INDE Syllabus

WHEN	WHAT (skills, goals, knowledge, concepts, readings)	HOW (activities)
DAY 1	"Recursive Formulas"	
Morning	1. Introductions, rules, honor code 2. Pre-assessment Test 3. Cake cutting problem	1. Names & other info about selves, rules & expectations discussion, sign honor code, etc. 2. Pre-Assessment Test 3. Students work on this as they finish the Pre-Assessment 6. Students find recursive formula
Afternoon	1. Number Devil (ND) Ch. 1 - fractions, 11x11=121 pattern 2. Intro to recursive formulas 3. Revisit Cake cutting problem 4. Make recursive formulas 5. Recursive Formulas Assignment 6. Daily letter	1. Instructor reads and discusses. Students do $(11,111,111,111)^2$ 2. Lecture 3. Work as a class to find the pattern & recursive formula 4. Students make own sequences & trade papers to write the recursive formulas for the sequences 5. Students work in pairs to complete Recursive Formulas Assignment worksheet 6. Students write short letter to instructor & TA
Supplement	1. Polygon Corners 2. Nim 3. Coin-weighing problems	1. For whole class, in pairs, or groups 2. For whole class initially, then in pairs 3. Give to students who finish assignments before you want to collect them from the whole class
DAY 2	"Inductive Reasoning, Explicit Formulas, and Figurate Numbers"	
Morning	1. Finish Recursive Formula Assignment 2. Intro to Inductive Reasoning 3. Thought Question #1 4. Discuss Thought Question 5. Intro to explicit formulas 6. Crisscross cubes activity – practice finding formulas	1. Students work in small groups 2. Lecture and discuss, get student examples 3. Students work individually to write their answer to Thought Question #1. 4. Students take turns expression their opinions about Thought Question 5. Lecture (through example 3) 6. Distribute cubes. Students may work individually or with someone sitting next to them.
Afternoon	1. ND Ch. 2 - Roman numbers, 0, bases and exponents 2. Finish crisscross cubes 3. Triangular numbers, sum of integers formula, & square numbers 4. Thought Question #2 5. Explicit Formulas Assignment	1. Instructor reads and discusses. 2. Same as above 3. Lecture mixed with student problem-solving and explanations. 4. Students work individually to write their answer to Thought Question #2. 5. Students start out working individually, then move to groups.

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	6. Daily Letter	6. Students write a short letter to Instructor & TA
Supplement	1. Penny problem	1. For whole class (in pairs) or individual early finishers.
DAY 3	"Deductive Reasoning"	
Morning	1. Circular Numbers Thought Question discussion 2. Intro to deductive reasoning. 3. Census-Taker Problems 4. Introduction to Venn Diagrams	1. Each student explains or reads his/her answer to thought question, followed by general discussion and instructor commentary. 2. Lecture – read through census-taker problems first, observe why they do not use inductive reasoning. 3. Students work individually or with someone sitting next to them, focusing on solving the problems. 4. Venn diagram of writing, science, math; students put themselves into the diagram by what they like to do. Then students work in groups on Venn Diagram worksheet(s).
Afternoon	1. ND Ch. 3 - Prime numbers 2. Distinguish between Inductive & Deductive Arguments 3. Intro to Syllogisms, part 1 (parts of a syllogism) 4. Intro to Syllogisms, part 2 (distinguish between true/false and valid/invalid) 5. Identify valid/invalid syllogisms 6. Thought Q – Bad day 7. Nim 8. Daily letter	1. Instructor reads and discusses 2. Game with whole class, lead by Instructor 3. Short lecture, then Syllogistically Speaking worksheet, followed by short discussion of answers (lead by TA). 4. Whole class lecture followed by whole class activity using True/False, Valid/Invalid worksheet (lead by TA). 5. Whole class activity – students determine valid/invalid syllogisms using "thumbs up or thumbs down" and discuss (lead by TA). 6. Students write answers quietly –discuss next day. 7. For whole class initially, then in pairs. 8. Students write short letter to instructor & TA
Supplement	1. Venn diagrams	1. Students solve *Get It Together* p. 83-87 problems in groups.
DAY 4	"Truth, Validity, Soundness"	

