categorize, Classify, Compare, Contrast, Describe Cause/Effect, Describe Patterns, Describe Relationships, Estimate, Generalize, Infer, Interpret, Make Observations, Predict, Summarize, Organize, Collect and Display	1. Identify and describe the relationships among angles formed by chords. 2. Identify and describe the relationships among central angles, inscribed angles and arcs.
Strategic Thinking Revise, Assess, Critique, Draw Conclusion, Investigate, Differentiate, Hypothesize, Cite Evidence	1. Investigate and prove properties of angles for a quadrilateral inscribed in a circle. 2. Derive the formula for the area of a sector. 3. Derive the formula for the equation of a circle using the Pythagorean Theorem or using Geometry software. 4. Investigate theorems about tangent lines to a circle, including the perpendicular to the tangent at the point of tangency and two tangents to a circle from the same external point. 5. Investigate justify and apply theorems about chords of circles including perpendicular bisectors. 6. Investigate, justify and apply theorems about the arcs determined by the rays of angles formed by two lines intersecting in a circle. 7. Investigate, justify and apply theorems regarding segments intersected by a circle. 8. Use similar triangles to verify the chord-chord product theorem

Extended Thinking Analyze, Apply Concepts, Connect, Prove, Synthesize, Create, Connect	

VOCABULARY

circle, center, radius, diameter, semi-circle	Chord, secant, tangent, central angle, arc, minor arc, major arc, congruent arcs, inscribed angle, intercepted arc, adjacent arcs, inscribed polygon, point of tangency, subtend	Arc length, area sector, secant segment, external secant segment, tangent segment

MATHEMATICAL PRACTICES

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Geometry

Unit 10 – Quadratics

	Timeframe: 19 School Days Mar 29 – Apr 29, 2016

Depth of Knowledge ↓	**Essential Questions For Unit**
	1. What can the zeros, intercepts, vertex, minimum, maximum and other features of a quadratic function tell you about real world relationships? 2. How is the polynomial system analogous to the system of integers? 3. What features distinguish the graph of a quadratic function from other graphs? 4. How can an understanding of polynomials help in understanding quadratic functions and equations?
	Enduring Understandings
	1. The basic shape and characteristics of the graph of a quadratic function. 2. How quadratic functions and equations relate to real life situations 3. How and why quadratics are used. 4. How to determine which method of solving is best to use given the situation.
	Content Knowledge Objectives
Recall Describe, Draw, Identify, Label, Locate, Match, Measure, Evaluate, Compute, Perform, Retrieve	1. Perform operations on polynomials. addition, subtraction, multiplication. 2. Find the vertex, axis of symmetry and zeros of a quadratic function. 3. Find monomial or binomial factors of quadratic functions. 4. Evaluate quadratic functions and create a table of values.
Skill/Concept Categorize, Classify, Compare, Contrast, Describe Cause/Effect, Describe Patterns, Describe Relationships, Estimate, Generalize, Infer, Interpret, Make Observations, Predict, Summarize, Organize, Collect and Display	1. Graph quadratic functions. 2. Efficiently solve quadratic equations by graphing, factoring and/or by using square roots.
Strategic Thinking Revise, Assess, Critique, Draw Conclusion, Investigate, Differentiate, Hypothesize, Cite Evidence	1. Investigate and compare features of linear functions and quadratic functions. 2. Investigate the key features of a quadratic function/parabolic model such as axis of symmetry, vertex, minimum/maximum, y intercept, x-intercept, roots, solutions, zeroes, and domain and range.
Extended Thinking Analyze, Apply Concepts, Connect, Prove, Synthesize, Create, Connect	1. Apply concepts of quadratic function to real world scenarios. 2. Interpret functions that arise in applications in terms of the context. 3. Analyze functions using different representations.

VOCABULARY

Quadratic Function	Standard Form	First and Second Differences
Quadratic Equation	Square Root Property	Monomial
Parabola	Zero Product Property	Binomial
Factored Form	Vertex	Trinomial
Vertex Form	Polynomial	Degree of Polynomial
Zeroes/Roots	Maximum Value	Axis of Symmetry
	Minimum Value	

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Geometry

Unit 11 – Surface Area and Volume

Timeframe:
10 School Days
May 2 – May 13, 2016

Depth of Knowledge

Essential Questions For Unit

1. How are three dimensional shapes formed?
2. How can we apply our knowledge of area to find surface area of three dimensional shapes?
3. How do we find the volume of a three dimensional shape?
4. How do we apply geometric concepts in modeling situations?

Enduring Understandings

1. A three-dimensional figure can be analyzed by describing the relationships among its vertices, edges, and faces.
2. The surface area of a three-dimensional figure is equal to the sum of the areas of each surface of the figure.
3. The volume of a prism and a cylinder can be found when its height and the area of its base are known.
4. The volume of a pyramid is related to the volume of a prism with the same base and height.
5. The surface area and the volume of a sphere can be found when its radius is known.
6. Ratios can be used to compare the areas and volumes of similar solids.

Content Knowledge Objectives

Depth of Knowledge	Content Knowledge Objectives
Recall Describe, Draw, Identify, Label, Locate, Match, Measure, Evaluate, Compute, Perform, Retrieve	1. Define terms such as: prism/cube, cylinder, pyramid, cone and sphere. 2. Define terms such as: Lateral face, lateral edge, surface area, surface area of prism/cube, cylinder, pyramid, cone and sphere lateral area, net, right prism, oblique prism, slant height. 3. Define terms such as: Volume, volume of prism/cube, cylinder, pyramid, cone and sphere.
Skill/Concept Categorize, Classify, Compare, Contrast, Describe Cause/Effect, Describe Patterns, Describe Relationships, Estimate, Generalize, Infer, Interpret, Make Observations, Predict, Summarize, Organize, Collect and Display	1. Categorize and describe relationships between prisms, point solids, and the sphere. 2. Categorize and describe relationships between the surface areas of prisms, point solids, and the sphere. 3. Construct nets of three dimensional shapes in order to find the surface area. 4. Categorize and describe relationships between the volumes of prisms, point solids, and the sphere. 5. Construct nets of three dimensional shapes in order to find the volume.
Strategic Thinking Revise, Assess, Critique, Draw Conclusion, Investigate, Differentiate, Hypothesize, Cite Evidence	1. Construct nets of three dimensional shapes in order to analyze properties and parts. 2. Utilize the surface area formulas to obtain desired measurements. 3. Utilize the volume formulas to obtain desired measurements.
Extended Thinking Analyze, Apply Concepts, Connect, Prove, Synthesize, Create, Connect	1. Explore the use of three dimensional shapes in real world context. 2. Apply surface area formulas to real world problems. 3. Apply volume formulas to real world problems.

