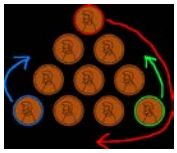
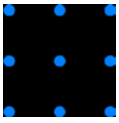
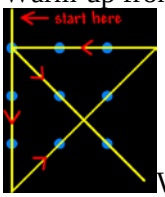
Math Problem Solving (MPSE)
CTY Course Syllabus

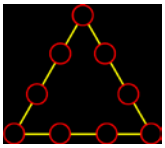
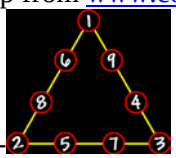
Day	Time	Objectives	Activities
1	AM	1. Create a positive classroom environment. 2. Get baseline data of student knowledge 3. Introduce and practice using the **4 Step Problem Solving** Process.	1. Introduce myself using the personal shield template. Have students create their own to teach us about themselves. 2. Have students' complete written pre-assessment. 3. Review CTY Honor Code, Technology form, general rules and procedures. 4. Introduce students to the concept of problem solving through completing a few introductory problems. Define problem solving as "what you do when you don't know what to do." Create a list of students' ideas on how to solve problems as another informal pre-assessment. Blend these ideas into introducing the 4 steps of the problem solving process: Understand, Devise a Plan, Carry out the Plan, Look Back/Check.
	PM	1. **Draw a diagram** to represent and solve problems 2. Use the **4 Step Problem Solving** process to solve problems.	1. Problem Solving Read Aloud *Math Appeal* by Greg Tang 2. Present the Candy for Sale problem from *The Second Book of Challenging Mathematics Problems that Stretch Students' Thinking* by Gale Waibel and Shari Sternberg and model going through the 4 steps of problem solving and the problem solving form with the students. Then give them the "Pencils for Sale" problem and allow them time to complete the process independently.
	HW		Draw a diagram homework from page 11 of *Creative Problem Solving; Multiple Strategies for the Same Answer* by Cindy Barden and Leslie's problem: Leslie has 25 cents her pocket, but does not have a quarter. How many combinations of coins could she possibly have that sum to 25 cents? **Complete a problem solving form to show your work.**
Day	Time	Objectives	Activities
2	AM	1. Utilize the strategy of **drawing a diagram** to solve problems.	1. Warm-up- logic puzzle: write on the board AEFHIKLMNTVWXYZ BCDGJOPQRSU *Why are some letters above the line while others are below it?* 2. Review of last night's homework- discuss student answers to "Leslie's question" and evaluate the usefulness of the Problem Solving form. 3. Present the Use a Picture Diagram activity on page 11 of *Creative Problem Solving; Multiple Strategies for the Same Answer* by Cindy Barden, to introduce the strategy of drawing diagrams. After modeling this strategy as a whole class have students work in pairs or small groups to solve and then share their results to the East or West to Banana Boulevard?/Karen's Neighborhood (pg. 13) problem, using a problem solving form if necessary. 4. Model drawing a diagram for the "Modern Basketball Association"

