Stamford Public Schools

EXCELLENCE IS THE POINT.

Mathematics Handbook

Algebra I

2015-2016

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Directions for the Algebra I Handbook

There is a great deal of information contained in this handbook which will enhance the implementation of the Algebra I 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, the pacing guide, the 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, math notebook set-up, and a brief review of integer operations. 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 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.

For the 2015-2016 school year, the handbook will include some samples of activities that can be used during the extended period in the High School schedule. The activities can be found on the public folder. Some of the activities are links from Illustrative Mathematics. When they are opened you will need to click the "direct link to this task". Working collaboratively with other teachers teaching Algebra I (building based) and with the Math Department Head, more activities can be included in the folder to be added to this handbook.

In addition to the activities for extended periods, 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, 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.

In order to assist grade 8 Algebra I students to be better prepared for the SBAC test, a folder titled Grade 8 Geometry Review has been added to the public folders. The folder contains resources on the concepts of Volume, Exterior Angle Theorem, Transversals, Transformations, and the Pythagorean Theorem. These can be used throughout the year to familiarize the students with these concepts.

The HS Math Committee will supply two assessments for Algebra I throughout the school year. These assessments are: Midterm and Final Exam. There is a pre-assessment that you may use at your discretion for your teacher evaluation goals. When possible all other assessments should be generated by teachers collaboratively (by school). Teachers should begin discussions and/or work together and share ideas when possible on these assessments.

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.

There have been some changes in the questions to be asked on the Final Exam. These assessment questions will now be designed to address approximately 32% Conceptual Understanding, 40% Procedural Fluency and 28% Application. Although all of the concepts are important to cover, the concepts that are considered to be essential for mastery in Algebra I in preparation for Algebra II are Expressions, Equations and Inequalities(units 1-2), Linear Equations in Two Variables (units 4-6), and Systems of Equations and Inequalities (unit 7). They will make-up approximately 72% of the Final Exam.

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. 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!

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

Traditional vs. Student-Centered Teaching and Learning of Mathematics

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

Professional Development Protocol

Classroom-embedded PD is:
- NON-EVALUATIVE
- to provide individualized feedback to each teacher reading pedagogy

Expectations

The consultant will
- carry out the role with professionalism, integrity, and courtesy
- provide constructive oral feedback to individual teachers by providing at least one suggestion of what to work on for next time (e.g. putting students in groups with specific roles)
- respect the confidentiality of the information gained

The teacher will:
- know dates of visit in advance and not schedule tests/quizzes on these dates
- carry out the role with professionalism, integrity, and courtesy
- accept oral feedback and suggestions
- practice implementing suggestions in between visits
- provide math topic to DH in advance of visit (timeline for identifying topic to be determined with DH)
- debrief the classroom visit with the consultant during the contractual day and during his/her scheduled collateral duty

The Math Administrator/DH will:
- carry out the role with professionalism, integrity, and courtesy
- develop a schedule in advance of the visit and send schedule/math topic of the lessons to the Curriculum Associate in Central Office
- schedule time for teachers to individually debrief the classroom visit with the consultant during the contractual day and during his/her scheduled collateral duty

Central Office will:
- carry out the role with professionalism, integrity, and courtesy
- set up dates for visits with the provider
- schedule substitutes to cover teachers' collateral duty during debrief
- send schedule/math topic to the provider in advance of visit
- ask teachers, DHs, Math Administrators for feedback about PD

John Keogh: 2015 - 2016 High School Math Consultant Days *Dates are tentative and subject to change.		
Total Visits	Dates	Location
1	Monday, September 28, 2015	SHS
2	Tuesday, September 29, 2015	WHS
3	Wednesday, October 14, 2015	AITE
4	Monday, October 19, 2015	SHS
5	Friday, October 23, 2015	WHS
6	Thursday, November 5, 2015	WHS
7	Wednesday, November 18, 2015	SHS
8	Monday, November 23, 2015	AITE
9	Monday, December 7, 2015	WHS
10	Monday, December 14, 2015	SHS
11	Tuesday, December 15, 2015	AITE
12	Wednesday, January 6, 2016	SHS
13	Monday, January 11, 2016	WHS
14	Friday, January 15, 2016	AITE
15	Tuesday, February 2, 2016	SHS
16	Monday, February 8, 2016	WHS
17	Tuesday, February 9, 2016	AITE
18	Monday, February 22, 2016	WHS
19	Tuesday, March 1, 2016	SHS

20	**Wednesday, March 2, 2016**	**AITE**
21	**Monday, March 7, 2016**	**WHS**
22	**Wednesday, March 9, 2016**	**AITE**
23	**Tuesday, March 15, 2016**	**SHS**

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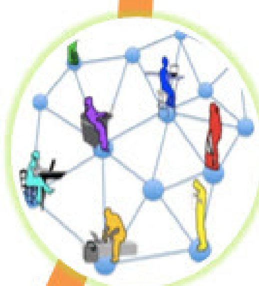
The 4Cs in a 21st Century Education



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

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CCSS Shifts, Mathematical Practices & Webb's DOK

CCSS Three Shifts in Mathematics:

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

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

3. **RIGOR: In major topics pursue <u>conceptual understanding</u>, <u>procedural skill and fluency</u>, and <u>application</u> 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 $x^2 + 9x + 14$, 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.

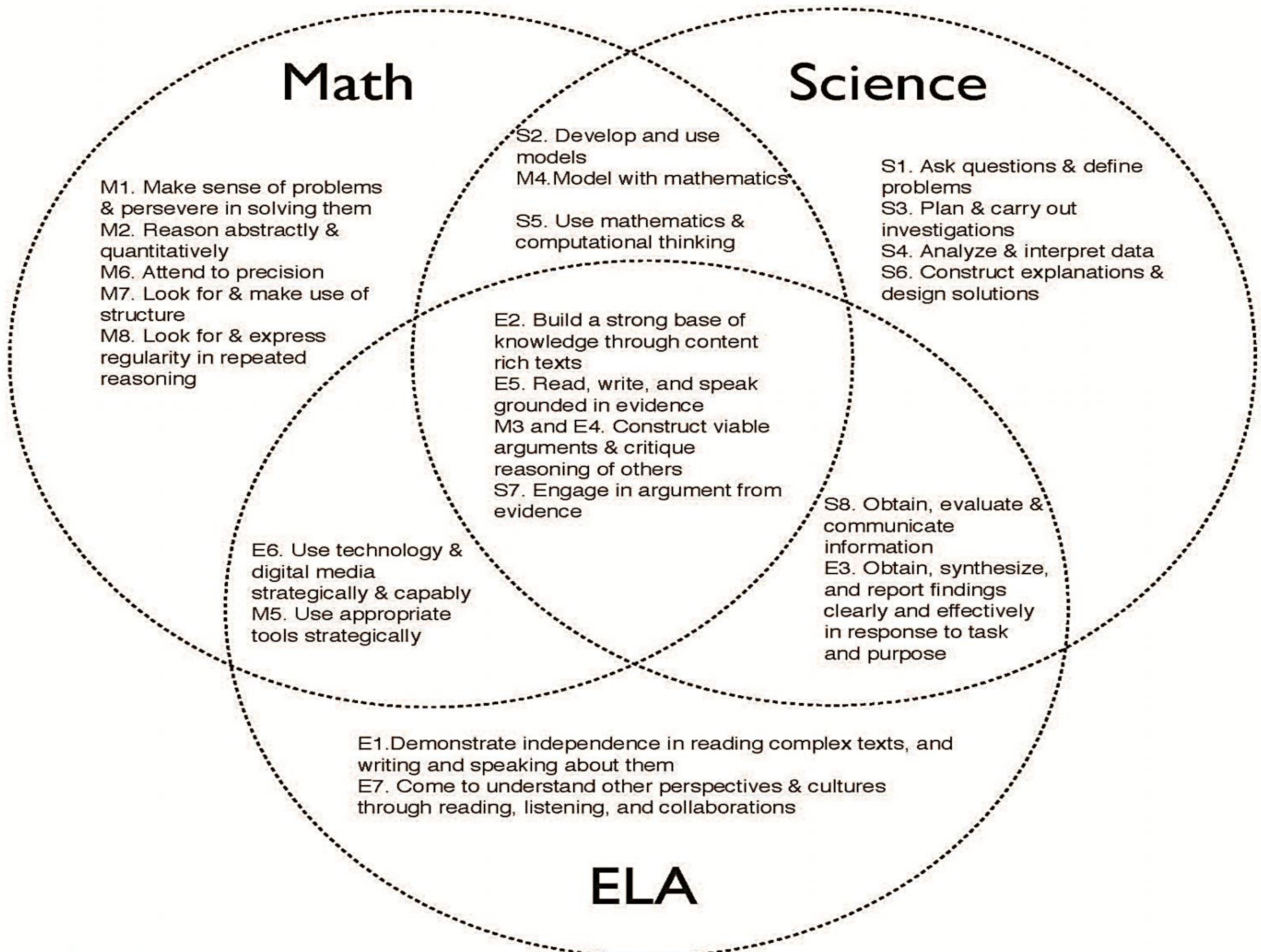
Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By 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 (y – 2)/(x – 1) = 3. Noticing the regularity in the way terms cancel when expanding (x – 1)(x + 1), (x – 1)(x2 + x + 1), and (x – 1)(x3 + x2 + 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

