

MATH PROBLEM SOLVING (MPSE)

CTY Course Syllabus

Day	Time	Objectives	Activities
1	AM	1. Create a positive classroom environment 2. Get a baseline of student knowledge 3. Create the big picture of the course/gather more data on students' prior knowledge 4. Draw a diagram to represent and solve problems	1. Introduce self using Getting to Know the Teacher PowerPoint. Have students interact in a team building activity or ice-breaker. 2. Have students complete written pre-assessment. 3. Introduce students to the concept of problem solving through completing a few introductory problems. Define problem solving: "what to do when you don't know what to do." Complete a list of students' ideas on how to solve problems as another informal pre-assessment. Bridge these ideas into the 4 steps of the problem solving process: Understand, Devise a Plan, Carry out the Plan, Look Back/Check (sample form can be found at the end of this syllabus). 4. Present the basketball problem on pg. 14 of Problem Solving Strategies: Crossing the River with Dogs by: Ken Johnson and Ted Herr to introduce strategy of drawing diagrams. Have students work in pairs and then share results to Model Train (pg. 17) and Alien Invaders (pg. 18) problems. Introduce students to Problem Solving Form (see end of syllabus) and have them complete it.
	PM	5. Use the 4 step process to solve math mystery 6. Introduce and use the Guess and Check Strategy to solve problems	5. Have students solve "The Case of the Questionable Carpet Dealer" on pg. 25 of Whodunit Math Puzzles by Bill Wise. Discuss and share results. Complete Problem Solving Form . 6. Present the Guess and Check strategy using Saturday at the "Five and Dime Garage Sale" problem on pg. 160 of Problem Solving Strategies: Crossing the River with Dogs by: Ken Johnson and Ted Herr. Again, have students pair up and find and present solutions (noting 4 steps) to other problems in the section.
	HW		

Day	Time	Objectives	Activities
2	AM	<p>1. Utilize the strategy of making an organized list to solve problems</p> <p>2. Develop and use basic concepts of probability to solve problems</p>	<p>1. Pose this problem: In the cafeteria at (fill in name of site here) they are offering three different main dishes and four types of beverages. How many different “meals” (drink and main dish) could you get? Discuss some of the possibilities. Then, ask “How can we be sure we are getting all the possibilities?” Brainstorm ways we can make an organized list.</p> <p>Introduce the students to Bobby Lee. Bobby Lee wants more variety in his wardrobe. He has 3 shirts, 2 pairs of pants, and 2 pairs of shoes. How many outfits does he have? Next, have students cut out shirts, pants, and shoes to determine the number of outfits that can made. They may glue the possible outfits on a larger sheet of poster board.</p> <p>(See http://illuminations.nctm.org/LessonDetail.aspx?ID=L180 for example)</p> <p>Re-visit making an organized list after students have physically made the outfits. For an extra challenge, add in another clothing item...how many does he have now? Have students practice strategy of making a list when given The Modern Basketball Association (pg. 32) and Loose Change (pg. 29) problems from Problem Solving Strategies: Crossing the River with Dogs by: Ken Johnson and Ted Herr.</p> <p>2. Show students a standard six-sided die. Ask students that if I were to roll it, how likely would it be that I get a 2? How do they know? How can we describe this? Introduce basic concept of probability (favored event/possibilities). Have students play race game with dice. (Have each student pick a number – can be on a car or horse —see who wins). Play game at least ten times. Then, combine the class data. Did it matter what numbers were picked? Were some better than others? Present several other scenarios using colored cubes, coins, and spinners. Have students complete problem sets associated with each item in pairs and then share results.</p>
	PM	<p>3. Combine the use of lists and probability concepts to solve problems.</p>	<p>3. Solve “The Case of the Carnival Probability Game” from Whodunit Math Puzzles by Bill Wise pg. 5. Complete Problem Solving Form. Discuss results.</p> <p>Revisit the cafeteria problem from earlier in the day. Ask students how likely it would be if all main dishes and beverages were randomly distributed for me to get Main Dish 1 and Beverage 3. How can we figure this out? Brainstorm and Revisit list.</p> <p>Have students complete extensions of outfit problems using probability concepts. For an extra challenge, discuss the probability of randomly getting a double scoop cone with vanilla and chocolate if an ice cream shop has 31 flavors.</p>
	HW		Problem Set 2 (Finding probability, making lists)