VOCABULARY

equilateral, equiangular, regular, convex, concave, triangle, isosceles, acute triangle, obtuse triangle, quadrilateral, square, rhombus, rectangle, parallelogram, trapezoid, kite, pentagon, hexagon

polyhedron, face, edge, vertex, base, prism/cube, cylinder, pyramid, cone and sphere, center, radius, chord, diameter, great circle, hemisphere, volume, volume of prism/cube, cylinder, pyramid, cone and sphere

lateral face, lateral edge, surface area, surface area of prism/cube, cylinder, pyramid, cone and sphere lateral area, net, right prism, oblique prism, slant height,

MATHEMATICAL PRACTICES

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Quizzes (individual and partner)
Teacher-generated assessments
Notebook quizzes
Exit slips
Participation sheets

Unit 12 – Probability

	Timeframe: 10 School Days May 16 – May 27, 2016

Depth of Knowledge	Essential Questions For Unit
	1. How do theoretical and experimental probabilities compare? 2. How can we use the concept of probability to make decision in real world situations? 3. How can we understand independence and conditional probability to interpret and make predictions based on data?
	Enduring Understandings
	1. The way data is collected, organized and displayed influences interpretation. 2. The probability of an event's occurrence can be predicted with varying degrees of confidence. 3. The basic concepts of probability can be applied to lengths and areas to determine the probability of hitting a point on the line or an area within a defined region.
	Content Knowledge Objectives
Recall Describe, Draw, Identify, Label, Locate, Match, Measure, Evaluate, Compute, Perform, Retrieve	1. Find geometric probability on a segment. 2. Identify sample spaces. 3. Use counting method as a way of finding probability. 4. Evaluate conditional probability of an event B in relationship to an event A.
Skill/Concept Categorize, Classify, Compare, Contrast, Describe Cause/Effect, Describe Patterns, Describe Relationships, Estimate, Generalize, Infer, Interpret, Make Observations, Predict, Summarize, Organize, Collect and Display	1. Compare the experimental probability and the theoretical probability. 2. Use areas to find geometric probabilities. 3. Estimate area to find probability. 4. Describe events as subsets of a sample space using characteristics of the outcomes, using "or", "and", "not"
Strategic Thinking Revise, Assess, Critique, Draw Conclusion, Investigate, Differentiate, Hypothesize, Cite Evidence	1. Investigate probability by determining if two events are independent or dependent. 2. Recognize and explain the concepts of conditional probability and independence in everyday language and everyday situations.
Extended Thinking Analyze, Apply Concepts, Connect, Prove, Synthesize, Create, Connect	1. 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.

VOCABULARY

Outcome	Geometric Probability	Compound Event
Event	Experimental Probability	Mutually Exclusive Events
Sample Space	Independent Events	Venn Diagram
Theoretical Probability	Dependent Events	Two-Way Frequency Table
Counting Principle	Conditional Probability	Union
		Intersection

MATHEMATICAL PRACTICES

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Stamford Public Schools

EXCELLENCE IS THE POINT.

Geometry Pacing Guide

Unit	Standards	Text Ref 2004	2007	Timeline	Expectations- "Students will be able to…"
1	**Introduction to Geometry**			**08/31-09/24/15** 15 school days	
	CCSS.MATH.Content.HSG.CO.A.1 Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.	1.2,1.4, 1.6, 2.4	1.1,1.4, 1.5, 2.5		Define points, lines and planes. Define vertical angles, linear pairs, and complementary and supplementary angles. Review vocabulary, definitions and symbolic notation. Review properties-Reflexive, Transitive, Substitution
	CCSS.Math.Content.HSG.CO.D.12 Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.	1.3,1.5	1.2, 1.3		Use Distance formula, Pythagorean Theorem and Midpoint formula and applications thereof. Construct segment, angle, bisected segment and bisected angle.
	CCSS.Math.Content.HSG.GPE.B.7 Use coordinates to compute perimeters of polygons and areas of triangles and rectangles, e.g., using the distance formula.*	2.1	2.2		Use basic logic principles such as Conditional, Inverse, Converse and/or Contrapositive. Construct basic definition proofs.

Unit	Standards	2004	2007	Timeline	Expectations "Students will be able to…"
2	**Parallel and Perpendicular Lines**			**09/25-10/15/15** 14 school days	
	CCSS.Math.Content.HSG.CO.A.1 Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.	3.1,3.2	3.1		Identify pairs of lines and angles. Write proofs including parallel and perpendicular lines.
	CCSS.Math.Content.HSG.CO.C.9 Prove theorems about lines and angles. Theorems include: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent and corresponding angles are congruent; points on a perpendicular bisector of a line segment are exactly those equidistant from the segment's endpoints.	3.3,3.4	3.2		Use parallel lines and transversals. Prove lines are parallel using angle theorems.
	CCSS.Math.Content.HSG.CO.C.11 Prove theorems about parallelograms. Theorems include: opposite sides are congruent, opposite angles are congruent, the diagonals of a parallelogram bisect each other, and conversely, rectangles are parallelograms with congruent diagonals.	3.5,3.6	3.3,3.5		Utilize properties of parallel lines in proofs. Use slopes of parallel lines in equations and the coordinate plane.

	CCSS.Math.Content.HSG.GPE.B.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 perpendicular to a given line that passes through a given point).	3.7	3.6		Utilize properties of perpendicular lines in proofs. Use slopes of perpendicular lines in equations and the coordinate plane.
	CCSS.Math.Content.HSG.CO.D.12 Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). *Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.*	6.3	8.2-8.3		Prove quadrilaterals are parallelograms. Construct parallel and perpendicular lines.

Unit	Standards	2004	2007	Timeline	Expectations- “Students will be able to…”
3	**Congruent Triangles**			**10/16-11/5/15** 14 school days	
	CCSS.Math.Content.HSG.CO.B.6 Use geometric descriptions of rigid motions to transform figures and to predict the effect of a given rigid motion on a given figure; given two figures, use the definition of congruence in terms of rigid motions to decide if they are congruent.	4.1	4.1		Classify triangles by sides and angles. Define interior and exterior angles. Review theorems such as Triangle Sum, Exterior Angle, etc.
	CCSS.Math.Content.HSG.CO.B.7 Use the definition of congruence in terms of rigid motions to show that two triangles are congruent if and only if corresponding pairs of sides and corresponding pairs of angles are congruent.	4.2	4.2		Define congruent, corresponding angles, sides. Write a congruence statement. Review Properties of Congruent Triangles.
	CCSS.Math.Content.HSG.CO.B.8 Explain how the criteria for triangle congruence (ASA, SAS, and SSS) follow from the definition of congruence in terms of rigid motions.	4.3, 4.4 4.6	4.3-4.5		Prove triangles are congruent using SSS, SAS, ASA, AAS, HL.
	CCSS.Math.Content.HSG.SRT.B.5 Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.	4.5	4.6		Use congruent triangles to plan and write proofs including CPCTC.
		4.6	4.7		Use properties of Isosceles and Equilateral Triangles