WHEN	WHAT (skills, goals, knowledge, concepts, readings)	HOW (activities)
Morning	1. Discuss thought question 2. Review validity 3. Truth, validity, and soundness 4. Soundness 5. Intro to using premises to reach a valid conclusion 6. Review syllogisms 7. Identify valid/invalid arguments based on given premises	1. Each student explains or reads his/her answer to thought question, followed by general discussion and instructor commentary. 2. Watch short video on YouTube by "Wireless Philosophy" titled, "CRITICAL THINKING – Fundamentals: Validity." 3. Go over front page of packet, using colored pencils to color code the different terms of the argument & then use colors to make Venn Diagrams of the argument. Read over rest of handout and discuss. Students complete Truth, Validity, Soundness worksheet individually; students are picked randomly to write answers on board, short whole class discussion about any disagreements. 4. Watch short video on YouTube by "Wireless Philosophy" titled, "CRITICAL THINKING – Fundamentals: Soundness." Students write their own sound arguments, 3 students randomly chosen to read out loud. 5. Instructor leads chart height problem – students assigned characters, use clues to put characters in order. 6. Students complete page 104 of syllogisms worksheet individually, discuss in pairs when finished 7. MARE Logic Problems – students complete #1 individually, whole class reads answers out loud together, then students work together for the rest of the problems
Afternoon	1. ND Ch. 4 - 0.99...=1, sqrt 2, rational/irrational #s 2. Lady/Tiger problems 3. Thought Question – Levels of Proof 4. Practice chart logic problem solving 5. Daily letter	1. Instructor reads and discusses 2. Students work individually or with someone sitting next to them. 3. Students write answers quietly – discuss tomorrow. 4. Students work individually or in pairs on chart logic problem packet 5. Students write short letter to instructor & TA
Supplement	1. Dames for Delphi & Frieda's Fiancé	1. For individuals or whole class. Solution to Dames for Delphi is a good example to hand out to class. Might have students critique each other's explanations.
DAY 5	"Proofs"	

WHEN	WHAT (skills, goals, knowledge, concepts, readings)	HOW (activities)
Morning	1. Thought Question Discussion 2. Parts of a Circle & Using a Protractor 3. Circle Discovery	1. Whole class discussion on level of proof. 2. Mini-lecture to set up for next activity 3. Students follow directions and work through the guided worksheet to discover some properties of circles.
Afternoon	1. ND Ch. 5 - triangular & square numbers (review) 2. Circle Discovery 3. Daily letter	1. Instructor reads and discusses. 2. Students finish Circle Discovery worksheets. 3. Students write short letter to instructor & TA
Supplement	1. Dames for Delphi & Frieda's Fiancé 2. Syllogism handout p. 104	1. For individuals or whole class. Solution to Dames for Delphi is a good example to hand out to class. Might have students critique each other's explanations. 2. Use for whole class, or for students who would like/need more practice with syllogisms.
DAY 6	"Proofs (cont.) & Limits and Fibonacci Numbers"	
Morning	1. Intro to proofs 2. Flow Chart Proofs 3. Intro to graphical proofs. 4. Graphical proof of Pythagorean Theorem 5. Practice graphical proofs	1. Discuss the definition of proof, what is required, and how to organize their thoughts. 2. Use a silly story as example of how to organize neatly and in order. Go over the first example with whole class & then everyone works individually 3. Challenge students to prove graphically that the area of triangle is ½ b*h; one or two students present. 4. Explore the Pythagorean Theorem using graph paper and ruler. Then give Graphical Proof of Pythagorean Theorem lecture. 5. Students work individually on Graphical Proofs assignment.
Afternoon	1. ND Ch. 6 - Fibonacci #s 2. Intro to limits 3. Limit of a regular polygon as number of sides approaches ∞ 4. Fibonacci Numbers & their connection to the Golden Ratio 5. Proof that $1/2 + 1/3 + \ldots \rightarrow \infty$; discuss "converge" & "diverge." 6. Worm Problems	1. Instructor reads and discusses 2. Lecture, led by TA 3. Lecture, led by TA 4. Lecture, led by TA. (Short activity – students work together to measure the angles between placement of leaves on a stem and watch a short video on that some topic) 5. Finish graphical proofs assignment. demonstrate, students try on their own examples. 6. Students work individually.
Supplement	1. Worm on rubber rope	1. Use with whole class. Challenging – give hints.
DAY 7	"Symbolic Logic"	