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3	AM	<p>1. Use the strategy of drawing a diagram (namely a tree diagram) to solve problems</p> <p>2. Use diagrams, lists, and concepts of probability to solve problems</p>	<p>1. Have students conduct this simulation: You are going to the zoo. You only have time to visit one cage at each of 3 locations (The Australian Outback, the African Savannah, and the Rainforest.) In the Outback, there are 4 cages to observe. In the Savannah there are 6 cages to observe, and in the Rainforest there are 2 cages to observe. How many possible combinations of cages can you visit? Discuss how we solve the problem (Make a list...) Walk through process of creating a tree diagram. Then ask follow-up questions (e.g., How likely is it that you would see monkeys, kangaroos, and alligators?)</p> <p>2. Give groups of students set of problems that could utilize tree diagrams (menus, songs on a CD, etc.)</p>
	PM	<p>3. Investigate and use patterns as well as lists and diagrams to determine orderings (Permutations).</p>	<p>3. Ask students how many different ways we could line up or how many different ways they could rearrange the letters in their names. Discuss strategies we can use to figure the problem out. Try them. Look at making lists and diagrams.</p> <p>Next, read Anno's Mysterious Multiplying Jar by Mitusmasa Anno. Make diagrams to illustrate factorials and have students complete practice problems.</p>
	HW		Problem Set 3 Using Making a List and Diagram Strategies and Probability
4	AM	<p>1. Use patterns and models to recognize and manipulate fractional relationships.</p>	<p>1. Introduce pattern blocks. Have students work through questions at http://math.rice.edu/~Janius/Patterns/. Stop after each section to discuss. Allow students ample time to create their own designs and then analyze the patterns and fractional relationships within.</p> <p>To culminate, have students create a "Quilt of Fourths." Each student can create several squares split into fourths in different ways. See examples at http://www.lucinda.net/surber/graphics0203/fourth_quilts2.jpg.</p>
	PM	<p>2. Use patterns, diagrams, and models/simulations to solve a problem.</p>	<p>2. Present students with "The Handshake Problem." (See 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. Have students get into groups of 2 or 3 and complete their solution and put on large white paper or poster to share. Have each group share their solution.</p>
	HW		Solve "Missing Country Club Funds" on pg. 29 of Whodunit Math Puzzles by Bill Wise. Complete on Problem Solving Form .

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5	AM	1. Revisit 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. Give students several examples of “Good, bad, and ugly” responses and explanations of problems. Have students construct their own good, bad, and ugly responses to a given problem and share results. 2. Explain the different between a code and cipher. Have students provide examples of each. Present students with ciphered sentence (Caesar’s cipher). Discuss strategies we may use to figure it out. Work through deciphering together. Have students develop their own Caesar cipher paragraph (to be traded later).
	PM	3. Continue work with codes.	3. Trade and decipher paragraphs. Share interesting observations. * If students finish early/aren’t challenged have Mastermind tournament and have students present their strategies when breaking the code. Available online at http://www.irt.org/games/js/mind/
	HW		Problem Set 4 (Review of strategies/problems from the week)
6	AM	1. Use pattern recognition and guess and check to decipher codes. 2. Use pattern recognition to develop strategies in playing a game.	1. Solve “Coded Calculator Clue” in Whodunit Math Puzzles by Bill Wise pg.79. Complete Problem Solving Form . 2. Introduce The Factor Game with age problem. (Today Jamie is 12 years old. Jamie has three younger cousins: Cam, Emilio and Ester. They are 2, 3, and 8 years old respectively...) Play factor game and discuss strategies. Discuss the use of patterns in factors to solve problems such as the one posed at the beginning of class. See the website following for details: http://www-tc.pbs.org/teachers/mathline/lessonplans/pdf/msmp/factor.pdf
	PM	3. Understand how letters or symbols can represent numbers and extend this concept to develop own code. (Introduce Translation Project)	3. Introduce students to the concept of representing numbers with variables. Complete lesson at http://illuminations.nctm.org/LessonDetail.aspx?ID=L291 including extension. Introduce students to the “Lost in Translation Project” in which students will be deciphering a code and then either creating their own or exploring the one given in greater depth. Students will also need to explain how the mathematics of their code as well as create a story about the people or beings that use their code. (Example: ** could represent A while **** could be B, etc.) This will be put on a poster to be displayed at the end of the session.
	HW		Complete the Lost in Translation Project Proposal (What are the student’s ideas for a code, beings, poster layout?)