			problem on page 14 of *Problem Solving Strategies: Crossing the River with Dogs* by Ken Johnson & Ted Herr. Allow students a chance to brainstorm how they might draw a diagram and then model the strategy used in the book.
	PM	1. Utilize the **4 Step Problem Solving Process** and the strategy of **Draw a Diagram** to solve math problems.	1. Problem Solving Read Aloud- *Math for All Seasons* by Greg Tang. 2. Continue working on practice problems using the draw a diagram strategy from of *Problem Solving Strategies: Crossing the River with Dogs* by Ken Johnson & Ted Herr. 3. Introduce the final projects to be completed by the end of the third week. Projects- ***It's Puzzling*** and ***Games People Play from _____***. 4. Visit the computer lab to explore the problem solving and logic puzzles at www.mathplayground.com and allow students time to begin researching for their final projects.
	HW		**Draw a Picture or Diagram** for "Model Trains" from page 17 of *Problem Solving Strategies: Crossing the River with Dogs* by Ken Johnson & Ted Herr using a problem solving form.
Day	Time	**Objectives**	Activities
3	AM	1. Utilize the **4 Step Problem Solving Process** to solve problems. 2. Introduce the strategy of **Guess and Check** to solve problems.	1. Warm-up logic puzzle; Answer:  *Can you move just three circles and flip this triangle upside down?* From www.coolmath4kids.com 2. Present **Guess and Check** strategy by reviewing page 17 in *Creative Problem Solving; Multiple Strategies for the Same Answer* by Cindy Barden, as a group and then going through the process using the "How Old Are They?" problem on page 18 independently or with partners to practice the strategy. 3. Continue practicing with other **Guess and Check** practice problems including "Bananas, Balloons, and Bluebirds" (pg. 16) and "Pet Show" (pg. 19) from *Creative Problem Solving; Multiple Strategies for the Same Answer* by Cindy Barden.
	PM	1. Utilize the strategy of **Guess and Check** to solve problems.	1. Continue working through **Guess and Check** problems from AM stopping to discuss and compare strategies/answers at the end. 2. Fire Drill 3. Problem Solving Read Aloud- *Sideways Arithmetic From Wayside School* by Louis Sachar and solving the math gram problems as a group.
	HW		Sample *Sideways Arithmetic* problem **she + eel = else;** and **Guess and Check** practice problems.
Day	Time	**Objectives**	**Activities**
4	AM	1. Introduce and utilize the strategy of **making an organized list** to solve problems.	**1.** Warm-up logic puzzle from www.coolmath4kids.com:

			Answer: *Can you move just two toothpicks and create seven squares? Hint-first figure= 5 squares* **2.** Pose this problem: In the cafeteria at (name of site here) they are offering three different main dishes, three types of fruit, and two types of beverages. How many different "meals" (drink, fruit, and main dish) could you get? Discuss some of the possibilities. Then ask "How can we be sure we are getting all of the possibilities?" Brainstorm ways we can make an organized list. **3.** Introduce the concept of making an organized list of possible combinations using page 38 in *Creative Problem solving; Multiple Strategies for the Same Answer* by Cindy Barden, **Make a List.** Continue practicing this strategy including introducing Tree Diagrams as an organized list using pg. 39, "Chess Tournament" and pg. 40 "Out to Lunch."
	PM	**1.** Continue to **make an organized list** to solve problems.	1. Introduce students to the concept of making an organized list of possible outfit combinations. Have students use the worksheet from http://illuminations.nctm.org/LessonDetail.aspx?ID=L180 to color in the possible color combinations for outfits as a way to create an organized list. If an extra challenge is necessary add in another article of clothing. 2. Additional practice with problems that require making an organized list or tree diagrams. 3. Students write their own organized list/tree diagram problems to share with classmates. 4. Problem Solving Read Aloud: *Sideways Arithmetic from Wayside School* by Louis Sachar.
	HW		**Create an Organized list** or **Tree Diagram** practice problems using the Problem Solving form to complete.
Day	Time	**Objectives**	**Activities**
5	AM	1. Continue **making organized lists** to solve problems. 2. Combine the use of **making a list and probability concepts** to solve problems.	1. Warm-up logic puzzle from www.coolmath4kids.com: Number Fun #1, follow these directions: (1)Pick a number between 1 and 10 (including 1 & 10). (2) Multiply your number by 9. (3)Add the digits of the number created in step two. (4) Subtract 5 from the number created in step 3. (5) Find the letter of the alphabet that corresponds to the letter created in step 4. Ex. 1-A, 2-B, 3-C, etc…. (6)Pick a country in Europe that starts with the letter from step 5. (7)Pick an animal that starts with the last letter of your country. (8) Pick a color that starts with the last letter of your animal. (9) Let me guess what you got…..it is an Orange Kangaroo in Denmark? 2. Review and discuss homework from the night before. 3. Computer lab to use computers for research and creation of Final Project puzzles and games.
	PM		1. Introduce the concept of probability or "chance" through the "Match

