Math 124 - Section 012
Practice Problems for Test 3

Questions similar to these may show up on the test, but this is not a comprehensive review.

1. Let $f(x) = e^{(-x^2)}$.

   a. Find the tangent line approximation, which we will call $l(x)$, for $f(x)$ near $x = 1$. (Give an exact answer: no decimal approximations.)

   b. Is $l(1.5)$ less than, greater than, or equal to $f(1.5)$? Use the second derivative of f to justify your answer.

2. A commercial cattle company currently allows 20 steer per acre of grazing land. On average a steer weighs 2000 pounds at the market. Estimates by the Department of Agriculture indicate that the average weight per steer will be reduced by 30 pounds for each additional steer added per acre of grazing land. How many steer per acre should be allowed in order to optimize the total market weight of the cattle?

3. When an electric current passes through two resistors with resistance r_1 and r_2, connected in parallel, the combined resistance, R, can be calculated from the equation

$$\frac{1}{R} = \frac{1}{r_1} + \frac{1}{r_2},$$

where R, r_1, and r_2 are positive. For this problem assume that r_2 is constant.

a. Show that R is an increasing function of r_1. (Hint: Solve for R.)

b. Where on the interval $a \leq r_1 \leq b$ does R take its maximum value?

4. Evaluate $\lim_{x \to 0} \left(\frac{1}{x} - \frac{1}{e^x - 1} \right)$ or show that it does not exist. Support your answer using algebra and calculus (not your calculator).

5. Circle **TRUE** or **FALSE** for each of the following.

   a. **TRUE** or **FALSE**: If $f''(a) = 0$, then f has an inflection point at a.

   b. **TRUE** or **FALSE**: If f is an everywhere differentiable function, then every inflection point of f is a critical point of f.

   c. **TRUE** or **FALSE**: If J is a continuous, increasing function on the interval $[1, 7)$, then J has a global minimum on $[1, 7)$

   d. **TRUE** or **FALSE**: If H is a differentiable function on $[0, 1)$ and $H'(x) > 0$ for all x in $[0, 1)$, then H has a greatest lower bound (the book uses the term *best lower bound*) on $[0, 1)$.