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

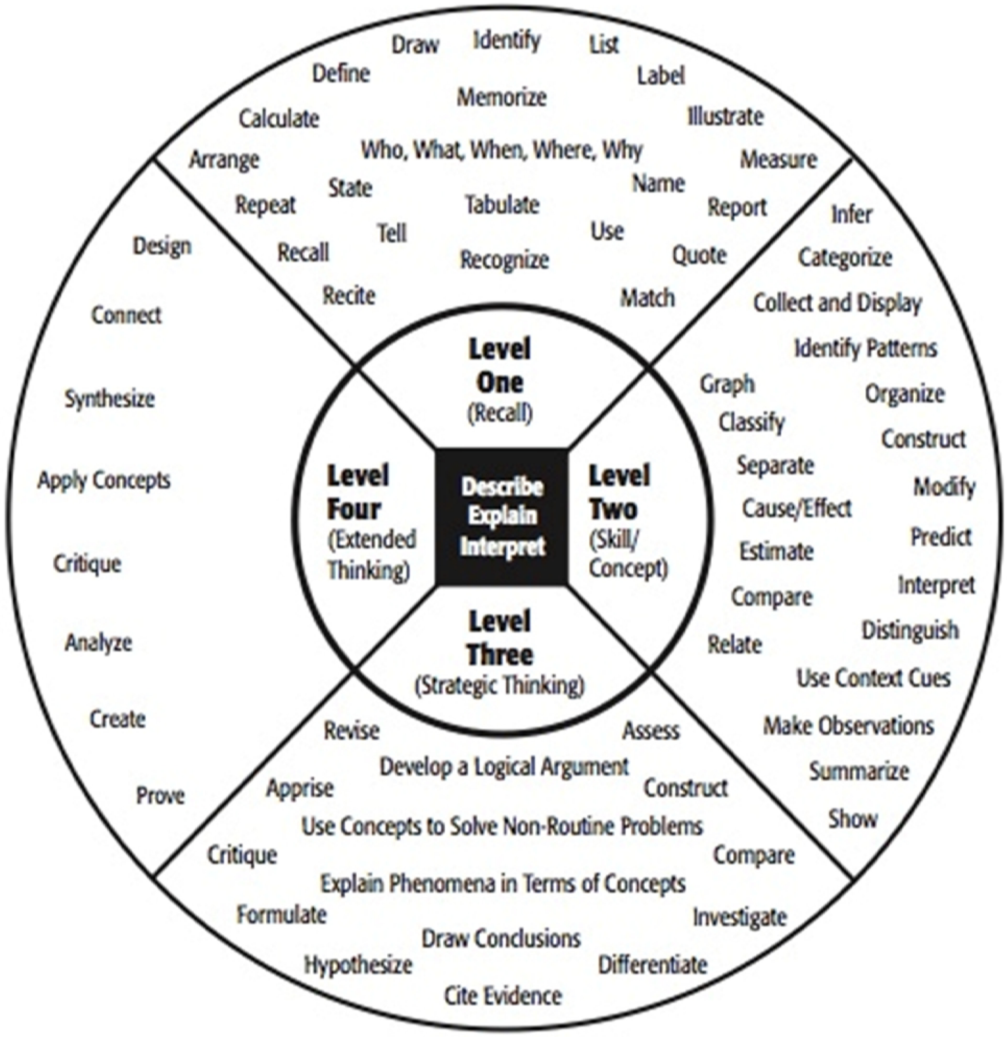
Relationships and Convergences Found in the Common Core State Standards in Mathematics (practices), Common Core State Standards in ELA/Literacy*(student portraits), and A Framework for K-12 Science Education (science & engineering practices)

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

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.*

GEF CCSS Classroom Rubric

	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.
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.
	PREPARING	**GETTING STARTED**	**MOVING ALONG**	**IN PLACE**
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.

Algebra I Syllabus

Algebra I 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 Common Core State Standards(CCSS), 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.

Textbook:

Larson, Boswell, Kanold, Stiff (2001, 2007). Algebra 1. McDougal Littell

- This textbook is available online at www.classzone.com.

Units:

Number Properties and Expressions

- Number Properties
- Rational Numbers and Absolute Value
- Order of Operations
- Translating and Evaluating Expressions & Equations
- Distributive Property
- Combining Like Terms

Linear Equations and Inequalities

- 1 & 2 step Equations
- Multi-step Equations
- Like Terms
- Distributive Property
- Variables both sides
- Solving for a given variable in a formula
- Substitution using a formula
- Solving and Graphing Inequalities in one variable
- 1 & 2 Step Inequalities
- Compound Inequalities

Functions

- Relationships
- Relations
- Functions
- Evaluating Functions
- Domain and Range
- Vertical Line Test

Rate of Change and Slope

- Physically Investigating Slope
- Rate of Change & d=rt
- Interpreting Rate of Change from Graphs
- Visual Approach of Slope
- Finding Slope
- Classification of Slope
- Slope using a Graph
- Slope Formula
- Identifying Slopes as Parallel & Perpendicular
- Applications

Graphing Lines

- Using x & y-intercepts
- Given Point & Slope
- Slope–Intercept Form
- Parallel & Perpendicular Slopes from an Equation
- Graphing Linear Inequalities (with 2 variables)

Writing Equations of Lines

- Given a Graph
- Given a Slope and the Intercept
- Given a Point and Slope
- Given two Points
- Applications
- Horizontal and Vertical Lines
- Parallel and Perpendicular given a point and equation in slope-intercept form
- Point-Slope Form
- Standard Form
- Inequalities given a graph
- Applications

System of Equations

- Verifying Solutions
- By Graphing
- By Substitution
- By Linear Combination - Adding and Subtraction Only
- By Linear Combination - By Multiplying First
- Types of Solutions
- Applications
- Systems of Linear Inequalities

Linear Regression

- Scatter Plot
- Line of Best Fit
- Prediction
- Extrapolation
- Interpolation
- Correlation
- Causation
- Applications

Laws of Exponents

- Multiplying
- Dividing
- Power of a Power
- Zero and Negative Exponents
- Scientific Notation
- Applications

Piecewise Functions

- Introduction to Piecewise and Function Notation
- Writing Piecewise Functions
- Graphing Piecewise Functions

What is Being Graded	**Range**
1. Formal Assessments: Tests & Quizzes	 50-65%
2. Homework	10%
3. Alternative Assessments: Projects, Performance Tasks, Class Activities Math Notebooks (evidence of student learning, not just copying notes) Presentations	25-40%

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.