			or No Match" activity in *50 Problem-Solving Lessons* by Marilyn Burns. 2. Play ***Probability*** Races: Show students a standard 6-sided die. Ask students "If I were to roll it, how likely would it be that I get a 2?" "How do you know?" Collect some data by rolling the die at least 10 times and recording what number it landed on. Then have students use this data to help them pick a number for "Probability Races". For these races students work with a partner and each chooses a different number from 1-6. Create a number line for them to use as their playing board. The teacher rolls the die and if a student's number is rolled they get to advance one place on the number line. Continue play until there is a "winner". After playing have a class discussion about whether it mattered which numbers were picked or not. 3. Complete other problems involving probability and use of tree diagrams to help identify the probability of an event occurring.
	HW		No homework- weekend.
Day	Time	**Objectives**	**Activities**
6	AM	1. Combine the use of **lists** and **basic probability concepts** to solve problems.	1. Warm-up from www.coolmath4kids.com;   Without lifting your pencil can you connect all of the lines with only 4 straight lines? 2. Visit the Computer Lab to work on Final Projects 3. Week one quiz reviewing the concepts of **drawing a diagram**, **making a list**, and **guess and check.**
	PM	**1.** Combine the use of **lists** and **basic probability concepts** to solve problems. **2.** Use patterns and models to solve problems.	1. Problem Solving Read Aloud from *Sideways Arithmetic from Wayside School* by Louis Sachar. 2. **Zone Rotations:** a) Teacher: Read *Anno's Mysterious Multiplying Jar* by Mitusmasa Anno. Make diagrams to illustrate factorials and have students complete practice problems. b) PA- Work on The Handshake Problem- http://dwb4.unl.edu/calculators/activities/middle/shake.html) Have students try to solve it on their own for about 10-15 minutes. Then discuss what they have been trying. Brainstorm ways we can solve it if needed. Discuss each step and various ways to solve the problem. c) Alternate zones: *Cross-Number Puzzles*- Independent cross-word style puzzles that require computation and following directions. *Problem Solving Cards*- card set including a series of cards with various Problem Solving problems on them, individual or partner work. *Logic Puzzles*- Logic puzzles can be independent or partner work, using the process of elimination to solve story problems.

	HW		Complete Factorials Worksheet
Day	Time	**Objectives**	**Activities**
7	AM	1. Use **patterns, diagrams**, and **models/simulation**s to solve a problem. 2. Visit the importance of **communicating mathematical thoughts and processes** through writing and explanation.	1. Warm-up from www.coolmath4kids.com: (1) Pick a number between 1 and 9 (including 1 or 9). (2) Multiply your number by 2. (3) Add 5 to the number you created in step two. (4) Multiply the number you created in step three by 50. (5) If you haven't had your birthday yet this year, add 1761 to the number you created in step four.. If you've had your birthday, add 1762 to that number. (6) Subtract the year you were born (ex: 1995) from the number you created in step five. (7) Let me guess what you got!! (the first digit of the number should be the number you started with and the remaining number is your age!) 2. Review well-written math responses from week 1 quizzes, explaining what is "good, bad, and ugly". Use specific examples and discuss the criteria for each category. 3. Continue with Zones from Day 6, rotating through the three groups until all groups have finished the Handshake Problem, worked on Factorial or organized list practice, and participated in Alternate Zones.
	PM	**1.** Use **patterns, diagrams**, and **models/simulation**s to solve a problem	1. Read and discuss creating a table to show a pattern from *Creative Problem Solving; Multiple Strategies for the Same Answer* by Cindy Barden on pages 33-34. 2. Assign pairs of students one of the "Sequences" listed on page 122 for them to discuss and complete. These pairs then share what the pattern is and what the missing 4 numbers are with the class for discussion. 3. Computer Lab to work on final projects and practice finding the missing number of a sequence online.
	HW		Solve "Missing Country Club Funds" on pg. 29 of *Whoodunit Math Puzzles* by Bill Wise. Complete your work on a problem solving form.
Day	Time	**Objectives**	**Activities**
8	AM	1. Visit the importance of **communicating mathematical thoughts and processes** through writing and explanation. 2. Use **pattern recognition and guess and check** to decipher a code.	1. Warm up from *www.coolmath4kids.com:* Write a math equation using only 4 nines (9) that equals 100. Answer is (9÷9) + 99= 100 2. Further explore how using a table can help to identify a pattern or the next number in a sequence of numbers. 3. Explain the difference between a code and a cipher. Have students provide examples of each using *Top Secret: A Handbook for Codes, Ciphers, and Secret Writing* by Paul B. Janeczko. Explore the Book Code on page 19 and give students time to practice writing their own book codes and exchanging with a partner to decode the messages.
	PM	1. Use **pattern recognition and guess and check** to decipher a code.	1. Problem solving read aloud: "The Case of the Mayor's Red Office" from *Whoodunit Math Puzzles* by Bill Wise 2. Present students with a ciphered sentence (Caesar's Cipher). Discuss strategies we may use to figure it out. Work through deciphering together. Allow students time to practice enciphering and deciphering