WHEN	WHAT (skills, goals, knowledge, concepts, readings)	HOW (activities)
Morning	1. Intro to symbolic logic: not, and, or, if-then, if and only if, truth tables 2. Practice converting between English and symbols	1. Symbolic logic lecture, broken into parts (part 1: not, and, or; part 2: if-then & if and only if; part 3: compound) with mini-games in-between where students have to figure out if a sentence is a statement or not, whether a statement is true or not, etc. using the "Evaluating Propositions" worksheet. 2. Students work on symbolic logic worksheets then review together
Afternoon	1. ND Ch. 7 - Pascal's triangle 2. Observe sequences in Pascal's triangle 3. Truth tables group activity 4. Mid-Course Self-Evaluations	1. Instructor reads and discusses 2. Pascal's triangle patterns lecture/demonstration and Pascal's triangle coloring activity 3. In groups, students make truth tables on the floor out of squares of construction paper; students copy solutions onto their own papers. 4. Students write self-evaluations covering the aspects of performance listed on the board.
Supplement	1. More time building truth tables 2. Carpool Logic Problems	1. This activity can go on indefinitely 2. For whole class or individuals
DAY 8	"Symbolic Arguments and Paradoxes"	
Morning	1. Revisit proofs (0.9999… = 1) 2. Introduction to contrapositive 3. Symbolic Arguments	1. Watch a video on YouTube by "Vihart" titled "9.9999… reasons why 0.9999… = 1). Students write responses afterwards. Short discussion follows. 2. Worksheet with lecture/explanation 3. Worksheets and activities
Afternoon	1. ND Ch. 8 - factorials, combinations 2. Analyzing Paradoxes 3. Begin painted cube project	1. Instructor reads and discusses 2. Read together, make sure students understand. Then students work individually or in small groups. 3. Explain project. Students have time to work on project individually.
Supplement	1. Analyzing arguments in truth tables group activity (day 7) 2. MARE logic problems part 2	1. Students work in groups, using truth table tiles to analyze arguments 2. For individuals or whole class in small groups.
DAY 9	"Reasoning Fallacies"	
Morning	1. Contrapositive Review 2. Intro to Fallacies 3. Intro to formal fallacies	1. Mini-lecture about the contrapositive 2. Students watch several different T.V. commercials that have obvious logical fallacies. 3. Lecture
Afternoon	1. ND Ch. 9 - infinities 2. Informal fallacies 3. Fallacy skits	1. TA reads and discusses 2. Short lecture and a video analyzing a politicians speech to point out his logical

