

INSTRUCTIONS: Books, notes, flying monkeys and electronic devices are not permitted. Write your (1) name, (2) instructor's name, and (3) recitation section on the front of your bluebook. Also make a scoring table, with places for 5 problems, plus a total score. This exam has 5 problems, on both sides of this sheet. Work all **5 problems**. Start each problem on a **new page**. Show your work. **BOX** in your answers. A correct answer with incorrect or no supporting work may receive no credit, while an incorrect answer with relevant work may receive partial credit.

1. (20 points) Answer the following TRUE if the statement is always true and FALSE if it is false under any circumstance.
 - a) If $f(x)$ is differentiable and $f'(x)$ is non-zero for all x , then $f(1) \neq f(0)$.
 - b) A function that is differentiable on an open interval has an absolute max and an absolute min on that interval.
 - c) The $f'(x) < 0$ on the interval $(-2,7)$ and $f(x)$ is continuous on the interval, then $f(x)$ is decreasing on $(-2,7)$.
 - d) If $f'(c) = 0$, then the function has a local max or min at $x = c$.
 - e) If $f'(x) = g'(x)$, then $f(x) = g(x)$
 - f) Pick one of the statements you marked FALSE, identify it, and give a counter-example (which demonstrates that the statement can be false).

2. (20 points) A farmer plans to fence a rectangular pasture adjacent to a river. The pasture must contain 180,000 square meters of pasture in order to provide enough grass for the herd. What dimensions should the field be so that the farmer can use the least amount of fencing? No fencing is needed along the river. Be sure that you justify the fact that your answer is a minimum.

3. (20 points) Let $y(x)$ be defined implicitly by $x^2(x - y)^2 = x^2 - y^2$
 - a) Find dy/dx .
 - b) Verify that $(x=1, y=1)$ satisfies this equation.
 - c) Evaluate dy/dx at $(x=1, y=1)$
 - d) The function $y(x)$ is defined locally near $x=1, y=1$. What is the linearization of this function near $(1,1)$?

4. (20 points) A girl flies a kite at a height of 300 feet, the wind carrying the kite horizontally away from her at a rate of 25 ft/sec. How fast must she let out the string when the kite is 500 feet away from her?

5. (20 points) Given the function: $f(x) = \frac{x^2 - 49}{x^2 + 5x - 14}$
 - a) Find the graphs and equations of any asymptotes (horizontal, vertical and oblique). (Justify your answers.)
 - b) Find the dominant terms and identify where they are dominant. Include them on your graph.
 - c) Graph the rational function from the information you have. Clearly label $f(x)$.