Unit	Standards	2004	2007	Timeline	Expectations- "Students will be able to…"
4	**Triangles**			**11/6-11/30/15** 14 school days	
	CCSS.Math.Content.HSG.CO.C.10 Prove theorems about triangles. *Theorems include: measures of interior angles of a triangle sum to 180°; base angles of isosceles triangles are congruent; the segment joining midpoints of two sides of a triangle is parallel to the third side and half the length; the medians of a triangle meet at a point.*	5.1-5.3	5.2-5.4		Use properties of perpendicular bisectors of a triangle and angle bisectors of a triangle including Perpendicular Bisector Theorem and Centroid Theorem. Define and recognize points of concurrency, ie, circumcenter, incenter, centroid, orthocenter
	CCSS.Math.Content.HSG.CO.D.12 Make formal geometric constructions with a variety of tools and methods (compass and straightedge, string, reflective devices, paper folding, dynamic geometric software, etc.). *Copying a segment; copying an angle; bisecting a segment; bisecting an angle; constructing perpendicular lines, including the perpendicular bisector of a line segment; and constructing a line parallel to a given line through a point not on the line.*	5.4 5.5 5.6			Identify and use properties of midsegment of a triangle and apply Midsegment Theorem. Utilize the Triangle Inequality Theorem to find possible side lengths of triangles. Use the Hinge Theorem and its converse to compare side lengths and angle measures. Construct the perpendicular bisector of a segment.

Unit	Standards	2004	2007	Timeline	Expectations- "Students will be able to …"
5	**Polygons**			**12/1-12/18/15** 14 calendar days	
	CCSS.Math.Content.HSG.GPE.B.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).*	6.1 6.2 6.4 11.1	1.6 8.1 8.2 8.4		Identify, name and describe polygons. Use the sum of the measures of the interior angles of a quadrilateral. Find angle measures in polygons. Classify and use properties of parallelograms. Classify and use properties of sides, angles, and diagonals of rhombuses, rectangles and squares.
		6.5	8.5		Use properties of trapezoids and kites.
		4.7,6.3	8.3,5.1		Write coordinate proofs with quadrilaterals. Write parallelogram proofs.

Unit	Standards	2004	2007	Timeline	Expectations- "Students will be able to…"
6	**Transformations**			**12/21-01/8/16** 8 calendar days	
	CCSS.Math.Content.HSG.CO.A.5 Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using, e.g., graph paper, tracing paper, or geometry software. Specify a sequence of transformations that will carry a given figure onto another.	7.1	9.1		Identify the three basic rigid transformations, reflection, rotation and translation.
	CCSS.Math.Content.HSG.CO.A.5 Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.	7.2	9.3		Identify and use reflections in a plane and identify relationships between reflections and line symmetry.
	CCSS.Math.Content.HSG.CO.A.3 Given a rectangle, parallelogram, trapezoid, or regular polygon, describe the rotations and reflections that carry it onto itself.	7.3	9.4		Identify rotations in a plane. Use rotational symmetry in real-life situations.
	CCSS.Math.Content.HSG.CO.A.4 Develop definitions of rotations, reflections, and translations in terms of angles, circles, perpendicular lines, parallel lines, and line segments.	7.4 7.5	9.1 9.5		Identify and use translations in the plane. Define and use vectors to translate figures. Represent transformations as compositions of simpler transformations.

Unit	Standards	2004	2007	Timeline	Expectations- "Students will be able to …"
7	**Similarity**			**01/25-02/11/16** 14 school days	
	CCSS.Math.Content.HSG.SRT.A.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.	8.1 8.2	6.1 6.2		Find and simplify the ratio of two numbers. Use proportions to solve real-life problems. Use properties of proportions and find geometric means.
	CCSS.Math.Content.HSG.SRT.A.3 Use the properties of similarity transformations to establish the AA criterion for two triangles to be similar.	8.3,8.6	6.4,6.6		Identify similar polygons and write similarity and proportionality statements.
	CCSS.Math.Content.HSG.SRT.B.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.*	8.4,8.6	6.5,6.6		Identify similar triangles and write similarity and proportionality statements.
	CCSS.Math.Content.HSG.SRT.A.1 Verify experimentally the properties of dilations given by a center and a scale factor:	8.5	6.4		Use similarity theorems to prove that two triangles are similar using SSS, SAS, AA
	CCSS.Math.Content.HSG.SRT.A.1.a A dilation takes a line not passing	8.6	6.6		Use proportionality theorems to calculate segment

	through the center of the dilation to a parallel line, and leaves a line passing through the center unchanged.				lengths.
	CCSS.Math.Content.HSG.SRT.A.1.b The dilation of a line segment is longer or shorter in the ratio given by the scale factor.	8.7	6.7		Identify dilations and find scale factor. Identify reductions and enlargements.
	CCSS.Math.Content.HSG.SRT.B.5 Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.				
	CCSS.Math.Content.HSG.GPE.B.6 Find the point on a directed line segment between two given points that partitions the segment in a given ratio.				

Unit	Standards	2004	2007	Timeline	Expectations- "Students will be able to…"
8	**Right Triangles and Trigonometry**			**02/17-03/4/16** 13 school days	
	CCSS.Math.Content.HSG.SRT.C.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.	9.1	7.3,6.1		Solve problems involving similar right triangles. Use geometric mean to solve problems.
	CCSS.Math.Content.HSG.SRT.C.7 Explain and use the relationship between the sine and cosine of complementary angles.	9.2	7.1		Prove and use Pythagorean Theorem to solve real-world problems. Define and recognize Pythagorean triple.
	CCSS.Math.Content.HSG.SRT.C.8 Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.*	9.4	7.2		Find the side lengths of special right triangles. Use special right triangles to solve real-world problems.
		9.5	7.4		Define trigonometric ratio. Find the sine, the cosine and the tangent of an acute angle.
		9.6	7.7		Solve a right triangle and use right triangles to solve real-world problems.