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	4. Painted Cube project (cont.)	fallacies. Students also pointed out the fallacies in the commercials watched earlier. 3. Pairs of students write short skits. Act out, audience guess which fallacy is being enacted. 4. Students work individually on their own projects.
Supplement	1. "Number Patterns" from *Get It Together* (p. 132)	1. Students work in groups to solve problems. A review of many of the sequences already presented.
DAY 10	"Number Theory"	
Morning	1. Introduction to Number Theory	1. Students split into two groups between TA or Instructor. Instructor's group works on modular arithmetic and how it can be applied to certain games. TA's group goes a little more in-depth and covers a couple of classic theorems.
Afternoon	1. ND Ch. 10 - geometry stuff 2. Finish Painted Cube project 3. Daily Letter	1. Instructor reads and discusses 2. Students put the finishing touches on their projects. 3. Students write a short letter to Instructor and TA.
Supplement	1. Perplexing paths	1. For individuals or whole class.
DAY 11	"Abductive Reasoning"	
Morning	1. Intro to abductive reasoning 2. Blocker game 3. Review Light-switching problem 4. "Mysteries" from *Get It Together* (p. 94)	1. Lecture, students generate examples 2. Students pair up, play game, figure out general strategy, explain why strategy works. 3. Have students who reached the complete solution explain. Use as example of abductive reasoning. 4. Students work in groups to solve problems.
Afternoon	1. ND Ch. 11 - combinatorics 2. Sticky gum problems 3. Debates 4. Thinking about reasoning worksheet 5. Daily letter	1. TA reads and discusses 2. Students work individually 3. Instructor/TA chooses two volunteers and assigns topic and sides. Students debate. After debate audience gives constructive feedback on fallacies used and overall poise, debating styles, etc. 4. Students work individually on #7 & 8 – discuss now or next day 5. Students write short letter to instructor & TA
Supplement	1. Modular arithmetic activity	1. Students work in pairs to solve problems.
DAY 12	"Tower of Hanoi"	

WHEN	WHAT (skills, goals, knowledge, concepts, readings)	HOW (activities)
Morning	1. Thinking about Reasoning 2. Discuss reasoning worksheet 3. Tower of Hanoi	1. Students respond to #9 & 10 individually 2. Instructor leads discussion, all students asked to participate. 3. Students play game and find the formulas individually. Students work on Truth Tellers and Liars before they have had a chance to use the tower manipulatives and after they have found the formulas.
Afternoon	1. *The Cat in Numberland* 2. Debates 3. Analyzing Arguments 4. Daily letter	1. Instructor reads & discusses. 2. As in day 11. 3. Students work in pairs on the first page. 4. Students write a short letter to instructor & TA.
Supplement	1. Truth Tellers and Liars	1. For whole class or individuals.
DAY 13	"Game Theory and Infinity"	
Morning	1. Finish Analyzing Arguments 2. Review analyzing arguments 3. Paper-Scissors Game 4. Prisoner's Dilemma, Tragedy of the Commons	1. Students complete the second page individually. 2. Students present their responses. 3. Write rules on board, students copy into notebooks. Play in various pairs. Students report on scores, ways games went. Discuss implications. 4. Lecture
Afternoon	1. *The Cat in Numberland* part 2 2. Discussion of uncountable infinity 3. Thought Question – Game theory and tragedy of the commons 4. Having fun using reasoning	1. Instructor reads and discusses. 2. Lecture 3. Students write answers down individually. 4. Students, Instructor, TA, & RAs all play the board game "Clue."
Late Afternoon/ Homework	1. Thought Question – Game Theory and tragedy of the commons 2. Daily letter	1. Students write individually (discuss next day) 2. Students write short letter to instructor & TA, including anything they are particularly proud of and want mentioned in their evaluations
Supplement	1. Any activity not previously used or completed.	
DAY 14	"Reasoning Outside the Box"	
Morning	1. SPEs 2. Post-Assessment 3. Reasoning Outside the Box activities and unfinished work	1. Another TA proctors. 2. Students work individually & silently. 3. Students work individually or in small groups, potentially of their own choosing
Afternoon	1. ND Ch. 12 2. Thank you letter to parents 2. Last daily letter	1. Class takes turns reading the pages from the book. 2. Students write a thank you letter to their

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	3. Choice of activities	parents for helping them come to CTY. 3. Students write a short letter to instructor & TA. 4. Students are given the choice of playing "Set" or "Clue" or working on the Tower of Hanoi.
Late Afternoon/ Homework	1. Finish loose ends from the week. 2. Daily letter	1. Pass back/review any assignments not already returned, students have time to finish unfinished assignments. 2. Students write short letter to instructor & TA
Supplement	1. Any activity not previously used or completed.	
DAY 15	"Closure"	
Morning	1. Is math discovered or created? 2. Choice of activities 3. Reading list/Return work	1. Open discussion 2. Students are given the choice of playing "Set" or "Clue" or working on the Tower of Hanoi. 3. Final words and good-byes.