Stamford Public Schools

EXCELLENCE IS THE POINT.

Algebra I Curriculum

Algebra 1

Unit 1: Number Properties and Expressions

Thinking Skill Category	Essential Questions For PreK-12 Mathematics		
	1. How do patterns and functions help us describe data and physical phenomena and solve a variety of problems? 2. How are quantitative relationships represented by numbers? 3. How do geometric relationships and measurements help us to solve problems and make sense of our world? 4. How can collecting, organizing and displaying data help us analyze information and make reasonable predictions and informed decisions?		
	Focus Questions For Unit 1		
	How do you utilize the number properties?	**How do you simplify numerical expressions involving rational numbers and absolute value?**	**How do you write, evaluate and simplify algebraic expressions and equations?**
	Content Knowledge Objectives		
Recall Describe, Draw, Identify, Label, Locate, Match, Measure, Evaluate, Compute, Perform, Retrieve	Identify the number properties: Associative, Commutative, Identity(multiplicative and additive), Zero(multiplicative and additive), Inverse and Distributive	Explain the characteristics of rational numbers, absolute value and order of operations	Evaluate the algebraic expression or equation using substitution
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	Compare and contrast the properties according to the four basic operations	Develop and utilize the rules for order of operations to evaluate numerical expressions	Translate an algebraic statement into phrases or sentences and phrases or sentences into algebraic statements
Strategic Thinking Revise, Assess, Critique, Draw Conclusion, Investigate, Differentiate, Hypothesize, Cite Evidence	Investigate the similarities between the properties	Discriminate between the correct use of the order of operations verses an inappropriate use of the order	Investigate the difference between an expression and an equation
Extended Thinking Analyze, Apply Concepts, Connect, Prove, Synthesize, Create, Connect	Create examples of each property	Critique the validity of a simplified expression and report any errors	Apply the concepts of like terms and the distributive property to simplify algebraic expressions

VOCABULARY			
	Associative Commutative Identity(Multiplicative and Additive) Zero(Multiplicative and Additive) Distributive Inverse	Absolute value Base Evaluate Exponent Expressions Integers Opposite Order of operations simplify	Difference Equation Greater than (or equal to) Less than (or equal to) Product Quotient Substitute Sum Variable

Common Core State Standards For Mathematics

A.SSE.1 Interpret expressions that represent a quantity in terms of its context.

A.SSE.1a Interpret parts of an expression, such as terms, factors, and coefficients.

A.SSE.1b Interpret complicated expressions by viewing one or more of their parts as a single entity.

A.SSE.2 Use the structure of an expression to identify ways to rewrite it.

N-Q 1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

N-Q 2 Define appropriate quantities for the purpose of descriptive modeling.

N-Q 3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.

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.

Algebra 1
Unit 2: Linear Equations and Inequalities

Thinking Skill Category	Essential Questions For PreK-12 Mathematics		
	1. How do patterns and functions help us describe data and physical phenomena and solve a variety of problems? 2. How are quantitative relationships represented by numbers? 3. How do geometric relationships and measurements help us to solve problems and make sense of our world? 4. How can collecting, organizing and displaying data help us analyze information and make reasonable predictions and informed decisions?		
	Focus Questions For Unit 2		
	How do you solve one and two step equations using inverse operations?	**How do you solve multi-step equations involving like terms, distributive property and variable terms on both sides of the equations?**	**How do you solve inequalities in one variable?**
	Content Knowledge Objectives		
Recall Describe, Draw, Identify, Label, Locate, Match, Measure, Evaluate, Compute, Perform, Retrieve	Develop an algorithm for solving equations involving one and two steps.	Identify the Distributive Property and like terms within multi-step equations.	Define inequality.
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	Solve one and two step equations using the algorithm developed.	Solve multi-step equations by using prior knowledge of the Distributive Property, like terms and the equation solving algorithm.	Describe the effect of multiplying or dividing by a negative number on an inequality
Strategic Thinking Revise, Assess, Critique, Draw Conclusion, Investigate, Differentiate, Hypothesize, Cite Evidence	Interpret and solve word problems using algebraic equations involving one and two steps.	Solve formulas for a given variable using the algorithm for equation solving.	Solve and graph the solution of an inequality in one variable.
Extended Thinking Analyze, Apply Concepts, Connect, Prove, Synthesize, Create, Connect		Apply the concept of solving equations to real world situations.	Apply the concept of inequality to solving compound inequalities. .

VOCABULARY			
	Inverse operation	Like terms Distributive property Formula	Inequality Compound inequality Closed circle Open circle

Common Core State Standards For Mathematics

A-CED 1 (part) Create equations and inequalities in one variable and use them to solve problems. *Include equations arising from linear ... functions*

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

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

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

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.

Algebra 1 **Unit 3: Functions**			
Thinking Skill Category	**Essential Questions For PreK-12 Mathematics** 1. How do patterns and functions help us describe data and physical phenomena and solve a variety of problems? 2. How are quantitative relationships represented by numbers? 3. How do geometric relationships and measurements help us to solve problems and make sense of our world? 4. How can collecting, organizing and displaying data help us analyze information and make reasonable predictions and informed decisions?		
	Focus Questions For Unit 3		
	How do you graph a relationship?	**How do you relate relations and functions?**	**How do you write and evaluate equations in function notation (y=…)?**
	Content Knowledge Objectives		
Recall Describe, Draw, Identify, Label, Locate, Match, Measure, Evaluate, Compute, Perform, Retrieve	Describe situations using graphs.	Define relation, function, domain and range.	Define and identify independent and dependent variables.
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	Compare and contrast relationships and graphs.	Represent relations using tables, graphs and mapping diagrams.	Relate independent and dependent variables by writing appropriate functions (equations in two variables).
Strategic Thinking Revise, Assess, Critique, Draw Conclusion, Investigate, Differentiate, Hypothesize, Cite Evidence		Draw conclusions about which relations are functions.	Draw conclusions about reasonable domains and ranges of given functions.
Extended Thinking Analyze, Apply Concepts, Connect, Prove, Synthesize, Create, Connect		Apply the concepts of relations and functions to real world situations.	Apply to real world situations.

VOCABULARY			
	Relation Increasing Decreasing Constant	Function Domain Range	Input Output Independent variable Dependent Variable Function notation

Common Core State Standards For Mathematics

F.IF.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationships.

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

F.IF.5 Relate the domain of a function to its graph and where applicable to the quantitative relationship it describes.

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.