Unit	Standards	2004	2007	Timeline	Expectations- “Students will be able to…”
9	**Circles**			**03/7-03/28/16** 15 school days	
	CCSS.Math.Content.HSG.CO.A.1 Know precise definitions of angle, circle, perpendicular line, parallel line, and line segment, based on the undefined notions of point, line, distance along a line, and distance around a circular arc.	10.1	10.1		Identify segments and lines related to circles. Use properties of a tangent to a circle. Define parts of a circle.
	CCSS.Math.Content.HSG.CO.D.13 Construct an equilateral triangle, a square, and a regular hexagon inscribed in a circle.	10.2	10.2,10.3		Use and apply properties of arcs and chords of circles. Use angle measures to find arcs measures. Define and identify central angles.
	CCSS.Math.Content.HSG.C.A.1 Prove that all circles are similar.	10.3	10.4		Define and use inscribed angles to solve problems. Use properties of inscribed polygons.
	CCSS.Math.Content.HSG.C.A.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.*	10.4	10.5		Use angles formed by tangents and chords to solve problems in geometry. Use angles formed by lines that intersect a circle to solve problems in geometry.
	CCSS.Math.Content.HSG.C.A.3 Construct the inscribed and circumscribed circles of a triangle, and prove properties of angles for a quadrilateral inscribed in a circle.	10.5	10.6		Find the length of segments of chords. Find the length of segments of tangents and secants.

	CCSS.Math.Content.HSG.C.A.4 (+) Construct a tangent line from a point outside a given circle to the circle.	10.6	10.7		Write the equation of a circle. Use the equations and its graph to solve problems.
	CCSS.Math.Content.HSG.C.B.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.	11.5	11.5		Find the area of a circle and a sector of a circle. Use areas of circles and sectors to solve real-world problems.
	CCSS.Math.Content.HSG.GPE.A.1 Derive the equation of a circle of given center and radius using the Pythagorean Theorem; complete the square to find the center and radius of a circle given by an equation.				

Unit	Standards	2004	2007	Timeline	Expectations- “Students will be able to…”
10	**Quadratics**			**03/29-04/29/16** 19 school days	
	CCSS.Math.Cont.HSA.APR.B.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.	Algebra1 Textbook 10.1,10.2 10.3	Algebra1 Textbook 9.1,9.2 9.3		Define polynomial, monomial, binomial, trinomial, degree of a polynomial, leading coefficient. Perform operations on polynomials. Find special products of polynomials.
	CCSS.Math.Content.HSA.APR.A.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.	Algebra1 Textbook 10.4	Algebra1 Textbook 9.4		Solve polynomial equations in factored form. Use the zero-product property.
	CCSS.Math.Content.HSA.APR.C.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] CCSS.Math.Content.HSA.APR.C.4 Prove polynomial identities and use them to describe numerical relationships. *For example, the polynomial identity $(x^2 + y^2)^2 = (x^2 - y^2)^2 + (2xy)^2$ can be used to generate Pythagorean triples.*	Algebra1 Textbook 10.5,10.6 10.8	Algebra1 Textbook 9.5,9.6 9.8		Factor trinomials of the form x^2 + bx + c. Factor basic trinomials of the form a x^2 + bx + c. Factor polynomials by grouping and completely.

	CCSS.Math.Content.8.F.A.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*.	Algebra1 Textbook 9.1	Algebra1 Textbook 10.1		Define key vocabulary. Quadratic function, parabola, parent quadratic function, vertex, axis of symmetry. Graph parent quadratic function and y=ax^2 + c for $\lvert a\rvert$>1 and $\lvert a\rvert$<1.
	CCSS.Math.Content.8.F.B.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.	Algebra1 Textbook 9.2	Algebra1 Textbook 10.2		Graph y = ax^2 + bx + c . Define and find the axis of symmetry, the vertex, and use symmetry to plot several points. Determine maximum or minimum values.
	CCSS.Math.Content.HSA.APR.B.2 Know and apply the Remainder Theorem: For a polynomial *p*(*x*) and a number *a*, the remainder on division by *x* – *a* is *p*(*a*), so *p*(*a*) = 0 if and only if (*x* - *a*) is a factor of *p*(*x*).	Algebra1 Textbook 9.3 9.4	Algebra1 Textbook 10.3 10.4		Solve quadratic equations having two solutions by graphing. Solving quadratic equations having one or zero solutions. Find the zeros of a quadratic function by graphing. Simplify radicals. Identify perfect squares. Solve quadratic equations using square roots.

Unit	Standards	2004	2007	Timeline	Expectations- “Students will be able to…”
11	**Surface Area and Volume**	1.7 12.1	1.7 12.1	**05/2-05/13/16** 10 school days	Review area and perimeter as needed. Use properties of polyhedral.
	CCSS.Math.Content.HSG.GMD.A.3 Use volume formulas for cylinders, pyramids, cones, and spheres to solve problems.*	12.2,12.3	12.2,12.3		Define net. Find the surface area of a prism, cylinder, pyramid and cone.
	CCSS.Math.Content.HSG.MG.A.2 Apply concepts of density based on area and volume in modeling situations (e.g., persons per square mile, BTUs per cubic foot).*	12.4,12.5	12.4,12.5		Use volume postulates. Find the volume of a prism, cylinder, pyramids and cone and apply to real-world problems.
		12.6	12.6		Find the surface area and volume of a sphere.

Unit	Standards	2004	2007	Timeline	Expectations- "Students will be able to…"
12	**Probability**			**05/16-05/27/16** 10 school days	
	CCSS.Math.Content.HSS.CP.A.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").		Algebra1 Textbook 13.1		Find samples spaces and find probabilities. Define and compute theoretical & experimental probability.
	CCSS.Math.Content.HSS.CP.A.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.		Algebra1 Textbook 13.4		Find probabilities of compound events.
	CCSS.Math.Content.HSS.CP.A.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*.	11.6	11.7		Find a geometric probability. Use geometric probability to solve real-world problems.
	CCSS.Math.Content.HSS.CP.A.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.*				
	CCSS.Math.Content.HSS.CP.A.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.*				
	CCSS.Math.Content.HSS.CP.B.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.				
	Final Exam REVIEW **Final Exam**			**05/31-06/7/16**	

Geometry
Grading Practice
& Description of Assessments

Grading Practice

The following is the 2015-2016 grading practice for the Stamford Public Schools high school mathematics classes. A brief description of each part of the grade and a range for the percentage is given below.

The actual percentage for each part will be determined by teachers of the course with the help of the math coach/math department head.

The math coach/math department head will be able to provide you with more clarification if needed.

What is Being Graded	Range
4. Formal Assessments: Tests & Quizzes	 60-65%
5. Homework	10%
6. Alternative Assessments: Projects, Performance Tasks, Math Notebooks (evidence of student learning, not just copying notes) Presentations	25-30%

Description of Assessments

There will be two common, district-wide assessments for this course. These assessments are not included in this handbook nor will they be in the public folders; they will be distributed to your school as the time for each assessment approaches.

The common, district-wide assessments are a:

- Mid-term assessment (data collected),
- Final exam (data collected).

A scan sheet will be used for answering the questions on these assessments. Scores for the assessments will be used to determine with which concepts students need more support.

