California State University, San Bernardino

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Math 3100 - Mathematical Thinking: Communication and Proof - Week 1 Outline

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<u>Note</u>: The section, page, problem, and "Progress Check" numbers mentioned below are from the book *Mathematical Reasoning: Writing and Proof* by Ted Sundstrom (available at https://scholarworks.gvsu.edu/cgi/viewcontent.cgi?article=1009&context=books

Day 1

1. Course introduction and brief overview of syllabus

2. Warm-up: Is 0 even, odd, both, or neither? (collect individual student responses)

3. Task*: (Groundwork for importance of definition and use of academic language*)
    Work individually to create a definition of an even integer.
    Compare with at least one other student, followed by whole class discussion.

    Anticipated student responses (*instructor can propose some of these for discussion if no student does*)

    i. A number that ends in 0, 2, 4, 6, or 8 (skip count by 2's)

        Questions to consider: Is this generalizable? How do you know this works for any "even" number? Is number 3.24 even? What about negative integers?

    ii. A number that is divisible by 2; a number that 2 divides evenly

        Questions to consider: Are the terms "even" and "evenly" related? What do we mean by "evenly"? What do we mean by "divisible"? Is any real number divisible by 2?

    iii. A multiple of 2

        Questions to consider: In what number system (integers, rational, real)? What is the difference between the terms 'multiple' and 'factor'?

    iv. Any number that can be written in the form $2k$, where k is an integer.

        Question to consider: What are the advantages to this definition over the

others? Does this definition include the ideas in the other definitions?

4. Revisit the original question using your 'definition'. How would you answer the question with each definition in mind?

5. Other questions to consider:

   a. How would you define what it means for a number to be odd?

   b. What do you notice about the sum of two even numbers? What conjecture can you make? How would you prove your conjecture? (*Discussion regarding the difference between empirical evidence as a convincing argument vs. a formal proof for a universal statement.*)

   c. What other conjectures can you make regarding the sum or product of even/odd integers? Determine if your conjecture is true or false. If true (based on empirical evidence), try to write a formal proof of the conjecture using the generalized definitions of an even and odd integer. If the conjecture is false, justify. (*Discussion of what constitutes appropriate justification for a true universal statement and a false universal statement.*)

6. <u>Homework</u>: ***Read*** Section 1.1, pages 1-5 (up to "Conditional Statements"). ***Write*** responses to Progress Check 1.1 and Progress Check 1.2. ***Reflect***: Include one new idea that you learned through the reading; What questions do you have? Bring at least one question to the next class meeting.

Day 2

1. Share out questions from end of Day 1.

2. Task 1
   a. In small groups, discuss Section 1.1, Progress Check 1.1 concerning statements. Teams to come to a group decision.
   b. Whole class debrief – select groups to explain their responses
   c. Formative Assessment: Ensure students understand what a statement is.

3. Task 2
   a. In small groups, discuss Progress Check 1.2 concerning the validity of a statement. Teams to come to a group decision.
   b. Whole class debrief – select groups to explain their responses
   c. Formative Assessment: Ensure students understand what it means for a mathematical statement to be true or false.

4. Discuss conditional statements
   a. Introduce conditional statements - Write on the board: 'If a student earns more than 90% of the points, then the student will earn an A."

      Under what conditions is this statement false? That is, when would this statement be considered a lie?
      (Instructor may use another example other than 1.3 from the text)

   b. Task: Students work in groups to discuss Progress Check 1.4 followed by whole class debrief.

   c. Task: Students work in groups to discuss Progress Check 1.5 followed by whole class debrief.

5. Discuss closure concept - Assign one of the prompts from Progress Check 1.7 as an "exit card". Instructor to collect and review responses for a short debrief at the start of the next class and then use the other parts of the Progress Check as formative assessment.

6. Homework: ***Read*** Section 1.1, pages 6-11. ***Write*** responses to Exercises #1, 2, 3, 6, and 9, and LaTeX Assignment #1. ***Reflect***: Include one new idea that you learned through the reading; What questions do you have? Bring at least one question.