Algebra 1

Unit 4: Rate of Change and Slope

Thinking Skill Category	Essential Questions For PreK-12 Mathematics		
↓	1. How do patterns and functions help us describe data and physical phenomena and solve a variety of problems? 2.How are quantitative relationships represented by numbers? 3. How do geometric relationships and measurements help us to solve problems and make sense of our world? 4. How can collecting, organizing and displaying data help us analyze information and make reasonable predictions and informed decisions?		
	Focus Questions For Unit 4		
	How do you relate slope to rate of change?	**How do you determine slope on a coordinate plane?**	**How do you determine slope algebraically using the formula?**
	Content Knowledge Objectives		
Recall Describe, Draw, Identify, Label, Locate, Match, Measure, Evaluate, Compute, Perform, Retrieve	Describe situations that change at a constant rate.	Identify that given any two points on a line there is a vertical and horizontal change in order to get from one to another.	Describe the change in y and the change in x in terms of two ordered pairs of the given line.
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	Examine and describe the rates of change through stories and their graphs.	Describe slope in terms of vertical change (change in y) over horizontal change (change in x).	Develop the formula for finding slope based on the relationship found.
Strategic Thinking Revise, Assess, Critique, Draw Conclusion, Investigate, Differentiate, Hypothesize, Cite Evidence	Compare the rate of change in the graph to the vertical and horizontal changes. e.g. ramp, staircase (noting the sign or absence of change-zero or undefined).	Draw the conclusion that any two points on a line will lead to the same slope.	Compute the slope of a line given two points on the line.
Extended Thinking Analyze, Apply Concepts, Connect, Prove, Synthesize, Create, Connect	Interpret rate of change as slope.	Given the graph of a line, find the slope.	Using the knowledge of slope, characterize the slopes of parallel and perpendicular lines.

VOCABULARY

	Horizontal Rate of Change Slope Vertical Rise Run	Undefined Slope Positive Slope Negative Slope Zero Slope	Parallel Perpendicular

Common Core State Standards For Mathematics

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

F-LE 1 Distinguish between situations that can be modeled with linear functions [and with exponential functions].

F-LE 1a Prove that linear functions grow by equal differences over equal intervals... over equal intervals.

S-ID 7 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.

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.

Algebra 1
Unit 5: Graphing Lines

Thinking Skill Category	Essential Questions For PreK-12 Mathematics			
	1. How do patterns and functions help us describe data and physical phenomena and solve a variety of problems? 2. How are quantitative relationships represented by numbers? 3. How do geometric relationships and measurements help us to solve problems and make sense of our world? 4. How can collecting, organizing and displaying data help us analyze information and make reasonable predictions and informed decisions?			
	Focus Questions For Unit 5			
	How do you graph a line on the coordinate plane using x and y intercepts?	**How do you graph a line given a point and the slope?**	**How do you graph a line given an equation in slope-intercept form?**	**How do you graph a linear inequality? (In the form y<, y>, y≤ y≥)**
	Content Knowledge Objectives			
Recall Describe, Draw, Identify, Label, Locate, Match, Measure, Evaluate, Compute, Perform, Retrieve	Define x-intercept and y-intercept.	Identify a slope as constant for any given line using prior knowledge.	Define the slope-intercept form of an equation.	Define linear inequality.
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	Describe the relationship between the x-intercept and y-intercept given the line.	Given a point on the coordinate plane, utilize the slope to graph additional points to create the line.	Explain the connection between the slope-intercept form of an equation and the graph of the line for that equation.	Describe the relationship between graphing the equation of a line and a linear inequality.
Strategic Thinking Revise, Assess, Critique, Draw Conclusion, Investigate, Differentiate, Hypothesize, Cite Evidence	Determine the x-intercept and y-intercept given the equation using substitution.	Explain that the line created is unique to the point and slope given.	Graph the line given the slope-intercept form of the equation.	Graph the linear inequality determining whether to use dotted or solid lines.
Extended Thinking Analyze, Apply Concepts, Connect, Prove, Synthesize, Create, Connect	Generate a graph of the line for the given equation using the x-intercept and y-intercept.	Make an inference that every line graphed can be represented by a unique equation.	Generate the specific forms of the equation for the line with parallel and perpendicular slopes	Judge the region to be shaded that shows all solutions for the linear inequality by using a test point.

VOCABULARY				
	x -intercept y-intercept		Slope-intercept form	Dotted line Shaded region Solid line

Common Core State Standards For Mathematics

F-IF.B.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.

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

F-IF.C.7a Graph linear functions and show intercepts.

A-CED.A.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.

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

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.

Algebra 1

Unit 6: Writing Equations of Lines

Thinking Skill Category	**Essential Questions For PreK-12 Mathematics**			
	1. How do patterns and functions help us describe data and physical phenomena and solve a variety of problems? 2. How are quantitative relationships represented by numbers? 3. How do geometric relationships and measurements help us to solve problems and make sense of our world? 4. How can collecting, organizing and displaying data help us analyze information and make reasonable predictions and informed decisions?			
	Focus Questions For Unit 6			
	How do you write the equation of a line in slope-intercept form given a graph?	**How do you write the equation of a line in slope-intercept form given slope and y-intercept, slope and a point, or two points?**	**How do you write an equation in alternative forms, point-slope and standard?**	**How do you write equations of horizontal, vertical, parallel and perpendicular lines?**
	Content Knowledge Objectives			
Recall Describe, Draw, Identify, Label, Locate, Match, Measure, Evaluate, Compute, Perform, Retrieve	Identify the y-intercept from the graph using prior knowledge.	Identify what needs to be found in order to write an equation of the line in slope-intercept form.	Define an equation in point-slope and standard forms.	Identify the special characteristics of horizontal, vertical, parallel and perpendicular lines.
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	Determine the slope from any two points on the line using prior knowledge.	Determine the slope and/or y-intercept from the given information using prior knowledge of the slope formula and/or equation solving.	Given various pieces of information, write the equation of the line in all 3 forms.	Determine the slope and y-intercept of each type of line based upon its individual characteristics.
Strategic Thinking Revise, Assess, Critique, Draw Conclusion, Investigate, Differentiate, Hypothesize, Cite Evidence	Write the equation of the line in slope-intercept form using the y-intercept and the slope.	Write the equation of the line in slope-intercept form.	Given an equation in one form, rewrite it in an alternate form.	Write the equations for horizontal, vertical, parallel and perpendicular lines.
Extended Thinking Analyze, Apply Concepts, Connect, Prove, Synthesize, Create, Connect	Extend the knowledge of writing equations from graphs and graphing linear inequalities to writing the linear inequality given a graph	Apply this knowledge to real world situations.		

VOCABULARY			
		Point-Slope Form Standard Form	

Common Core State Standards For Mathematics

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

F-LE.A.2 Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

S-ID.C.7 Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.

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.