			the messages on pages 27-28 of *Top Secret: A Handbook of Codes, Ciphers, and Secret Writing* by Paul B. Janeczko. 3. Collect and redistribute student's coded messages. Students decipher the message they were given and then respond to their classmate's message using the same cipher.
	HW		Continue to decipher messages from class and write a message to the PA or Instructor using Caesar's Cipher.
Day	Time	**Objectives**	**Activities**
9	AM	**1.** Recognize **patterns, diagrams, and models/simulations** to determine ciphers and identify the next number in a sequence.	**1.** Warm-up from www.coolmath4kids.com:  possible solution-  Put the following numbers in the bubbles so that each edge adds up to the same thing: 1, 2, 3, 4, 5, 6, 7, 8, 9 **2.** Explore Rosicrucian, Pig Pen, and The Shadow's Ciphers. Practice enciphering and deciphering messages using these methods. **3.** Break **4.** Learn how to use a Date Shift Cipher and practice using it.
	PM	**1.** Combine the use of **lists** and **tables** as well as **simulations/models** to solve problems. **2.** Use patterns and models to solve problems.	**1.** Continue enciphering and deciphering messages using the Date Shift Cipher from AM **2.** Continue exploring Fibonacci's sequence through the activity "Fibonacci Trains" (http://illuminations.nctm.org/LessonDetail.aspx?ID=L736) and Rabbit simulation maths.slss.ie/resources/Fibonacci%20Number%20worksheet.doc **3.** Explore Fibonacci's Sequence via Problem Solving Read Aloud; *Wild Fibonacci Nature's Secret Code Revealed* by Joy N. Hulme
	HW		Complete Fibonacci's Sequence worksheet http://www.dadsworksheets/com and Pascal's Triangle worksheet to practice patterns.
Day	Time	Objectives	Activities
10	AM	**1.** Investigate and use **patterns as well as lists and diagrams** to solve problems.	**1.** Visit computer lab to work on final projects/puzzles **2.** Complete Mid-session evaluation of students experience at CTY **3.** Read *Sir Cumference and the Legend of Pi* as background knowledge of circles and the ability to use a pattern to solve a problem (in this case repeated trials discover a pattern that leads to the knowledge that Pi helps determine the distance around a circle.
	PM	**1.** Use **number patterns** to	**1.** Use number patterns to create designs within a circle using the

