

50 min. No books, no notes, no electronic devices. You must show your work to receive credit.

1.[17] For the function $f(x) = x^3 - 3x^2 + 3$

(a) Find the critical points of f .

(b) Find $f''(x)$.

(c) Find the open intervals on which f is concave up and the open intervals on which f is concave down.

(d) Identify any inflection points for the graph of f . Give the actual points.

(e) Use the second derivative test to identify all local extrema for the graph of f .

2.[7] Use l'Hôpital's rule to calculate $\lim_{x \rightarrow 0} \frac{x e^{2x}}{e^{3x} - 1}$. *To get full credit, you must state which case of l'H you're using.*

3.[5] A rectangular field is to be bounded by a fence on three sides and a straight stream on the fourth side. Find the dimensions of the field with maximum area that can be enclosed using 1000 ft. of fence.

4.[11] Find the general antiderivative by integrating term-by-term: $\int \left(\cos x + x^7 + e^{4x} - \frac{3}{\sqrt{x}} + \frac{1}{x^2 + 1} \right) dx$.

Evaluate the following definite integrals using FTC (part 2). Some may also require u-substitution.

5.[9] Evaluate $\int_0^2 \frac{x^2}{\sqrt{x^3+1}} dx$.

6.[8] Evaluate $\int_{\frac{\pi}{2}}^{\pi} (x - \sin x) dx$.

7.[8] Evaluate $\int_e^5 \frac{\ln x}{x} dx$.