Algebra 1
Unit 7: Systems of Equations

<table>
<tr><th rowspan="3">Thinking Skill Category</th><th colspan="4">Essential Questions For PreK-12 Mathematics</th></tr>
<tr><td colspan="4">1. How do patterns and functions help us describe data and physical phenomena and solve a variety of problems?
2. How are quantitative relationships represented by numbers?
3. How do geometric relationships and measurements help us to solve problems and make sense of our world?
4. How can collecting, organizing and displaying data help us analyze information and make reasonable predictions and informed decisions?</td></tr>
<tr><th colspan="4">Focus Questions For Unit 7</th></tr>
<tr><td></td><td>How do you solve a system of equations by graphing and verify its solution?</td><td>How do you solve a system of equations by substitution and linear combinations?</td><td>How do you use systems of equations in problem solving?</td><td>How do you graph a system of linear inequalities? (In the form y<, y>, y≤ y≥)</td></tr>
<tr><td></td><th colspan="4">Content Knowledge Objectives</th></tr>
<tr><td>Recall
Describe, Draw, Identify, Label, Locate, Match, Measure, Evaluate, Compute, Perform, Retrieve</td><td>Define a system of equations.
Define a solution of a system of equations.</td><td>Describe the equivalence of multiplying or dividing an equation by a constant value.</td><td>Identify the given information in the problem and the question being asked.</td><td>Define system of linear inequalities.</td></tr>
<tr><td>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</td><td>Determine if an ordered pair is a solution of a given system of equations using substitution.</td><td>Determine the method to be used to solve the system of equations (substitution or linear combinations).</td><td>Write equations to represent the given information.</td><td>Graph each linear inequality from the system using prior knowledge.</td></tr>
<tr><td>Strategic Thinking
Revise, Assess, Critique, Draw Conclusion, Investigate, Differentiate, Hypothesize, Cite Evidence</td><td>Graph the lines for each equation in the system on a coordinate plane.</td><td>Apply the method chosen to solve the system of equations.
Identify the solution of the system of equations as an ordered pair.</td><td>Solve the system of equations.</td><td>Shade the region for all solutions for each linear inequality.</td></tr>
<tr><td>Extended Thinking
Analyze, Apply Concepts, Connect, Prove, Synthesize, Create, Connect</td><td>Identify and interpret the point of intersection of the lines as the solution of the system of equations.</td><td>Interpret special cases of solutions as no solution or infinitely many.</td><td>Determine the solution and assess its appropriateness for the question asked.</td><td>Interpret the solution for the system as the intersection of the regions shaded by all linear inequalities of the system.</td></tr>
</table>

VOCABULARY

	System of equations Consistent Inconsistent Dependent	Linear combinations Elimination Substitution	

Common Core State Standards For Mathematics

A-CED.A.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.

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

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

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

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

Mathematical Practices

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

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3. Construct viable arguments and critique the reasoning of others.
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Algebra 1

Unit 8: Linear Regression

Thinking Skill Category	**Essential Questions For PreK-12 Mathematics**		
	1. How do patterns and functions help us describe data and physical phenomena and solve a variety of problems? 2. How are quantitative relationships represented by numbers? 3. How do geometric relationships and measurements help us to solve problems and make sense of our world? 4. How can collecting, organizing and displaying data help us analyze information and make reasonable predictions and informed decisions?		
	Focus Questions For Unit 8		
	How do you create a scatter plot from data?	**How do you write the equation of a line of best fit for a collection of data?**	**How do you apply the line of best fit to real world situations?**
	Content Knowledge Objectives		
Recall Describe, Draw, Identify, Label, Locate, Match, Measure, Evaluate, Compute, Perform, Retrieve	Define a scatter plot.	Define a line of best fit.	Identify the information given in the problem.
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	Create a graph with all axes appropriately labeled and numbered.	Describe the relationship between the data on the scatter plot and a line of best fit that represents it.	Determine the line of best fit and its equation based upon the information given.
Strategic Thinking Revise, Assess, Critique, Draw Conclusion, Investigate, Differentiate, Hypothesize, Cite Evidence	Graph the data to create the scatter plot.	Draw a line of best fit to represent the data.	Use the equation of the line to make requested predictions and interpretations.
Extended Thinking Analyze, Apply Concepts, Connect, Prove, Synthesize, Create, Connect	Judge whether the data has a positive, negative or no correlation.	Write an equation of the line using two points from the line of best fit drawn.	

VOCABULARY			
	Negative correlation No correlation Positive correlation Scatter plot	Line of best fit Causation	Linear regression Prediction Interpolation Extrapolation

Common Core State Standards For Mathematics

S-ID 6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.

S-ID 6a Fit a function to the data; use functions fitted to data to solve problems in the context of the data.

S-ID 6c Fit a linear function for a scatter plot that suggests a linear association.

S-ID 8 Compute (using technology) and interpret the correlation coefficient of a linear fit.

Mathematical Practices

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

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3. Construct viable arguments and critique the reasoning of others.
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8. Look for and express regularity in repeated reasoning.

Algebra 1 Unit 9: Laws of Exponents			
Thinking Skill Category	**Essential Questions For PreK-12 Mathematics**		
	1. How do patterns and functions help us describe data and physical phenomena and solve a variety of problems? 2. How are quantitative relationships represented by numbers? 3. How do geometric relationships and measurements help us to solve problems and make sense of our world? 4. How can collecting, organizing and displaying data help us analyze information and make reasonable predictions and informed decisions?		
	Focus Questions For Unit 10		
	How do you simplify algebraic expressions involving exponents?	**How do you simplify expressions in scientific notation?**	
	Content Knowledge Objectives		
Recall Describe, Draw, Identify, Label, Locate, Match, Measure, Evaluate, Compute, Perform, Retrieve	Calculate the value of a number raised to a power.	Define scientific notation and its uses.	
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	Select the appropriate law of exponents to simplify an expression.	Convert numbers from scientific notation into standard form and the converse.	
Strategic Thinking Revise, Assess, Critique, Draw Conclusion, Investigate, Differentiate, Hypothesize, Cite Evidence	Investigate the meaning of zero and negative exponents.		
Extended Thinking Analyze, Apply Concepts, Connect, Prove, Synthesize, Create, Connect	Apply the concept of the Laws of Exponents to simplify algebraic expressions involving exponents with variable bases.	Apply the concept of exponential laws to simplify expressions in scientific notation.	

VOCABULARY			
	Base Exponent		

Common Core State Standards For Mathematics

A-SSE.A.2 Use the structure of an expression to identify ways to rewrite it.

F-IF.C.8b Use the properties of exponents to interpret expressions for exponential functions

8.EE.A.3 Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other.

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

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.
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Algebra 1

Unit 10: Piecewise Functions

Thinking Skill Category	Essential Questions For PreK-12 Mathematics		
	4. How do patterns and functions help us describe data and physical phenomena and solve a variety of problems? 5. How are quantitative relationships represented by numbers? 6. How do geometric relationships and measurements help us to solve problems and make sense of our world? 4. How can collecting, organizing and displaying data help us analyze information and make reasonable predictions and informed decisions?		
	Focus Questions For Unit 9		
	How do you evaluate a point given a piecewise function?	**How do you write a piecewise function from a graph?**	**How do you graph a piecewise function?**
	Content Knowledge Objectives		
Recall Describe, Draw, Identify, Label, Locate, Match, Measure, Evaluate, Compute, Perform, Retrieve	Define function notation (f(x) - for evaluation only). Define a piecewise function.	Identify the intervals of the graph of a piecewise function.	Identify the number of intervals and their endpoints.
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	Distinguish between the different intervals within a piecewise function. Determine which interval the point to be evaluated lies in.	Write the intervals from the graph using appropriate inequality notation. Write an equation of the line for each interval using two points from that interval.	Graph each interval using prior knowledge of tables of values or slope and y-intercept
Strategic Thinking Revise, Assess, Critique, Draw Conclusion, Investigate, Differentiate, Hypothesize, Cite Evidence	Evaluate the value of the point using the appropriate interval.	Write the piecewise function from the equations found for each interval.	Determine whether the endpoints are open or closed circles for each interval
Extended Thinking Analyze, Apply Concepts, Connect, Prove, Synthesize, Create, Connect	Interpret piecewise functions using stories and graphs.	Judge whether or not the intervals are represented correctly and identify any errors.	

VOCABULARY			
	Function Interval Piecewise function		

Common Core State Standards For Mathematics

F-IF.B.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.

F-IF.B.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes.

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

F-IF.B.7b Graph square root, cube root, and piecewise-defined functions, including step functions and absolute value functions.

