

- 1 (15 pts.)** Suppose $f(x)$ is a twice differentiable function on (a, b) . Is it always true that every critical point for $f(x)$ is a local extremum? (Justify your answer)
What are two methods of testing whether a given critical point is a local max?
- 2 (20 pts.)** A spherical balloon is inflated at the rate of 100π cubic feet per minute. How fast is the balloon radius increasing at the instant the radius is 5 feet?
How fast is the surface area increasing?

3 (15 pts.) Calculate the following limits:

(a) $\lim_{t \rightarrow 0} \frac{\sin t^2}{t}$.

(b) $\lim_{x \rightarrow 0^+} \frac{\ln(x^2 + 2x)}{\ln x}$.

4 (25 pts.) What are the dimensions of the lightest open-top cylindrical can that will hold 1000 cubic cm of liquid?

- 5 (25 pts.) Let $f(x) = e^x - 2e^{-x} - 3x$. Find the critical points, and the intervals on which $f(x)$ is increasing and decreasing. Find the points of inflection, and the intervals on which the graph is concave up and concave down. Sketch the graph of $f(x)$.