Day	Time	Objectives	Activities
7	AM	<p>1. Utilize pattern recognition and factor concepts to solve problem</p> <p>2. Introduce and/or review concepts related to algebraic pattern recognition</p> <p>3. Investigate the use of patterns and making a table to examine chairs around a table</p>	<p>1. Complete “Fishy Alibi” from pg. 35 in <i>Whodunit Math Puzzles</i> by Bill Wise. Discuss results. Complete Problem Solving Form.</p> <p>2. Go to http://www.mathlibs.com/ in computer lab if possible. Have students work through the lesson on patterns with instructor as guide.</p> <p>3. Introduce the problem of determining the number of chairs needed in a restaurant given the number of tables. Complete Chairs Around the Table Lesson from http://illuminations.nctm.org/LessonDetail.aspx?id=L627</p>
	PM	<p>4. Utilize tables, pattern recognition, and solving a simpler problem first to solve problems and work to generalize them</p>	<p>4. Pose the problem of counting the squares on a checkerboard. Brainstorm strategies we could use to figure the problem. Discuss the different ways squares can be made. Complete the rest of the lesson as outlined at http://illuminations.nctm.org/LessonDetail.aspx?id=L250 . If students want more of challenge continue lesson with Counting Rectangles and Counting Equilateral Triangles.</p>
	HW		<p>Problem Set 5 (Recognizing Patterns from <i>Problem Solving Strategies: Crossing the River with Dogs</i> by: Ken Johnson and Ted Herr.)/Work on Projects</p>
8	AM	<p>1. Systematically determine the number of primes between zero and 100 using pattern recognition.</p> <p>2. Use the concepts of recognizing primes and patterns to solve problem.</p>	<p>1. Introduce students to the concept of prime and composite numbers. Discuss what is different between 4 and 7, 16 and 17, etc. Pose the problem of finding all the prime numbers between 1 and 100. Discuss strategies. Complete Sieve of Eratosthenes (See http://en.wikipedia.org/wiki/Sieve_of_Eratosthenes).</p> <p>2. Solve “Predictable Burglar” on pg. 73 in in <i>Whodunit Math Puzzles</i> by Bill Wise. Discuss results. Complete Problem Solving Form.</p>
	PM	<p>3. Utilize tables, pattern recognition, and solving a simpler problem first to solve problems and work to generalize them</p>	<p>3. Pass out paper Cuisenaire rods (or real). Tell students that they are representing train cars. Pose this problem: build all the trains of length 1, 2, 3, 4, 5, and 6 using only cars of length one and/or two. Complete lesson as outlined at http://illuminations.nctm.org/LessonDetail.aspx?id=L736. Complete extensions if student interest/growth allows.</p>
	HW		<p>Problem Set 6 (From Patterns and Guess and Check section of <i>Problem Solving Strategies: Crossing the River with Dogs</i> by: Ken Johnson and Ted Herr)</p>