		create a design within a circle. **2.** Create a **table** and use **basic probability** to solve problems.	**Number Spirals** activity on pages 73-75 of *Math Art: Projects and Activities* by Carolyn Ford Brunetto. **2.** Practice using basic probability to solve problems using Problem Solving Cards. **3.** Problem solving Read Aloud- "The Case of the Hit-and-Run Taxi Driver" from *Whoodunit Math Puzzles* by Bill Wise. Use strategy of creating a table to organize the facts and solve the case.
	HW		NONE- Weekend
Day	Time	Objectives	Activities
11	AM	1. Review concepts of **identifying patters and organized lists** to solve problems. 2. Work on Final Projects	**1.** Warm-up: What number comes next in the following pattern? 1, 3, 6, 10, 15, 21, ____ **2.** Week Two Quiz reviewing using patterns and organized lists to solve problems. **3.** Work on Final projects/puzzles
	PM	1. **Make a table** and **use graphs** to solve problems.	**1.** Problem Solving Read Aloud: *The Math Curse* by Jon Sciezka **2.** Review using graphs and tables to solve problems using pages 42-43 of *Creative Problem Solving: Multiple Strategies for the Same Answer* by Cindy Barden. **3.** Practice using tables and graphs to solve problems using "Count the Vowels" on page 44 of *Creative Problem Solving: Multiple Strategies for the Same Answer* by Cindy Barden.
	HW		Complete Number 3 on "Count the Vowels" and "Tulip Bulbs Raise Money for Charity" on pages 44-45 of Creative Problem Solving: Multiple Strategies for the Same Answer by Cindy Barden.
Day	Time	Objectives	Activities
12	AM	**1. Make a table** and **use graphs** to solve problems. **2.** Use **tables** and **eliminating possibilities** or **simplifying a problem** to solve.	**1.** Complete the "Fishy Alibi" from page 35 in *Whoodunit Math Puzzles* by Bill Wise. Have students use the Problem Solving Form to solve and discuss the results. **2.** Review using graphs to solve problems using **"**Who Lives Where?" Page 46 from *Creative Problem Solving: Multiple Strategies for the Same Answer* by Cindy Barden. **3.** Tell students "I am thinking of a number between 1 and 100, can you guess what I'm thinking of?" Begin by having them randomly try to guess (for the sake of demonstration… be sure they don't guess the number right away). After a minute, stop guessing and discuss how we can organize their guesses or find the solution quicker. If an example is needed, ask "What questions could you ask me to narrow down the choices?" (e.g. Is it below 50? Is it prime?) Allow students to develop their own questions to eliminate the possibilities and model the recording of them on the board. Discuss how eliminating possibilities helps us solve problems.
	PM	1. **Make a table** and **use graphs** to solve problems.	1. Next review the strategy of *Simplify* using page 47 of *Creative Problem Solving Multiple Strategies for the Same Answer* by Cindy Barden. Walk students through the steps, discussing the strategy

			along the way. 2. Problem solving Read Aloud: *Math Appeal* and *Math Potatoes* by Greg Tang. Working through problems as reading. 3. Continue practicing the strategy of **Simplify** using practice worksheets/other problems in partners or independently. Rotating through Zones as they work. 4. Work on final projects, early finishers can practice their presentations for Friday's Open House.
	HW		• Worksheet to practice being able simplify the problem and eliminate possibilities along the way. • Work on final project, due in class tomorrow.
Day	Time	Objectives	Activities
13	AM	**1.** Use **logical reasoning** and **simplify** to solve problems.	**1.** Warm-up: Can you find the sum of all of the whole numbers from 1 to 100? Look for a pattern or a way to simplify the problem. **2.** Share Logic Puzzles from last night's homework and work on new logic puzzles together with a partner. **3.** Introduce the strategy of **Use Logical Reasoning** on page 51 of *Creative Problem Solving Multiple Strategies for the Same Answer* by Cindy Barden. Discuss the strategy as you read through the model, solving problems with the students. **4.** Introduce the Embedded Figures lesson by putting the question: How many squares are there on a checker board? (Hint-there are more than 64).
	PM	**1.** Determine students' knowledge and growth. **2.** Allow students time to complete Student Program Evaluations	**1.** Problem Solving Read Aloud: *Go Figure* by Johnny Ball. **2.** Continue looking for patterns to identify embedded figures with lesson from: http://illuminations.nctm.org/LessonDetail.aspx?id=L250 **3.** Allow students time to complete the Student Program Evaluations (SPEs).
	HW		Practice using Logical Reasoning to solve problems by completing a more difficult Logic Puzzle.
Day	Time	Objectives	Activities
14	AM	**1.** Review concepts: **draw a diagram, make an organized list, find a pattern, eliminate possibilities, use logical reasoning, and make a table or graph.**	**1.** Warm-up: Math Gram on the board: TOM + NAG= GOAT **2.** Review all of the concepts covered by practicing problems involving each strategy.
	PM	**1.** Demonstrate understanding of above concepts through Final Assessment.	**1.** Finish reviewing for the Final Assessment by discussing the problems completed before lunch. **2.** Begin the Final Assessment.

	HW		Finalize projects of Math Games and Puzzles to present at Open House tomorrow.
Day	Time	Objectives	Activities
15	AM	**1.** Celebrate and share the new knowledge gained.	**1.** Finish taking the Final Assessment. **2.** Students share/present their final projects (math games/puzzles) using concepts we've been studying.
	PM	**1.** Prepare for Open House	**1.** Problem Solving Read Aloud and Prepare for Open House **2.** Open House
	HW		NONE- Last Day