Cover Sheet for Activity*

Title: Calculus 1 Ethical Reasoning Questions with Solutions and Comments

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Course(s) and textbook(s) (or other info to contextualize the course and activity): Calculus I

Type/Size of Institution(s): tested at small liberal arts college, but should be applicable to all settings where calculus is taught

Class Size(s): tested with class sizes of 10-25, but should be applicable to all settings where calculus is taught

Mathematical Content: Average Rate of Change, Limits (at infinity), Continuity, Basic Derivatives, Product Rule, Second Derivatives, Implicit Differentiation, Related Rates, Linear/Tangent Line Approximation, L'Hospital's Rule, Analyzing and Sketching Graphs of Functions, Optimization

Learning Objective(s):

- Students will be able to apply mathematical tools to real-world problems.
- Students will be able to analyze ethical issues related to mathematical problems.
    - Each problem has at least one ethical reasoning learning objective based on the ethical reasoning "Knowledge, Skills, and Abilities" (KSAs) given in Tractenberg's book *Ethical Reasoning for a Data-Centered World*.
        - Understand the Mathematical Ethical Guidelines and other knowledge necessary to evaluate a situation (KSA #1)
        - Recognize that there is an ethical issue (KSA #3)
        - Evaluate possible responses (KSA #4)
        - Make and justify a response (KSA #5)

    These are given in the solutions for each problem.

Time Required & Implementation Plan: When completed in groups in class, each problem takes about 20-30 minutes for students to complete, plus 5-10 minutes as a class to discuss the ethical reasoning problem. These problems could also be assigned as homework.

Grading and Assessment Recommendations: When given as worksheets in class, the problems do not need to be graded, but formative assessment could be done as students work or through class discussion. As homework problems, we suggest grading based on whether the question was fully answered and the explanation given is reasonable.

Required resources and technology: A few problems suggest using Desmos to graph functions. Otherwise, they can be completed with paper and pencil and a scientific calculator.

Brief Description/Abstract: This is a set of problems covering the major topics of Calculus I, intended to be used by instructors wishing to teach ethical reasoning alongside mathematical skills and concepts. Generally speaking, each problem has a calculation question (CQ) where the students must use a calculus technique to arrive at a numerical solution, an interpretation question (IQ), where students must explain the meaning of that solution in the context of the problem, and an ethical reasoning question (EQ), where students are presented with a situation and must recognize an ethical issue or analyze a decision regarding the mathematical work done in the first two parts.