For the mid-term and final exams, both multiple choice and short answer questions will be included on the assessments. These assessments will be 90 minutes in length. Students will bubble in the answers to the multiple choice questions on the scan sheet and will answer the short answer questions directly in the test booklet.

Materials for the assessments include:

- calculator,
- ruler,
- graph paper (if requested by student).

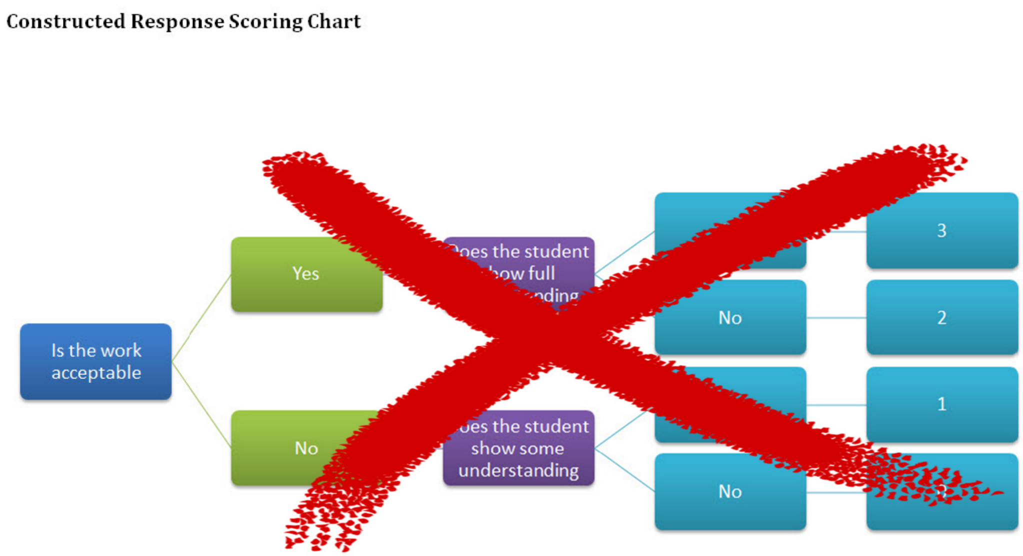
ASSESSMENT RUBRIC UPDATE

2015

Due to the recent changes with Connecticut Department of Education state assessments, the CAPT rubric will no longer be used to score the constructed response questions on the district's midterm and final exams.

This year, both middle and high school math exam questions will be scored using a point system.

Therefore, all secondary math district midterms and finals will each have a total of **100 points**.



Examples of Formative Assessment

Examples of Formative Assessment

Observations
Observations, sometimes called kid watching, can help teachers determine what students do and do not know. There are several instruments and techniques that teachers can use to record useful data about student learning.

- **Anecdotal Notes:** These are short notes written during a lesson as students work in groups or individually, or after the lesson is complete. The teacher should reflect on a specific aspect of the learning (sorts geometric shapes correctly) and make notes on the student's progress toward mastery of that learning target. The teacher can create a form to organize these notes so that they can easily be used for adjusting instruction based on student needs.
- **Anecdotal Notebook:** The teacher may wish to keep a notebook of the individual observation forms or a notebook divided into sections for the individual students. With this method, all of the observations on an individual student are together and can furnish a picture of student learning over time.
- **Anecdotal Note Cards:** The teacher can create a file folder with 5" x 7" note cards for each student. This folder is handy for middle and high school teachers because it provides a convenient way to record observations on students in a variety of classes.
- **Labels or Sticky Notes:** Teachers can carry a clipboard with a sheet of labels or a pad of sticky notes and make observations as they circulate throughout the classroom. After the class, the labels or sticky notes can be placed in the observation notebook in the appropriate student's section.

Questioning
Asking better questions affords students an opportunity for deeper thinking and provides teachers with significant insight into the degree and depth of student understanding. Questions of this nature engage students in classroom dialogue that expands student learning. Questions should go beyond the typical factual questions requiring recall of facts or numbers.

Discussion
Classroom discussions can tell the teacher much about student learning and understanding of basic concepts. The teacher can initiate the discussion by presenting students with an open-ended question. The goal is to build knowledge and develop critical and creative thinking skills.

Graphic Organizers
Graphic organizers are visual models that can assist students in organizing information and communicating clearly and effectively. Students can use graphic organizers to structure their writing, brainstorm ideas, assist in decision making, clarify story structure, help with problem solving, and plan research.

Peer/Self Assessments
Peer and self assessment help to create a learning community within the classroom. When students are involved in criteria and goal setting, self evaluation becomes a logical step in the learning process. Students become metacognitive and are more aware of their personal strengths and weaknesses. With peer assessment students begin to see each other as resources for understanding and checking for quality work against previously determined criteria. The teacher can examine the self assessments and the peer assessments and identify students' strengths and weaknesses. "When students are required to think about their own learning, articulate what they understand, and what they still need to learn, achievement improves." (Black and Wiliam 1998)

Visual Representations
There are several forms of visual representation, or nonlinguistic representation, but one that offers assessment data for the teacher is the use of drawing. Graphic organizers can be used as visual representations of concepts in the content areas. Many of the graphic organizers contain a section where the student is expected to illustrate his/her idea of the concept.

Kinesthetic Assessments
These examples of the formative assessment process require students to incorporate movement to demonstrate their understanding of a topic or concept. Although usually connected with the Arts (dance, playing a musical piece) or physical education (dribbling a basketball, serving a volleyball), kinesthetic assessments can be used in the core content classrooms to furnish teachers with insight into their students' understandings and misconceptions concerning a concept. Kinesthetic assessments are a good way to add movement in the classroom and allow teachers to determine the depth of student learning to inform their instructional decisions.

Individual Whiteboards
Individual slates or whiteboards are a great way to hold all students in the class accountable for the work. They actively involve students in the learning and are a terrific tool in the formative assessment process because they give the teacher immediate information about student learning. When students complete their work and hold their whiteboard up, the teacher can quickly determine who is understanding and who needs help and adjust his/her instruction accordingly.

Students meet with their half hour appointment and the teacher conducts the same informal observation and adjusts the third section of the lesson. Students continue this process until the lesson is complete. By structuring a lesson in the manner, the teacher is able to determine the current level of understanding for the class and for individual students, and make immediate adjustments to instruction to assist students in their learning.

Source: http://wvde.state.wv.us/teach21/ExamplesofFormativeAssessment.html

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Mathematics Notebook

The following is a list of **basic required criteria** that high school mathematics notebooks need to include along with a brief description of each. Teachers of the course along with the math coach/math department head should together determine the set-up of the notebook.