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.
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Stamford Public Schools

EXCELLENCE IS THE POINT.

Algebra I Pacing Guide

Algebra 1 Pacing Guide 2015-2016
Concepts and Applications
BOLD activities are **required**.

See Unit Folders in the Public Folders for listed activities and Additional Activities

Applications and problem-solving should be embedded throughout all units.

UNIT Introduction: Integer Operation Review		
Time Frame: 8/31-9/4 Instructional Time: 5 Days		
CCSS Standard	**Key Concepts**	**Lessons/Resources/Activities**
	Review Integer Operations	**Patterns in Signed Numbers** The Magic of Algebra 7-7 Following Math Directions 5-6 Adding Integers 5-7 Subtracting Integers 5-8 Multiplying and Dividing Integers Reviewing the Concepts and Skills of Integers Group Activity 1 Group Activity 2

UNIT 1: Number Properties and Expressions		
Time Frame: 9/8-10/2 Instructional Time: 16 Days		
CCSS Standard	**Key Concepts**	**Lessons/Resources/Activities**
A-SSE.A.1 Interpret expressions that represent a quantity in terms of its context. **A-SSE.A.1a** Interpret parts of an expression, such as terms, factors, and coefficients. **A-SSE.A.1b** Interpret complicated expressions by viewing one or more of their parts as a single entity. ***A-SSE.A.2*** Use the structure of an expression to identify ways to rewrite it. **N-Q 1** Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.	Number Properties Rational Numbers and Absolute Value Order of Operations • Include exponents Combining Like Terms Distributive Property Translating and Evaluating Expressions and Equations	Fill in the Blanks 5-5 Finding Equal Expressions 1-16 The Missing Symbols 1-3 Skills Practice Properties of Numbers 5-4 Using the Number Line Using the Order of Operations II 5-2 Using the Order of Operations 1-2 Skills Practice Order of Operations 5-9 Parentheses, Please 5-2 Using the Order of Operations 1-1 Skills Practice Variables and Expressions **5-14 Matching and Evaluating Expressions** High/Low Finding Expressions **Writing Phrases as Algebraic Expressions I** 5-3 Evaluating Expressions **Algebra Game** 1-4 Skills Practice The Distributive Property **Using the Distributive Property** Compromising Computers 5-13 Simplifying Expressions

N-Q 2 Define appropriate quantities for the purpose of descriptive modeling. **N-Q 3** Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.		

UNIT 2: Linear Equations and Inequalities		
Time Frame: 10/5-11/13 Instructional Time: 28 Days		
CCSS Standard	**Key Concepts**	**Lessons/Resources/Activities**

A-CED 1 (part)
Create equations and inequalities in one variable and use them to solve problems.
 	
A-CED 4
Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. *For example, rearrange Ohm's law V = IR to highlight resistance R.*
 	
A-REI 1
Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.
 	
A-REI 3
Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
	Solving Equations:
	• 1 & 2 Step Equations
	• Multi-Step Equations:
	    ○ Like Terms
	    ○ Distributive Property
	    ○ Variables on Both Sides
	    ○ Word Problems
	
	Formulas:
	• Solving for a given variable
	• Substitution
	
	Solving and Graphing Inequalities using one variable:
	• 1 & 2 Step Inequalities
	• Compound Inequalities
		Solving Equations That Contain Like Terms
		Solving Equations with the Variable on both sides
		Comparing Cab Fares
		NYC Cab Fares
		A Walk-A-Thon
		Pizza Party
		Equations and Inequalities
		Working with Inequalities
		Inequalities in the Real World
		Equations -Translate and Solve. How do owners of Large Estates Spend Their Time?
		Formulas 3-5 Using Formulas for Finding Temperatures
		Formulas – Solving For a Given Variable in a Formula – Literal Equations
		Formulas- The Grass is Greener
		Formulas- What is the Temperature
		Graphing and Combining Inequalities
		Multi-step Inequalities
		One-Step Inequalities
		Solving Multi-step Equations 3-6
		Solving Multi-step Equations 3-7
		Solving Multi-step Equations 3-15
		Solving Multi-step Equations 3-16
		Solving One-step Equations 3-2
		Solving One-step Equations 3-3
		Solving One-step Inequalities by Multiplying and Dividing
		Two-step inequalities
		Solving Linear Equations with Variables on One Side
		Solving Inequalities by Multiplying or Dividing

UNIT 3: Functions		
Time Frame: 11/16-11/25 Instructional Time: 7 Days		
CCSS Standard	**Key Concepts**	**Lessons/Resources/Activities**
F.IF.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationships. **F.I.F.1** Understand that a function from one set (called the domain) to another set (called a range) assigns to each element of the exactly one element of the range. If f is a function and x is an element of its domain then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y=f(x). **F.IF.5** Relate the domain of a function to its graph and where applicable to the quantitative relationship it describes.	Relationships Graphing Relationships(from a situation) Relation Function Table-Graph-Mapping Diagram of relations Domain Range Vertical Line Test Writing functions (y=…)	**Representing Relations I** **Representing Relations II** **Is it a Function?** **Functions Everywhere – Identifying Independent and Dependent Variables** **Function Machines** **Function Applications – Travel Time** **Bottled Water** **Hartford Precipitation** **Celsius and Fahrenheit** **Introduction to Function Notation** Vertical Line Test II LTF-Working with Formulas and Function Notation LTF-Slope – Investigation LTF-Introduction to Function Notation Functions and Function Notation Function Domain and Ranges Evaluating Functions Evaluating Functions II Evaluating Functions- Finding the Values of Functions Domain and Range -Identifying Domain and Range of a Function

UNIT 4: Rate of Change and Slope		
Time Frame: 11/30-1/8 Instructional Time: 23 Days		
CCSS Standard	**Key Concepts**	**Lessons/Resources/Activities**

F-IF 6
Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.
F-LE 1
Distinguish between situations that can be modeled with linear functions [and with exponential functions].
***F-LE 1* a.**
Prove that linear functions grow by equal differences over equal intervals... over equal intervals.
S-ID 7
Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.
	Slope and Rate of Change:
	• Physically investigating slope
	• Rate of Change (ex. d=rt)
	• Interpreting Rate of Change from graphs
	• Visual approach to slope
	
	Finding Slope:
	• Classification of Slope:
	  ○ Positive
	  ○ Negative
	  ○ Zero
	  ○ Undefined
	• Slope from a graph
	• Slope formula
	• Identifying slope as parallel and perpendicular
	• Applications
	
	****1/11-1/15 Midterm Review****
	****1/19-1/22-Midterm Week****
		Measuring Trend and Rise
		What is Slope?
		Calculating and Interpreting Slope
		Rate of Change
		Rate of Change of Objects
		Slope and Rate of Change (using the formula)
		From Graphs to Stories
		Representing Data Using a Graph I
		Motion Graph Scenarios
		More Motion Graphs
		Positive and Negative Slope
		Horizontal and Vertical Lines
		Additional Practice with Horizontal and Vertical Lines
		Classification and Slope of a Graph(Practice A)
		Classification and Slope of a Graph (Practice B)
		Investigating Parallel and Perpendicular Lines
		Parallel and Perpendicular Lines
		
		Extension Activities:
		Magnitude of Slope
		Motion Graph Challenge Problem
		Slope foldable
		Hiking Mount Fiction