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9	AM	1. Utilize tables, pattern recognition, and solving a simpler problem first to solve problems and work to generalize them	1. Pose introductory problem to students: Every Saturday you play basketball in the local community youth club. At the end of the season after a club tournament, the players in the club meet at a fast-food restaurant for a party. If hamburgers cost 59 cents, what is the total cost for 15 players to have a hamburger each? Discuss multiple ways to approach the problem and the solution. Note that there is one basic solution. Pose the following problem as a twist: Every Saturday you play basketball in the local community youth club. At the end of the season after a club tournament, the players in the club meet at a fast-food restaurant for a party. If hamburgers cost 59 cents, find a way to determine the total cost of hamburgers when various numbers of players in the club each have a hamburger. Note the differences between this problem and the previous. Discuss ways we could demonstrate a solution.(table, list, etc.) Proceed to bridging to algebraic symbols with subsequent problems. See http://illuminations.nctm.org/LessonDetail.aspx?id=L247 for rest of problems. Work through as far as students can be stretched (probably just with linear relationships.)
	PM	2. Utilize tables, pattern recognition, and solving a simpler problem first to solve problems and work to generalize them	2. Work on Lost in Translation project
	HW		Work on Project (Final project due tomorrow.)
10	AM	1. Use tables and eliminating possibilities to solve problems	<p>1. Tell students that I am thinking of a number between 1 and 100. 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 possibilities and model the recording of them on the board. Discuss how eliminating possibilities helps to solve problems.</p> <p>Next, work through "Three Brothers Go A-Courtin' from pg. 51 in Problem Solving Strategies: Crossing the River with Dogs by: Ken Johnson and Ted Herr. Note the idea of listing or diagramming ALL possibilities and then eliminating from there.</p> <p>In pairs, have students solve and share "Penny's Dimes" on pg. 52 of Problem Solving Strategies: Crossing the River with Dogs. Have them complete the Problem Solving Form. Discuss results.</p>

Day	Time	Objectives	Activities
	PM	2. Utilize the strategy of eliminating possibilities to solve problems	2. Read selections of <i>Sideways Arithmetic from Wayside School</i> by Louis Sachar. Solve $TOM + NAG = GOAT$ and various problems. Discuss how eliminating possibilities applies. Next, Introduce students (who need introduction) to Sudoku. Demonstrate as needed how to play. Allow students time to play on their own. Discuss how eliminating possibilities comes into play. Have a tournament or challenge to complete puzzles in the quickest amount of time, etc.
	HW		Problem Set 7
11	AM	1. Review Strategies learned throughout session	1. Present class project of compiling MPSE Puzzler book. Each student will submit at least 1 problem (and its solution). Students may type problems or neatly write them. All problems will be compiled in to Class Book. Students can decide on a cover and propose a title as a contest or in a "title team" and "cover team"
	PM		Continue to work on Puzzles
	HW		Problem Set 8 (Mixed Review)
12	AM	1. Use a diagrams to solve problems 2. Use the strategy of guess and check and a diagram to investigate the Konigsberg bridge classroom	1. Warm-up class with diagrams by solving "Where's the Fire?" and "Find the Fastest Way" from <i>Math Problem-Solving Brain Teasers</i> by Sylvia J. Connelly. Discuss strategies for working through them. 2. Introduce students to the Konigsberg Bridge Problem and network terminology. Have students complete figures at bottom of pg. 23 of <i>Math Problem-Solving Brain Teasers</i> by Sylvia J. Connelly.
	PM		Continue work with Networks
	HW		Have students design their own "Map" or "Network" Problem
13	AM	1. Explore patterns in Power Cards (binary numbers)	1. Tell students that I possess the power to read minds and demonstrate using power cards. Then, split students into groups to examine patterns within each card. Why does it work? See lesson details at http://illuminations.nctm.org/LessonDetail.aspx?id=L245
	PM	2. Utilize multiple strategies to solve problems	2. Read <i>Math Curse</i> by Jon Scieszka and Lane Smith and solve problems as we go through.
	HW		Problem Set 9 (Mixed Review)

Day	Time	Objectives	Activities
14	AM	1. Determine students' knowledge growth 2. Allow students time to complete Student Program Evaluations (SPEs)	1. Have Students complete post-assessment 2. Allow students time to complete Student Program Evaluations (SPEs)
	PM	3. Have students put finishing touches on projects	3. Work on projects
	HW		Put finishing touches on projects.
15	AM	1. Celebrate and share the new knowledge gained	1. Students will share their final projects
	PM	2. Prepare for Open House	2. Open House
	HW		NONE