1. Table of Contents which includes date, learning objective/topic, page number.

How to Set Up the Table of Contents (ToC)

- Students should leave the first few pages of the notebook blank for the Table of Contents (ToC).
- Students should then number each page after the blank ones left for the ToC.
- Each student's ToC will have different numbers based on the student's writing size and their work.

Example of the ToC:

Date	Learning Objective/Topic	Page Number
9/16	PT: 1.1 Finding Proper Factors	5-7
9/17	PT: 1.2 Prime & Composite Number	8-10

2. Notes from Math Class

These notes are the explanation, examples, etc. generated from math class.

3. Class Work from Math Class

How to Set Up the Class Work

- If students are working on problems from a book, they need to put the page and number the problems they are working on.
- If students are working on problems from a worksheet, they should put the title of the worksheet in their notebook or tape/staple the worksheet in their notebook.

4. Math Homework

How to Set Up the Math Homework

- If students are working on problems from a book, they need to put the page and number the problems they are working on.
- If students are working on problems from a worksheet, they should put the title of the worksheet in their notebook or tape/staple the worksheet in their notebook.

5. Reflection

How to Set Up a Reflection

- Students should write the reflection statement/question in their notebook and then answer it in their notebook.

OR

- Students can staple/tape the statement/question in their notebook if it is given to them separately and then answer it in their notebook.

What is Reflection in Math Class?

Reflection is:

- A way for students to make sense of what they are seeing and doing.
- Is essentially never-ending.
- Helps students answer basic questions of what, so what, and now what.
- continuous, connected, challenging, & contextualized.
- A way for teachers to understand what students know and don't know.

Possible Math Reflections

1. Use of CMP Mathematical Reflections
2. Have students explain a concept(s) in which they did well on during the post-test for unit ___ and then write which concept(s) they think they still need more practice on/with.
3. Ask students to answer a question such as:
   - After today's lesson, this week's lessons, etc., what do you feel you need more work on?
   - How would you explain _(a concept, problem in class, etc)_ to your friend who was absent from class today?
4. Have students complete one of the following sentences:
   - I learned that I...
   - I was surprised that I...
   - I noticed that I...
   - I discovered that I...
   - I was pleased that I...
   - Today I…
   - Describe how you feel about solving _________ problem.
   - My strategy for _____ is…
5. Have students explain familiar math ideas in their own words
   - Explain what is most important to understand about fractions
   - Explain in your own words what subtraction means.
6. Ask students to write a summary of how they reached a solution, including any "false starts" or "dead ends."
7. After a small group assignment, ask each student to write an explanation of the group's work on a problem. Have the small groups discuss the individual explanations.

Taken From:

University of Minnesota, Duluth, College of Education and Human Service Professions, http://www.d.umn.edu/cehsp/civic-engagement/reflection.html
Burns, M. (1995). *Writing in math class.* Sausalito, CA: Math Solutions Publications.

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Mathematics Classroom Expectations

Math Classroom Expectations

Students will:

- **Communicate their reasoning and justifications for mathematical ideas with their peers and the teacher.**
- **Use mathematical vocabulary during discussions.**
- **Be engaged during the explore section of the lesson.**
- **Use concrete representations or manipulatives when appropriate for the problem.**
- **Provide multiple methods and solutions for problems.**
- **Use technology when appropriate for the problem.**
- **Organize their materials in a notebook.**
- **Use math talk and explain their thinking.**
- **Show confidence in explaining their solutions.**
- **Show mathematics proficiency in understanding, computing, applying, and reasoning.**
- **Be engaged throughout the lesson.**
- **Be empowered to *THINK!***

Standards-Based Classroom Experience Checklist

Classroom Environment

_____ The desks can be easily arranged for students to be able to work together frequently.
_____ Generalizations from the summarize portion of the problems are posted and visible in the classroom.
_____ The environment can be described as a community of learners.
_____ There is evidence of mutual respect.
_____ Teacher moves around the room, not standing at the front.
_____ There is evidence of a word wall.
_____ There is evidence of students maintaining an organized notebook.
_____ Manipulatives and/or calculators are easily accessible.
_____ Unit and lesson objective(s) are posted.

Student Behavior

_____ Students communicate their reasoning and justifications for mathematical ideas with their peers and the teacher.
_____ Students use mathematical vocabulary during discussions.
_____ Students use concrete representations or manipulatives when appropriate for the problem.
_____ Students provide multiple methods and solutions for problems.
_____ Students use technology when appropriate for the problem.
_____ Students organize their materials in a notebook.
_____ Students are empowered to think!
_____ Students use math talk and explain their thinking.
_____ Students show confidence in explaining their solutions.
_____ Students show mathematics proficiency in understanding, computing, applying, and reasoning.
_____ Students are engaged throughout the lesson (Launch, Explore, Summary).

Teacher Behavior

_____ Teacher effectively launches the problem.
_____ Teacher exhibits sound questioning techniques (Launch, Explore, Summary).
_____ Teacher effectively facilitates the summary.
_____ Teacher paces the lesson according to the Launch, Explore, Summarize model.
_____ Teacher differentiates for the various learners in the classroom.
_____ Teacher uses materials provided.
_____ Teacher follows district curriculum and pacing guide.
_____ Teacher appropriately assigns homework questions.
_____ Teacher uses formative assessment to be flexible in the delivery of the lesson.
_____ Teacher shows evidence that s/he believes all students can learn mathematics.
_____ Teacher acts as a facilitator.
_____ Teacher models activities.
_____ Teacher prompts students to share different ways to solve the math.

Participation Grading Sheet

Participation Sheet

The following weekly *Participation Sheet* can be used as a way to document student participation in math class. These sheets may also provide useful information for parent conferences.

Using the *Participation Sheet*

- The *Participation Sheet* is to be used at the week
- Students should answer “yes” or “no” to each question
- Teachers may need to model the use of this form with students when used for the first time.
- If there is a discrepancy between the student’s view of his/her participation and the teacher’s view, the teacher will need to meet with that student to discuss the discrepancy.

Participation Grading Sheet

Name: ____

Week of: ____

We have completed almost a full week of math class. Think about how well you have participated in class this week

1. Answer the following questions, as they will help you give yourself a fair participation grade for this week.

   Did you participate in whole group discussions?

   Did you ask questions when you didn't understand?

   Did you come prepared to class so that you could ask questions?

   Did you LISTEN carefully to others?

2. Now count your "yes" responses.
   If you answered "yes" to ALL of them, you are doing a great job! Give yourself a **4**.
   If you answered "yes" to most of them, give yourself a **3**.
   If you answered yes to a couple of them, give yourself a **2**.
   If you answered yes to one of them, give yourself a **1** and you need to rethink your role in the class and speak to your teacher.