UNIT 5: Graphing Lines

Time Frame: 1/25-2/19
Instructional Time: 17 Days

CCSS Standard	Key Concepts	Lessons/Resources/Activities
F-IF.B.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. **F-IF.C.7** Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases. **F-IF.C.7a** Graph linear ……. functions and show intercepts. **A-CED.A.3** Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.	Using x & y-intercepts Given two points Given point and slope From Slope Intercept Form Parallel and Perpendicular slopes from an equation Graphing Linear Inequalities with 2 variables – Limited to y<, y>, y≤, y≥ **Extension - Graphing other inequality forms**	Linear Graphs **Recognizing Linear Functions from Words, Tables, and Graphs** Using a table to determine if a function is linear Finding the Slope of a line Slope 1-4 **Exploring Solutions of Linear Equations** Linear Equations – Finding intercepts **Amusement Park** Standard form of a linear equation **Practice with standard form and slope intercept form** Effects of changing parameters (uses graphing calculator) Graphing a line given a coordinate and a Slope A-G Finding the slope and y-intercept from a graph Slippery Slopes Using the slope and y-intercept to graph a line Practice with slope-intercept form **Applications of slope-intercept form** Parallel and perpendicular slopes given an equation **Parallel and perpendicular lines** Solve for Y **Stained glass window** **Air and water temperature**

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

UNIT 6: Writing Equations of Lines		
Time Frame: 2/22-3/11 Instructional Time: 15 Days		
CCSS Standard	**Key Concepts**	**Lessons/Resources/Activities**
F-BF.A.1 Write a function that describes a relationship between two quantities. **F-LE.A.2** Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table) **S-ID.C.7** Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.	Write Equations in Slope Intercept Form: • Given a graph • Given slope and y-intercept • Given point and slope • Given two points Horizontal and Vertical Lines Applications Parallel given a point and equation in slope intercept form and Perpendicular as an extension Point-Slope Form Standard Form Applications	**5.1 Modeling Linear Relationship** 2-1 Practice Writing Equations Writing Equations in Slope-Intercept Form Given a Graph (classwork) Writing Equations in Slope-Intercept Form Given a Graph (homework) Slope-Intercept Form Given Point and Slope (classwork) Slope-Intercept Form Given Point and Slope (homework) Slope-Intercept Form Given 2 Points (classwork) Slope-Intercept Form Given Point and Slope (homework) What happened when Two Fruit Companies Merged? 5.2 Using Data to Write a Linear Equation Lesson 5.1 Practice A Slope-Intercept Form Lesson 5.1 Practice B Slope-Intercept Form 4-2 Skills Practice Writing Equations in Slope-Intercept Form **Writing Equations Packet** Can We Both Be Right? What's My Line? Kayak Storage Costs The Bicycle Factory Creating Word Problems Renting a Moving Van Walking Rates Charity Walkathons Pledge Plans **Sort Them** Missing Information Part 1 You Choose Delicious Delight 5.5 Write Equations of Parallel and Perpendicular Lines City Streets 4-4 Skills Practice Parallel and Perpendicular Lines

		5.5 Practice A Writing Equations of Parallel and Perpendicular Lines 5.5 Practice B Writing Equations of Parallel and Perpendicular Lines Illustrative Mathematics 5.3 Exploring Equations in Point-Slope Form 4-3 Skills Practice Writing Equations in Point-Slope Form 5.3 Practice A Point-Slope Form 5.3 Practice B Point-Slope Form Point-Slope Form Given A Graph (classwork) Point-Slope Form Given A Graph (homework) Point-Slope Form Given Point and Slope (classwork) Point-Slope Form Given Point and Slope (homework) Point-Slope Form Given 2 Points (classwork) Point-Slope Form Given 2 Points (homework) **Point-Slope Form of an Equation** Practice with Point-Slope Form 5.4 Investigating Graphs of Equations in Standard Form 5.4 Practice A Standard Form Slope-Intercept Form to Standard Form (classwork) Slope-Intercept Form to Standard Form (homework) Standard Form to Slope-Intercept Form (classwork) Standard Form to Slope-Intercept Form (homework) **Practice with Standard Form and Slope-Intercept Form** **More Standard Form** Finding and Using Linear Functions Sort Them #2 Missing Information Part I,II,IV LTF- Write the Equation of the Line- Review' Transforming Linear Forms Writing Equations of Linear Inequalities (classwork) Writing Equations of Linear Inequalities (homework)

UNIT 7: Systems of Equations		
Time Frame: 3/14-4/14 Instructional Time: 18 Days		
CCSS Standard	**Key Concepts**	**Lessons/Resources/Activities**
A-CED.A.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. **A-REI.C.5** Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions. **A-REI.C.6** Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables. **A-REI.D.11** Explain why the *x*-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive	Verifying solutions Solve Systems by: • Graphing • Substitution • Linear Combinations Special Types of Solutions Applications Systems of Linear Inequalities - Limited to y<, y>, y≤, y≥	**Big Apple or Bust** 7-1 Solving Linear Systems by Graphing 4-14 Solving Systems of Equations by Graphing 6-1 Practice Graphing Systems of Equations Solving Systems of Equations by Graphing – Practice B **Phone Plans** **Choosing a Gym** 6-2 Skills Practice Substitution Solving Linear Systems of Equations by Substitution Practice A **Passing on the Gift** Soling Systems by the Substitution Method **Drag Racing** Break Even analysis-Popcorn 6-4 Skills Practice Elimination Using Multiplication 6-3 Skills Practice Elimination using Addition and Subtraction Solving Systems of Equations by Adding or Subtracting-Practice A Solving Systems of Equations by Multiplying First – Practice A Solving Systems of Equations by Multiplying First – Practice B Activity A 7-4 Solving Linear Systems by Multiplying First **Applications of the Elimination Method** Chapter 3.2 Solving Systems of Equations Algebraically **Writing Systems of Equations I** Writing Systems of Equations II

approximations. Include cases where *f*(*x*) and/or *g*(*x*) are linear, polynomial, rational, absolute value, exponential, and logarithmic functions. **A-REI.D.12** Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.		**Solving Word Problems by Writing Systems of Equations** 6-5 Applying Systems of Linear Equations **Systems of Linear Equations Applications** "Killer Board, Dude" **Activity 7-5 Investigating Special Types of Systems** Using Tables and Graphs to Determine the Better Deal **6-6 Skills Practice Systems of Inequalities** **Systems of Linear Inequalities**

UNIT 8: Linear Regression		
Time Frame: 4/15-4/26 Instructional Time: 8 Days		
CCSS Standard	**Key Concepts**	**Lessons/Resources/Activities**
S-ID 6 Represent data on two quantitative variables on a scatter plot, and describe how the variables are related. **S-ID 6.a** Fit a function to the data; use functions fitted to data to solve problems in the context of the data... **S-ID 6.c** Fit a linear function for a scatter plot that suggests a linear association **S-ID 8** Compute (using technology) and interpret the correlation coefficient of a linear fit.	Scatter Plot Line of Best Fit Prediction Extrapolation Interpolation Correlation Causation Applications Integrate Graphing Calculators	5.6 Using a Linear Model 5.7 Collecting and Org. Data Graphing a Scatter Plot The Wave **Bike Weights and Jump...** **Weights and Drug Doses** Model Data from the Int. Population of New London... Milk Prices Population Boom Computer Science Degrees Line of Best Fit-Pract. A&B Healthy Relationships

