Cover Sheet for Activity*

Title: Fostering Ethical Awareness in Differential Calculus with Optimization Problems

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Course and textbook: This is for a Differential Calculus class. Any undergraduate calculus textbook may be used. Examples are:

- *Calculus: Early Transcendentals*, Briggs
- *Calculus: Early Transcendentals*, Rogawski
- *Calculus: Concepts & Contexts*, Stewart

Type/Size of Institution: High school, college, or university

Class Size: This activity can be used for any class size, large or small.

Mathematical Content: Optimization problems using derivatives

Learning Objectives: Upon completion of this activity, students should be able to:

- Apply differential calculus techniques to real-world modeling problems.
- Identify and evaluate the prerequisite knowledge needed to ethically apply mathematical models and contextualize assumptions in mathematical modeling.
- Use a stakeholder analysis to consider potential harms and benefits to affected parties.

Time Required & Implementation Plan: The problems can be given to students in different environments, such as in the classroom, homework, and exams. In class, each problem takes about 20 minutes to complete. Start with the first problem given to students in an ungraded in-class capacity for discussion and choose how the remaining problems should be given to students.

Grading and Assessment Recommendations: Do not give all ethical reasoning problems to students as a graded assessment. At least one problem should be shown to students in class prior to expecting students to complete others for a grade. When assessing, how to grade ethical reasoning questions is up to the instructor, but one way is to assign full credit to any student who made an honest attempt to respond to the prompt. Students can still struggle with how to answer, so their efforts should not be graded harshly.

Required resources and technology: None, but a graphing utility may be helpful.

Brief Description/Abstract: This activity introduces ethical reasoning in differential calculus using real-life mathematical modeling problems. While traditional textbook problems often focus solely on mathematical solutions, this activity encourages students to critically examine the ethical implications of using mathematical models. Instructors guide students through problems that ask them to consider the assumptions made in the models, the potential impacts on various

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involved parties, and the trade-offs involved in decision-making based on these models. By embedding ethical questions into the calculus curriculum alongside standard calculation questions, students engage in group discussions and reflective activities that help them understand the broader social and organizational consequences of mathematical applications. This approach not only strengthens students' mathematical problem-solving skills but also fosters a deeper awareness of how these tools can influence real-world decisions, preparing them for ethical decision-making in their future careers.

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