3. I give myself ___________ for this week. Student Signature:

____

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Differentiated Instruction: Ways to Reach a Variety of Math Learners

EXPEDITIONARY LEARNING

MEETING STUDENTS' NEEDS THROUGH SCAFFOLDING

Lessons that involve highly complex text require a great deal of scaffolding. Many of the suggestions we make in the Meeting Students' Needs column of the NYS lessons are scaffolds—temporary instructional supports designed to help students successfully read texts that are supposedly too hard for them. **Many scaffolds are excellent for all types of learners—English Language Learners (ELLs), students with special needs and/or students who are just generally challenged by reading.**

Scaffolding *becomes* differentiation *when students access or have access to scaffolding only when needed. Scaffolds that are provided to the whole class might be appropriate and necessary, but whole class scaffolds are not differentiation.*

<table>
<tr><td rowspan="2">FRONT-END SCAFFOLDING</td><td>Front-end scaffolding is defined as the actions teachers take to prepare students to better understand how to access complex text before they read it. Traditionally, front-end scaffolding has included information to build greater context for the text, front-loading vocabulary, summarizing the text, and/or making predictions about what is to be read. Close analytical reading requires that teachers greatly reduce the amount of front-end scaffolding to offer students the opportunity to read independently and create meaning and questions first. It also offers students the opportunity to own their own learning and build stamina.</td></tr>
<tr><td>Examples of front-end scaffolding that maintain the integrity of close reading lessons include:
• Using learning targets to help students understand the purpose for the reading
• Providing visual cues to help students understand targets
• Identifying, bolding, and writing in the margins to define words that cannot be understood through the context of the text
• Chunking long readings into short passages, (literally distributing sections on index cards, for example), so that students see only the section they need to tackle
• Reading the passage aloud before students read independently
• Providing an audio or video recording of a teacher read-aloud that students can access when needed (such as SchoolTube, podcasts, ezPDF, or GoodReader)
• Supplying a reading calendar at the beginning of longer-term reading assignments, so that teachers in support roles (special needs, ELL, AIS) and families can plan for pacing
• Prehighlighting text for some learners so that when they reread independently, they can focus on the essential information
• Eliminating the need for students to copy information—and if something is needed (such as a definition of vocabulary), providing it on the handout or other student materials</td></tr>
</table>

MEETING STUDENTS' NEEDS THROUGH SCAFFOLDING

BACK-END SCAFFOLDING	**Back-end scaffolding**, on the other hand, is defined as what teachers plan to do after students read complex text to help deepen understanding of the text. When teachers provide back-end scaffolds, they follow the "Release-Catch-Release model," allowing students to grapple with hard text FIRST, and then helping students as needed.
	Examples of back-end scaffolds include, but are not limited to: • Providing "hint cards" that help students get "unstuck" so they can get the gist—these might be placed on the chalkboard tray, for example, and students would take them only if they are super-stuck • Encouraging/enabling students to annotate the text, or—if they can't write directly on the text—providing sticky notes or placing texts inside plastic sleeves (GoodReader is an app that allows students to mark up text on an Ipad. Adobe Reader works on a wide variety of electronic platforms) • Supplying sentence starters so all students can participate in focused discussion • Placing students in heterogeneous groups to discuss the text and answer text-dependent questions • Providing task cards and anchor charts so that expectations are consistently available • Highlighting key words in task directions • Simplifying task directions and/or create checklists from them so that students can self-monitor their progress • Placing students in homogeneous groups and providing more specific, direct support to the students who need it most • If special education teachers, teachers of ELLs, teaching assistants, etc. are pushed in to the ELA block, teaching in "stations" so that students work in smaller groups • Designing question sets that build in complexity and offer students multiple opportunities to explore the answers: * Students discuss the answer with peers, then write answers independently and defend answers to the whole class. * Provide time for students to draft write responses before asking for oral response. • Identifying and defining vocabulary that students struggled with • Using CoBuild (plain language) dictionaries • Providing partially completed or more structured graphic organizers to the students who need them • Providing sentence or paragraph frames so students can write about what they read • **AFTER students have given it a shot:** * Examine a model and have students compare their work to the model and then revise. * Provide a teacher think-aloud about how he/she came to conclusions and have students revise based on this additional analysis. * Review text together as a class (smartboard or document camera) and highlight the evidence.

Teacher Tool Box for Differentiation in the Math Classroom

1. Use graphic organizers to help students organize information

http://www.teachervision.fen.com/graphic-organizers/printable/6293.html
http://www.graphic.org/goindex.html
http://www.eduplace.com/graphicorganizer/
http://www.enchantedlearning.com/graphicorganizers/

2. Assess, Assess, Assess: Use Formative Assessment to see what students know

"Formative assessment is a process used by teachers and students during instruction that provides explicit feedback to adjust ongoing teaching and learning to improve students' achievement of intended instructional outcomes.[1] Formative assessment is a method of continually evaluating students' academic needs and development within the classroom."
From the website http://www.learnnc.org/lp/pages/5212

Examples of formative assessment:

- Exit slips
- Thumbs up/down
- Have students discuss their thinking about a question or topic in pairs or small groups, then ask a representative to share the thinking with the larger group (sometimes called think-pair-share).
- Present several possible answers to a question, then ask students to vote on them.
- Ask all students to write down an answer, then read a selected few out loud.
- Have students write their understanding of vocabulary or concepts before and after instruction.
- Ask students to summarize the concepts after an activity
- Have students complete a few problems or questions at the end of instruction and check answers.
- Interview students individually or in groups about their thinking as they solve problems.
- Use of math notebooks to answer a question, explain their thinking, etc.

3. Listen to students' conversation to hear what students are thinking and what they understand

4. Assign different questions to students

5. Provide students with access to calculators

6. Pair a student with another student of similar different academic levels or learning styles

7. Group and regroup students throughout the course of the class period within the same lesson

8. Have students create similar problems/Write own story problems

9. Extend a problem by adding an additional section

10. Focus on logic, reasoning and <u>explanations</u>

11. Use simpler numbers in the examples

12. Minimize reading - Read aloud to certain groups or have one student read to the rest of the group

13. Break down problems- Have students do the problem in sections

14. Use of concise language (make sure that students know what is being asked)

“Keys Ideas for Successful Differentiation”

The following ideas will help provide differentiated instruction for all students:

- **Start small. Use materials that you are already working with and adjust then to response to varied needs around your objective.**
- **Promote growth for all learners: keep struggling, grade-level, and advanced students in mind.**
- **Give all students access to rich, worthwhile tasks and ideas that encourage higher-level thinking and mathematical applications.**
- **Adjust the number of tasks along with the complexity, but avoid given any group of students significantly more or fewer problems to solve.**
- **Use assessment continuously, and group flexibly according to assessed needs.**
- **Recognize that some students may have needs beyond what can be met with tiering.**

Taken from:

Little, C., Hauser, S., & Corbishley, J. Constructing complexity for differentiated learning. *Mathematics Teaching in the Middle School.* Volume 14, No.1, August 2009.