UNIT - 9: Laws of Exponents		
Time Frame: 4/27-5/9 Instructional Time: 9 Days		
CCSS Standard	**Key Concepts**	**Lessons/Resources/Activities**
A-SSE.A.2 Use the structure of an expression to identify ways to rewrite it. **F-IF.C.8b** Use the properties of exponents to interpret expressions for exponential functions.	Laws of Exponents: • Multiplying • Dividing • Power of a Power Zero and Negative Exponents Scientific Notation Simplifying Expressions in scientific notation • Multiplying • Dividing Applications	8-1 **Investigating Products and Powers.** 8.2 **Investigating Quotients and Powers - Activity A, B, and C.** 8.3 **Exploring Zero and Negative Exponents.** 8.4 Why Are Babies Like Hinges? 8.5 Why Couldn't The Chicken Find Her Egg? **Balloon Baffled** **Exponential Properties Part I** **Exponential Properties Part II** **Scientific Notation** **Scientific Notation - Multiplication and Division** 2-21 Human Body Statistics 2-22 Celestial Facts 7-4 Skills Practice Scientific Notation Solo Success Incredible Irony 7-1 Practice Multiplication Properties of Exponents 7-2 Skills Practice - Division Properties of Exponents 7-2 Practice - Division Properties of Exponents

UNIT 10: Piecewise Functions		
Time Frame: 5/10-5/27 Instructional Time: 14		
CCSS Standard	**Key Concepts**	**Lessons/Resources/Activities**
F-IF.B.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. **F-IF.B.5** Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function* **F-IF.B.6** Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph. **F-IF.C.7b** Graph ……. piecewise-defined functions, including step functions and absolute value functions.	Interpret using stories and graphs Introduction to piecewise and function notation (f(x)=…) Evaluating piecewise functions **Extension: • Writing piecewise functions • Graphing piecewise functions ****Final Review – 5/31-6/3 **Final Week – 6/6-6/10**	Swimming Records **Swimming in a Pool** **Jack's Summer Day!** **Touchdown!** **Leaves!!!** Where to Park Piecewise Functions-Step Functions Piecewise Functions- Garage Rates **Game Day!** **Extension 2.7 Writing and Graphing Piecewise Functions** Piecewise Functions: Copy Prices **Creating Stories** **Bike Tours** **Dog Food** LTF-Piecewise Functions LTF- Applying Piecewise Functions 2.7 Application Lesson Opener 2.7 Piecewise Functions Lesson 2.7 Practice A,B,C 2.7 Re-teaching with Practice Evaluating Piecewise Functions Graphing Piecewise Functions Writing Piecewise Function

Algebra I 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 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	50-65%
5. Homework	10%
6. Alternative Assessments:	25-40%
Projects, Performance Tasks, Class Activities	
Math Notebooks (evidence of student learning, not just copying notes)	
Presentations	

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).

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. Teachers will bubble in the score for each short answer problem on the scan sheet. Data from these exams will be collected by the district. (If teachers have a question about the score to give for a short answer items, they should see members of the committee for clarification.)

Materials for the assessments include:
- calculator,
- ruler,
- graph paper (if requested by student).

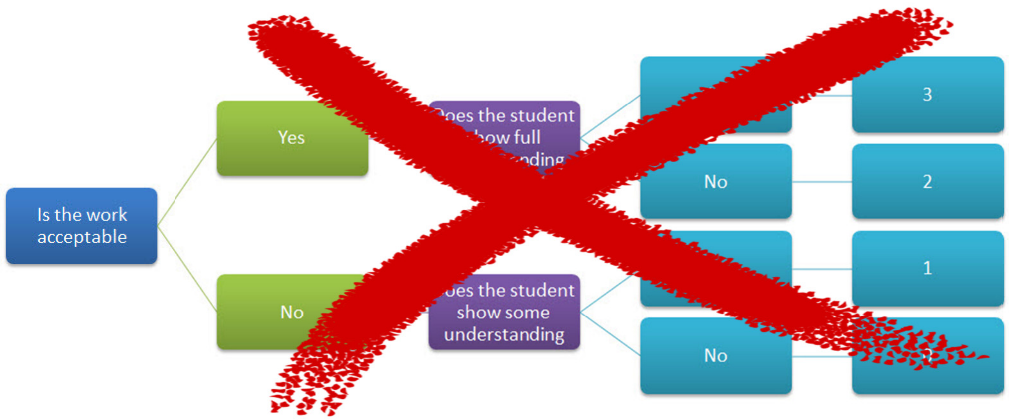
ASSESSMENT RUBRIC UPDATE
2015

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**.

Constructed Response Scoring Chart



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 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.

<u>Possible Math Reflections</u>

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 <u>_(a concept, problem in class, etc)</u> 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.

Stamford Public Schools

EXCELLENCE IS THE POINT.

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:
____

Differentiated Instruction: Ways to Reach a Variety of Math Learners

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.*

FRONT-END SCAFFOLDING	**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.
	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

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 explanations

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.
   - $P = l + l + w + w$
   - 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. **<u>Use a Problem of the Day (Warm-Up/Do Now/etc.)</u>**
   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. **<u>Teach group work expectations and have students reflect on their own participation</u>**
   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. **<u>Exit Slips for individual accountability</u>**
   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. **<u>Use RED, YELLOW, GREEN cups to monitor class needs</u>**
   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. **<u>Keep homework easy to correct</u>**
   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. **<u>Use the interactive white boards</u>**
   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 **<u>not optional</u>**.

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.

Algebra I:
List of Possible Websites

- Algebasics Tutorials
http://www.algebasics.com/
- Algebra Online Balance Scales
http://nlvm.usu.edu/en/nav/frames_asid_201_g_4_t_2.html?open=instructions
- Algebra online
http://teachers.henrico.k12.va.us/math/hcpsalgebra1/
- California State University, Northridge NSF GK-12 Resources
http://www.csun.edu/~mathgs/fermat/resources.htm
- CoboCards (create flash cards)
http://cobocards.com/
- Connecticut State Department of Education – Goals 200
http://www.sde.ct.gov/sde/cwp/view.asp?a=2618&q=321088
- Cut the Knot
http://www.cut-the-knot.org/algebra.shtml
- Balanced Assessments
http://balancedassessment.concord.org/
- Figure THIS!
http://www.figurethis.org/challenges/math_index.htm
- Fly By Math
http://smartskies.nasa.gov/flyby/index.html
- GraphSketch
http://graphsketch.com/
- Inside Mathematics
http://www.insidemathematics.org/index.php/tools-for-teachers/algebra-a-functions
- Learning & Teaching Math
https://sites.google.com/site/mathmaine/home
- Math2.org
http://math2.org/
- Math Central
http://mathcentral.uregina.ca/index.php
- Math Exercises
http://www.emathematics.net/
- Math is Fun - Algebra
http://www.mathsisfun.com/algebra/index.html
- Math Playground
http://www.mathplayground.com/logicgames.html
- Math TV
http://www.mathtv.com/

- NCTM Illuminations

http://illuminations.nctm.org/

- Nick's Math Puzzles

http://www.qbyte.org/puzzles/

- NRich

http://nrich.maths.org/public/monthindex.php?mm=3

- Online Math Learning

http://www.onlinemathlearning.com/algebra-help.html

- Purple Math

http://www.purplemath.com/modules/

- Pythagorean Theorem

http://www.youtube.com/watch?v=hbhh-9edn3c
http://www.youtube.com/watch?v=hTxqdyGjtsA

- SOS Mathematics – Algebra

http://www.sosmath.com/algebra/algebra.html

- Texas A&M Virtual Math Lab

http://www.wtamu.edu/academic/anns/mps/math/mathlab/

- WY Math Project

http://www.nwlincs.org/wyGEDtran/Mathindex.htm

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:

Required & Suggested Activities

How to Use the Activities/Resources Provided

There are activities included in the public folder for classroom use. The activities **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.