Cover Sheet for Activity*

Title: Calculus On Tour with Ethical Reasoning Compass

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Course: Calculus 1

Type/Size of Institutions: The approach was initially implemented at a small liberal arts college. Nevertheless, it is designed to be broadly applicable across a range of institutional types and instructional settings.

Class Sizes: Piloted in courses with enrollments of up to 26 students, though the instructional methods are intended to be adaptable to classes of varying sizes.

Mathematical Content:

- Limits and Continuity: computing limits, limits at infinity, continuity at a point, continuity on an interval
- Derivatives and Differentiation Techniques: rate of change, derivatives, derivative rules (product rule, quotient rule, and chain rule), L'Hôpital's Rule, implicit differentiation
- Applications of Derivatives: curve sketching, critical points, relative extrema, inflection points, concavity, applied maximum/minimum problems
- Sequences and Series

Learning Objectives:

1. Students will use calculus to model real-world systems and interpret results in meaningful context.
2. Students will apply calculus to analyze decisions and evaluate the ethical, social, and environmental impacts of mathematical models.
3. Students will engage in collaborative problem-solving and discussion to deepen their understanding of calculus concepts and connect quantitative reasoning with ethical reflection.

Time Required and Implementation Plan: These activities can be integrated throughout a semester-long calculus course using a mix of direct instruction, collaborative discussions, group work, homework assignments, and projects.

Grading and Assessment Recommendations: In-class worksheets may serve as ungraded practice, supported by instructor observation, peer collaboration, and guided discussion. Homework assignments can be assessed based on conceptual understanding, completeness of responses, and the soundness of reasoning, rather than focusing solely on final answers.

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Required resources and technology: A scientific calculator may be used as needed to support computations.

Brief Description/Abstract: This module invites students to reflect on how calculus functions not only as a powerful analytical tool but also as an ethical lens for navigating real-world challenges. Students apply key calculus concepts to model complex systems in areas such as economics, healthcare, and sustainability. Beyond computation, the module emphasizes the importance of interpreting mathematical results within ethical, social, and environmental contexts. By integrating mathematical reasoning with ethical reflection, students develop a deeper understanding of how calculus can inform responsible decision-making in an increasingly complex world.