Strategies for Math Class
Originally Developed June 2010

1. Use this strategy to help students find a missing width when the perimeter and length are given (Academic Geometry).
    - $P = l + l + w + w$
    - 22 = 6 + 6 + ___ + ____
    - 22 = 6 + 6 + 5 + 5

2. To go over problems in class, have a student go to the Promethean/Smart board and to act as the teacher. The student calls on other students to work through each step of the problem asking questions of the class of students as they work through the problem. Thinking through the problem as the teacher must think through a problem leads to a greater understanding of the math.

3. Make sure that the writing on the Word Walls is large enough so that the words are easily read from anywhere in room.

4. Put answers to a quiz on the Promethean/Smart board immediately after students hand in their quiz. Students liked the immediate feedback.

5. Differentiation
    - see previous handouts
    - have the next problem ready to go for students who successfully complete the given one
    - provide a "CHALLENGE" homework assignment as an option for those students who want to stretch themselves (see handout entitled "Ways to Challenge Students in Math Class").

10 Rituals and Routines That Work

Originally Developed June 2010

1. **Use a Problem of the Day (Warm-Up/Do Now/etc.)**
   Incorporate concepts students need to review into a POD, Warm-Up, Do Now.
   To determine these concepts, look at pre-requisite skills for the unit. Doing these concepts as a warm up will help keep the concepts connected.

2. **Teach group work expectations and have students reflect on their own participation**
   Use the SPS Participation Grading Sheet to help teach students the expectations for math class and to teach them how to reflect on their work. The Participation Grading Sheet can be found in the SPS Mathematics Handbook

3. **Exit Slips for individual accountability**
   Create an Exit Question(s) on your lesson objective. All students answer this question individually before leaving class and hand in exit slip on their way out. Student responses will help guide teachers' instructional decisions. It also helps to ensure that a student is not being "carried" by their partner(s). <u>These do not need to be graded; they are used formatively.</u>

4. **Use RED, YELLOW, GREEN cups to monitor class needs**
   Use these when students are doing group/partner work so that the teacher can easily see which groups need assistance, which are done, and which need more time.
   Red – ALL DONE
   Yellow – WE HAVE A QUESTION
   Green – WE ARE STILL WORKING

5. **Keep homework easy to correct**
   Don't let homework eat up too much of the class time. Class time focuses on problem solving. Students still need drill to solidify concepts – do that for homework.

6. **Use the interactive white boards**
   These are the best tool for keeping both students and teachers on their learning objective.

7. Have colored pencils available for graphing of equations

Tie a red, green, and blue colored pencil together with a rubber band. Together with a regular pencil this makes four colors to work with. Discussion is made easier when everyone has graphed the first equation in red, the second in green, and the third in blue, for example.

8. Plan for the closure of the lesson while students are working in small groups

The teacher should walk around while students are working in small groups and choose students with interesting solutions to present their work during the close of the lesson. Let students know that they will be called upon and for which specific part of the problem. In order to keep track of the students and the problem they are presenting, the teacher should write down the student names and the part of the problems they are to present on a piece of paper.

9. Always have something "up your sleeve" for students who finish early

For example, if all students are doing parts A – C of a problem, those who finish early can move on to part D and/or E. Students who finish early can also work on something to present during the close of the lesson or can work on an on-going project, activity that focuses on the same concepts/topics.

10. ALWAYS have closure to a lesson

Leave a minimum of 10 minutes for the close of the lesson. Even if the class has not finished the problem, there should be a summary of what was completed so far. An exit slip and some sort of VERY short notes that students take in their notebooks are good ways to ensure closure.

Suggestions on How to Challenge Students in Math
Originally Developed June 2010

1. Teachers can post two homework assignments every day.
   For example:

   HW – p. 21 (3 – 5)
   Challenge – p. 24 (32, 33)

2. Teachers should contact parents of students consistently getting A's or better to say:
   "Your child is doing wonderfully in math and I want to make sure we are challenging him/her. I assign challenge problems every night and I would like your son/daughter to try those problems in addition to the regular homework (which they probably finish very quickly) These problems will typically cover the same topics we are studying in class, but will allow your son/daughter to explore the concepts in greater depth."

3. For these top students (when arranged with the parents) the challenge questions are **not optional**.

4. Other students may try the challenge questions if they want to as long as they are also getting their regular homework done well.

5. Teachers can put a basket out to collect the challenge homework which the teacher can correct and returned.

6. The regular homework can be corrected in class since all students are doing that assignment.

This is a simple, pro-active way to show parents that you recognize the needs of your top students and you are doing everything you can to meet those needs.

Appendix A:
Course Feedback

Curriculum Feedback

Course_________Quarter_______________

I like the way the curriculum/Handbook…
If I could change something about the curriculum/Handbook, I would…
If I could add something to the curriculum/Handbook, I would…

Stamford Public Schools

EXCELLENCE IS THE POINT.

Appendix B:

Explanation of Performance Based Assessments

It is expected that the students in the Geometry classes will complete performance based assessments. Academic level courses should include at least one performance based assessment per semester. The CP and Honors level courses should include at least one performance based assessment per quarter.

Below is a list of performance based assessments included in this handbook (see Appendix A for assessments/activities). Although these are only a sampling of performance based assessments, all Geometry classes of all levels should complete the first performance based assessment listed during Quarter 1. Geometry teachers should discuss the use of other performance based assessments (ones listed and not listed in the handbook) with their Math Department head and with teachers in their PLCs.

Please submit any projects or performance base assessment to members of the High School Math Committee or to the Math Department Head/Coach at your school.

- Geometry Poster Project (Given to *all* students during Quarter 1)
- Activity 6-11 Creating Problems and Applying Formulas
- Activity 6-12 Creating Problems and Applying Formulas (Advanced)
- If you Sleep in Class, Then You Will Miss Notes!
- Geometric Logo
- Think Big
- Self Similarity
- Geometric Ornament

Appendix C:
Explanation of Activities/Resources

How to Use the Activities/Resources Provided

There are activities included in this handbook for classroom use. The activities in the handbook should not just be photocopied and used as “worksheets” for students to complete individually. Instead, they should be used in the workshop model. This means that small groups of students work on the activity collaboratively or certain parts of the activity are assigned to certain groups of students. While students are working on these, the teacher should be circulating the room to help each group and determining which students will present their work and solutions to the class. The groups that the teacher asks to present should show a variety of ways to solve the problem/do the work.

If teachers feel that they need help with the workshop model, they can contact their Math Department Head.